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# Time-series and cross-sectional momentum investment strategies: <br> <br> International evidence 

 <br> <br> International evidence}

A thesis<br>submitted in fulfilment of the requirements for the degree<br>of<br>Doctor of Philosophy in Finance<br>at<br>The University of Waikato<br>by<br>Xiaojun Gao



THE UNIVERSITY OF
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## Executive summary

Numerous studies have found that profits that can be realised from following a momentumbased investment strategy of buying recent outperforming stocks (winners) and selling recent underperforming stocks (losers) (Jegadeesh \& Titman, 1993, 2001). Momentum strategies have proved to be robust across time, countries and asset classes, leading Fama (1998) to observe that momentum remains the "premier unexplained anomaly". The existence of the momentum abnormal returns continues to challenge the market efficiency theory.

The majority of momentum studies have investigated cross-sectional momentum strategies in which stocks are selected on the basis of their relative performances over some prior period. In a recent study, Moskowitz, Ooi, and Pedersen (2012) introduce a time-series momentum strategy which provides an alternative approach to security selection where stocks are chosen on the basis of their absolute performance over some prior period.

Although previous literature has evaluated momentum strategies in numerous markets settings, by far the bulk of these studies have concentrated on equity markets. Therefore, it is somewhat surprising that we are yet to see a comprehensive study that compares the two types of momentum strategies in this arena. The main objective of this study is to evaluate and compare the performances of the two momentum strategies in the security markets in order to examine validation of the market efficiency theory across international stock markets.

The study addresses the objective in three stages: before-transaction costs performance (raw returns), after-transaction costs performance (net returns) and after-transaction costs performance adjusted for risks (risk-adjusted net returns). A further by-product of our research is that we utilise a large number of implementation alternatives for both momentum
strategies and so provides an insight into the optimal way to implement both time-series and cross-sectional momentum strategies.

## Before transaction cost (raw) return:

The first thing that has been found is that the time-series and cross-sectional momentum returns reduce as we increase the cut-offs used when choosing both winning and losing stocks and so increase the number of stocks in the momentum portfolios (i.e. including $32 \%, 60 \%$ and all stocks in either the winner or loser portfolios). The extension of the cut-offs from 32\% to $100 \%$ results in a reduction in the returns on the momentum portfolios by approximately $50 \%$ on average based on the pooled data for the 24 markets. Having established this, we then use the $32 \%$ cut-offs over the remainder of our analysis.

The study finds that both time-series and cross-sectional momentum strategies produce significant positive outcomes under numerous implementations in the majority of developed stock markets with the major exceptions being Greece, Israel, Japan, Hong Kong, Portugal, Spain and the US. The time-series momentum strategy outperforms the cross-sectional momentum strategy under optimal implementations conditions in all markets and is statistically significant in half of these markets.

## After transaction costs (net) returns, and risk-adjustment net returns:

We find that the transaction costs and standard risk explain most profitability of the timeseries and cross-sectional momentum strategies. In terms of the Fama-French alpha determined using after-transaction costs return, about $6 \%$ on average of the implementations evaluated produce significant positive risk-adjusted net returns. There are absolutely no implementations that yield significant positive returns in Austria, France, Germany, Greece, Hong Kong, Israel, Japan, Norway, Portugal, Singapore, Spain and the US., while less than 5\%
of the implementations in Australia, Canada, and Ireland. The findings support that the market efficiency hypothesis still holds across the most markets in our sample and the existence of exploitable investment opportunities is rare.

The study particularly concentrates on the optimal implementations of both the time-series and cross-sectional momentum strategies across the 24 markets. Common characteristics of these optimal implementations for the risk-adjusted net returns are that they combine a formation and a holding period of between 15 and 18 months, a buy-and-hold portfolio construction policy and the use of either a market or inversed-volatility portfolio weighting scheme.

Based on the optimal implementation approach for each market, the overall performance of the two momentum strategies is eroded from $2.09 \%$ (raw return) to $1.34 \%$ (net return) and to $0.9 \%$ (Fama-French alpha) for the time-series momentum strategy, and from $1.43 \%$ (raw return) to $0.87 \%$ (net return) and finally to $0.51 \%$ (Fama-French alpha) for the cross-sectional momentum strategy. At each of the three steps along the way, this study finds that the timeseries momentum strategy continues to outperform the cross-sectional momentum strategy; however the magnitude of the superior performance is diluted with an average difference from $0.66 \%$ (raw return) to $0.47 \%$ (net return) and to $0.39 \%$ (Fama-French alpha). In addition, the superior performance of the time-series momentum strategy relative to the cross-sectional momentum strategy comes during periods when the markets have been performing poorly but that this advantage also erodes as we proceed from raw returns to net returns to risk-adjusted net returns.

One possible explanation for the superiority of the time-series momentum strategy is that it forms portfolios of slightly smaller capitalization stocks with a greater spread in past performance between the winner and loser stocks. Both of these features suggest that the
time-series momentum strategy will outperform the cross-sectional momentum strategy. On the other hand, the transaction costs and risk from the time-series momentum strategy are higher than the costs from the cross-sectional momentum strategy which is largely a consequence of time-series momentum strategy selecting smaller and growth stocks, and generating a higher turnover over a market cycle, so it is not surprising that the outperformance of the time-series momentum strategy becomes smaller after adjusting for risk on an after-transaction costs basis.

## Preface and Acknowledgements

I wish to thank Professor Ron Bird and Dr Daniel Choi for his encouragement, guidance and expertise throughout the process of accomplishing this thesis.

I am grateful to my parents and family for all of their love, encouragement and praying for my success.

Specially, I am thankful to my wife, Na Wei (Sienna) and my sweet heart, Yueyan Gao (Ella).

Twinkle, twinkle, little star,
How I wonder what you are!
(2 and half years ...><...)

I believe I can fly,
I believe I can touch the sky!

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## Chapter 1 - Introduction

### 1.1. Introduction

This thesis compares the performances of cross-sectional (Jegadeesh \& Titman, 1993) and time-series (Moskowitz et al., 2012) momentum investment strategies across security markets in 24 developed countries (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the UK and the US) using data from 1992 to 2012.

Numerous studies have found that profits that can be realised from following a trend (momentum)-based investment strategy of buying recent outperforming stocks (winners) and selling recent underperforming stocks (losers) and the return is difficult to explain using the standard risk factors (Jegadeesh \& Titman, 1993, 2001). The fact that this momentum strategy has proved robust across time, countries and asset classes has led Fama (1998) to observe that momentum remains the "premier unexplained anomaly". ${ }^{1}$ Therefore, the existence of momentum abnormal returns consistently challenges the market efficiency theory.

The majority of momentum studies have used cross-sectional momentum strategies as the basis for their security selection framework with securities being chosen on the basis of their

[^0]relative performance over some prior period. ${ }^{2}$ In a recent study, Moskowitz et al. (2012) introduce a time-series momentum strategy as an alternative framework for security selection where securities are chosen on the basis of their absolute performance over some prior period. Moskowitz et al. (2012) find that the time-series momentum strategy performs well both in absolute terms and relative to the cross-sectional momentum approach, across futures markets in equity indices, bonds, currencies and commodities. In contrast, Menkhoff et al. (2012) when examining currency markets, find that the cross-sectional momentum strategy outperform the time-series momentum strategy.

Although previous studies have investigated momentum strategies in numerous market settings, by far the bulk of these studies have concentrated on equity markets. Therefore, it is somewhat surprising that we are yet to see a comprehensive study that compares the use of cross-sectional and time-series momentum strategies in this arena. This study contributes to the growing literature in this field by using data drawn from the 24 markets to compare the two momentum strategies under a range of computational implementation where performance is measured using (i) before-transaction costs (raw) returns, (ii) after-transaction costs (net) returns, (iii) net returns adjusted for standard risk.

Momentum is an investment strategy employed by numerous quantitative investors within different asset classes and even by mutual funds managers in general. ${ }^{3}$ From a practitioner perspective, the empirical results pertaining to the economic viability of momentum strategies are mixed. ${ }^{4}$ This study seeks not only to identify which of the two momentum strategies

[^1]offers the best performance, but also to identify whether they can be implemented to generate excess returns after account is taken of transaction costs and risk.

This chapter discusses the background to momentum studies, the essential difference between the time-series and cross-sectional momentum strategies, an overview of this study's research objectives and contributions, and provides an outline of the structure of the remaining chapters.

### 1.2. Background

### 1.2.1. Market efficiency

Standard finance theory assumes that rational investors correctly evaluate the probability of every outcome and achieve a rational valuation before buying or selling stocks. An important and major principle of standard finance theory is the Efficient Market Hypothesis (EMH, hereafter). This theory asserts that financial markets are informationally efficient when prices fully reflect all available information. In other words, given the information available at the time that the investment is taking place, excess (abnormal) returns on a risk-adjusted basis cannot be consistently achieved. Fama (1970) identifies three levels of the market efficiency hypothesis: weak, semi-strong and strong. ${ }^{5}$

The weak-form of EMH implies that returns are unpredictable (or follow random walk) and therefore, information about future returns cannot be predicted by the historical series of returns. Although this wisdom gained the acceptance and support of the majority of academics, there has been a growing market inefficiency camp that questions the EMH on the basis of available empirical and conceptual evidence. Jess Livermore (1923, as cited in

[^2]Lefevre, 2012, p. 54) claims explicitly that "big money was not in the individual fluctuations but in the main movements that is, not in reading the tape, but in sizing up the entire market and its trend."

### 1.2.2. Cross-sectional momentum strategy

Jegadeesh and Titman (1993) demonstrate a failure of the EMH when they document that stocks that have done well in the past tend to keep doing well, and that those that have done badly tend to keep doing badly. The trend-following trading strategy based on this insight attempts to profit from momentum with little exposure to standard risk factors by buying past winners and selling past losers in anticipation of a continuation of past performance. Fama and French (2012) confirm that profitability from the momentum strategy still survives in most international markets. In addition, the broad consensus regarding the existence of abnormal return continuation means that a momentum factor is commonly included in returngenerating models, most notably in the four-factor model (Carhart, 1997). ${ }^{6}$

To date, the majority of studies have used and extended the Jegadeesh and Titman (1993) cross-sectional momentum strategy as the basis for their security selection criteria with securities being chosen on the basis of their performance over prior period relative to other stocks' historical performance. For example, cross-sectional stock selection criteria based on recent returns have been investigated broadly across international stock markets (Fama \& French, 2012; Gupta et al., 2013; Rouwenhorst, 1998), industry markets (Moskowitz \& Grinblatt, 1999), and currency and futures markets (Asness et al., 2013; Menkhoff et al., 2012). In addition, the extension of selection criteria on the basis of industry (Moskowitz \& Grinblatt, 1999) and 52 week high stock prices (George \& Hwang, 2004) has been examined.

[^3]
### 1.2.3. Time-series momentum strategy

Moskowitz et al. (2012) evaluate the time-series momentum strategy which uses an alternative framework for security selection where securities are chosen on the basis of their absolute performance over some prior period. ${ }^{7}$ They report on the performance of a timeseries momentum strategy that invests in 59 futures markets across four asset classes. Importantly, the time-series momentum approach does better than the cross-sectional momentum approach and speculators are using the time-series momentum investment strategy to extract profitability from hedgers in the futures market (Moskowitz et al., 2012). Hurst, Ooi, and Pedersen (2012) report that the time-series momentum strategy applied to the futures of equity and bond indices, currencies and commodities has realised a return after fees of in excess of $14 \%$ p.a. over the last 110 years with a Sharpe ratio of 1.0. One of the main objectives of this thesis is to determine which one of the two momentum strategies performs better in equity markets.

### 1.2.4. Rational explanations

### 1.2.4.1. Data mining

There is considerable literature on what influences momentum effect, or indeed whether it truly exists. One of the concerns always raised in momentum studies when a new investment strategy is documented, is whether it is a one-off or more generalizable phenomenon. Numerous studies provide significant evidence that momentum excess return exists in different markets, time horizons and assets classes. However, the criticism of data mining may be levied at outcomes that are not repeatable using alternative implementation approaches. Fama (1998) observes that various financial anomalies documented in the

[^4]literature may disappear if they are tested using an alternative implementation method, such as monthly rebalancing versus buy-and-hold portfolio constructions. Given the conflicting results arising from the change in implementation approaches, further empirical evidence is needed to uncover the difference of momentum returns using different implementation methods.

The momentum strategy of picking stocks in terms of their historical performance, however, involves a number of steps and can be completed in various ways that may influence the performance of the momentum strategies. As with any trend-following investment strategies, the success of momentum strategies depends on security prices trending in both directions. This is best articulated in the momentum life cycle developed by Lee and Swaminathan (2000) which suggests that the prices of securities oscillate around their fair value. The success of any momentum strategies will depend on it being based on implementation rules that are in harmony with the periodicity of the pricing cycles. As momentum trading signals are based on recent pricing movements, they will always be late in identifying winning and losing securities. However, the more successful momentum strategies will be those based on implementation rules that result in identifying winners (losers) early in their up-(down) cycles and reversing these positions in close to an optimum fashion. Thus, considering various implementation approaches to the two momentum strategies are a key focus in the study.

In order to undertake a thorough comparison, this study examines the performances of the two strategies utilising combinations of various implementation rules for stock selection and portfolio construction. As a consequence, this thesis not only seeks to identify which of the two momentum strategies provides the best performance in international equity markets, but also to identify the optimal rules for their implementation. The actual approaches to implementation used in the study will be discussed in Chapter 4.

### 1.2.4.2. Transaction costs

Transaction costs play an important role in a host of empirical analyses on topics ranging from market efficiency to international market research. It is important for financial scholars and practitioners to understand transaction costs because the net gains to investments are influenced by such costs and market equilibrium returns are likely to be impacted by crosssectional differences in costs (Roll, 1984).

The data of transaction costs, however, are not readily available, particularly in international markets (Liu, Liu, \& Ma, 2011), or where available, they are cumbersome to apply or difficult to acquire. As noticed by Roll (1984),

For the practical investor, the measurement of trading costs is painful but direct. (They appear on his monthly statement of account.) For the empirical researcher, trading cost measurement can itself be costly and subject to considerable error. For example, brokerage commissions are negotiated and thus depend on a number of hard-to-quantify factors such as the size of transaction, the amount of business done by that investor, and the time of day or year. The other blade of trading costs, the bidask spread, is perhaps even more fraught with measurement problems. The quoted spread is published for a few markets but the actual trading is done mostly within the quotes (p.1127).

Roll (1984) proposes a mean for measuring transaction costs which can be used in situations where bid and ask data is not available. However, Harris (1990) demonstrate that the Roll approach does not provide a good measure of the transaction costs if the auto-covariance in returns is positive. Author points out that more than half of the stock costs listed on the New York stock exchange (NYSE)/ American stock exchange (AMEX) cannot be estimated using the Roll model due to this problem.

The most direct method of estimating transaction costs is the bid-ask spread plus commission approach, which is the sum of the proportional bid-ask spread from specialist quotes and a representative commission from a brokerage firm if the data is available. However, Lee and Ready (1991) and Petersen and Fialkowski (1994) present evidence that trades are consummated at prices that are inside the bid-ask quotes as the commission schedule of brokers often reflects more than the cost of executing a trade, which may or may not be related to the specific trade. In fact, measuring cost based on the sum of quoted bid-ask spread and commission does not capture all aspects of the transaction costs.

Since the majority of investors would be able to estimate the aggregate trading costs that face them, the literature finds that evaluating the trading costs in terms of investors' behaviour might provide a better means for arriving at a comprehensive measure of the transaction costs. Lesmond, Ogden, and Trzcinka (1999) propose trading cost measurement models, named the LOT model that is based on daily returns. The model extrapolates the transaction costs from the buyer's side in terms of investors' behaviour. The costs estimated from the model include not only bid-ask spread plus commission, but also the taxes, short-selling expenses, liquidity cost and price impact.

In order to answer the question as to how accurate are the estimated transaction costs generated by the transaction costs measure models, Goyenko, Holden, and Trzcinka (2009) compare cost estimates from 12 measure models with the cost estimates that are calculated based on actual data sets (Trade and Quote, and Rule 605 data) in the US markets from 1993 to $2005 .{ }^{8}$ Based on the benchmarks of effective and realised spread and price impact, they

[^5]conclude that the Holden, extended (or new) version of Lesmond et al. (1999) model, named the LOT Y-split model, and the Effective Tick model are more accurate than other measures of capturing transaction costs.

Although momentum strategies may generate positive returns, it is important to assess whether an investment strategy is still profitable after accounting for the transaction costs. Jegadeesh and Titman (1993) assume a conservative one-way transaction cost of $0.5 \%$ per trade based on the trade-weighted mean commission and market impact as calculated by Berkowitz, Logue, and Noser (1988). Jegadeesh and Titman (1993) and Rouwenhorst (1998) conclude that cross-sectional momentum profits are still significantly positive when the transaction costs are taken into account.

Lesmond et al. (2004) argue that the method of measuring transaction cost used by Berkowitz et al. (1988) under estimates costs for three reasons. First, they argue that using an NYSE (New York Stock Exchange) trade-weighted measure is inappropriate because momentum strategy is dominated by small, off-NYSE, extreme performer stocks. Second, they point out a single period assessment cannot capture the substantial time-series variations in transaction costs over a long time period. Third, a number of important costs facing investors, such as taxes, short-sale costs and holding period risk are excluded or understated. They estimate transaction costs based on the incidence of zero returns and find that the total costs of implementing a momentum strategy are significantly larger than the profits that they generate. Therefore, they argue, the EMH still holds in the sense that using past information, such as

Trade and Quote data collects intraday transactions data (trades and quotes) for stocks listed in the American stock exchange, the New York stock exchange, the NASDAQ, the National market system and Small Cap issues.

Rule 605 is the Securities and Exchange Commission's Rule 605 (formerly 11Act1-5) in the US market. The rule mandates that stock exchanges, dealers and other market centres provide selected data on selected order executions.
data obtained using a momentum strategy, cannot consistently produce abnormal returns after accounting for appropriately estimated transaction costs.

In contrast, Hanna and Ready (2005) and Li, Brooks, and Miffre (2009) argue that there are ways to implement momentum strategies which reduce the transaction costs and so give rise to profits that are exploitable. The inconsistent findings on momentum profit after the transaction costs indicate the sensitivity of implementation approaches that use a momentum strategy and the importance of utilising an accurate cost measurement model. From a practical perspective, the second objective of this study is to the investigate performances of the two momentum strategies using numerous implementation approaches after accounting for the transaction costs using the LOT Y-split model (Goyenko et al., 2009).

### 1.2.4.3. Risk factors

The debate on momentum anomalies focus not only on the existence of profitability but also on the explanations of the causes of the momentum phenomenon. Theoretically, returns are correlated with risks, and high returns usually come with high risks in financial markets. However, Jegadeesh and Titman (1993) find the standard risk model, the Capital Asset Pricing Model (CAPM) does not satisfactorily explain the returns from the momentum strategy. Fama and French (1996) claim that the Fama-French three-factor model, that includes market risk, size premium (Small Minus Big) and value premium (High Minus Low), can explain most of financial anomalies but not the momentum returns. The returns from the momentum strategy after standard risk adjustment (the intercept term in the CAPM or threefactor regression model) tends to be significantly positive, which indicates momentum strategies yield positive abnormal returns (or excess returns) (Jegadeesh \& Titman, 1993; Moskowitz et al., 2012).

Researchers apply the three factor model to measure the risk-adjusted return attributable to the momentum strategies (e.g. Cooper, Gutierrez, and Hameed (2004); Li et al. (2009); Moskowitz et al. (2012)). This study applies not only the Fama-French three-factor model but the Sharpe ratio to measure and compare the risk-adjusted performance of time-series and cross-sectional momentum strategies based on their after-transaction costs returns. We undertake this analysis in order to determine whether there are exploitable momentum opportunities across our 24 markets after the transaction costs and standard risk factors are taken into account.

### 1.2.5. Behavioural explanations

Evidence of momentum profits violates one of the principles of the EMH, investor rationality as defined by the axioms of choice (investors' irrationality) and the random walk hypothesis. The violations of standard finance theory and the existence of a number of anomalies that are contrary to the EMH led to the development of prospect theory (Kahneman \& Tversky, 1979). Kahneman and Tversky (1979) find that people often make decisions based on their mental frame that are normally inflexible and capricious, and trend may be predictable under herd behaviour. In general, 'rational' individuals may not be rational in reality (Statman, 1999).

The theory of the use of cognitive and emotional factors to understand the investment decisions of investors is called behavioural finance. Behavioural finance recognises the importance of human "emotions" and "spirits" and shows that decisions that are made by investors are influenced by several psychological elements, such as overconfidence, mental accounting, regret aversion, anchoring, herding and so on.

Financial trading activities are driven by human decision-making processes. Irrationalities or biases will lead to mis-pricing of stocks; unless these biases negate each other. Proponents of
behavioural finance argue that decision-biases found in the psychological literature manifests themselves in the behaviour of financial market participants. The failure of rational models to completely explain momentum profits has led researchers to turn to behavioural finance for possible explanations of the momentum effect. In essence, behavioural finance refutes the assumption of the rationality of market participants found in standard finance theory. This is based on a considerable body of evidence which shows that investors are irrational and systematically make errors in processing information (Statman, 1999). As Albert Einstein states: "two things are infinite: the universe and human stupidity; and I'm not sure about the universe."

According to the field of behaviour finance, the momentum effect (anomaly) is caused by irrational reactions to information related to stock prices and herding behaviour. Proponents of behavioural finance attribute under- and over-reaction to cognitive biases that influence investors when they interpret information about financial markets. For example, investors may be too slow to draw conclusions when confronted with new or contradictory evidence (a conservative bias), or they may be too quick to assume that a given stock belongs to a particular "ideal type" (mental accounting, representativeness heuristic). The tendency to herd among market participants, such as fund managers, is another possible explanation for the existence of momentum profits (Grinblatt, Titman, \& Wermers, 1995; Lakonishok, Shleifer, \& Vishny, 1994).

If irrationality exists in the market, investment decisions will be influenced by the ex-ante market conditions, such as whether previous markets have been strong (gain/positive) or weak (loss/negative) (Cooper et al., 2004). Cooper et al. (2004) find that a risk-adjusted return from the cross-sectional momentum strategies in positive market conditions is greater than the same returns from the same strategies in negative market conditions. This study
seeks to validate this finding for the cross-sectional momentum strategies and see if the timeseries momentum strategies in equity markets are robust to that outcome. It does so by examining the performance of both strategies in positive ("up") and negative ("down") markets.

### 1.3. Time-series momentum strategy v. Cross-sectional momentum strategy

The return of momentum strategy is typically measured by the aggregate of the return from a long position in the winner portfolio consisting of the better performing stocks over some prior periods and a short position in the loser portfolio consisting of the worst performing stocks over the same prior periods.

The essential difference between the time-series and cross-sectional momentum strategies is in the way that each method chooses the stocks to be included in the winner and loser portfolios. With the cross-sectional momentum strategy, all stocks are ranked on the basis of their performance over some pre-defined period and then individual stocks are assigned to portfolios based upon their ranking. For example, the rule might be to include the top $20 \%$ of stocks in the winner portfolio and the bottom $20 \%$ of stocks in the loser portfolio. With the time-series momentum strategy, stocks are assigned to portfolio on the basis of their absolute returns over some pre-defined periods. For example, the procedure might be to assign to the winner portfolio all stocks that have realised a return greater than $5 \%$ during this period and to assign to the losing portfolio all stocks that have realised a return less than $-5 \%$ during this period.

The cross-sectional and time-series approaches may well result in the same investment recommendation but typically they will differ. Assume we have two stocks with Stock A realising a return of $10 \%$ over the last six months while Stock B has realised a return of $-2 \%$.

Assume the rule under the cross-sectional momentum strategy is to invest in the better performing of the two stocks in the winner portfolio and the worse performing stock in the loser portfolio. Assume that the rule under the time-series momentum strategy is to include in the winner portfolio any stock that has realised a positive return over the last six months and in the loser portfolio any stock that has realised a negative return over this period. Under this rule, given these stock selection rules, both momentum strategies will include stock A in the winner portfolio and Stock B in the loser portfolio. However, now assume that Stock A returned $-1 \%$ over the last six months while Stock B still realised $-2 \%$. Now, the crosssectional momentum strategy would still allocate Stock A to the winner portfolio and Stock B to the loser portfolio while the time-series momentum strategy would allocate both stocks to the loser portfolio. ${ }^{9}$

It is typical when using the cross-sectional momentum strategy to set symmetrical cut-offs. For example, the rule might be for the top $20 \%$ of stocks to form the winner portfolio and the bottom $20 \%$ to form the loser portfolio. As a consequence there are always an equal number of stocks in the two portfolios. In contrast the cut-offs in the time-series momentum strategy are expressed in absolute returns with the outcome being that the number of stocks assigned to the winner and loser portfolios will typically differ. Moskowitz et al. (2012) set a single cut-off of $x \%(x=0)$ resulting in all securities with a positive return being assigned to the winner portfolio and all securities with a negative return being assigned to the loser portfolio. In this case it is unlikely that an equal number of securities will be assigned to the two portfolios. If the market has been doing well, then more securities will be assigned to the

[^6]winner portfolio, but equally if the market has been doing poorly, then more securities will be assigned to the loser portfolio.

The above discussion highlights that in the time-series momentum strategy, the number of stocks held in the winner and loser portfolios is likely to vary through the market cycle. Interestingly, Cooper et al. (2004) claim the market contains information about the profitability of momentum strategies, with the strategies performing much better in strong markets than in weak markets. This suggests that the time-series momentum strategy may perform better as it will load up on winning stocks when markets are strong and on losing stocks when markets are weak.

### 1.4. Research objectives and contribution

The main objective of this study is to evaluate both the absolute and relative performances of time-series and cross-sectional momentum strategies and to provide some insights into why their performances might differ across developed stock markets. We undertake this utilising the full complement of implementation strategies that have been used in studies to date. Further, we base the analysis on the three measures of performance: returns before the transaction costs, returns after the transaction costs and risk-adjusted after-transaction costs returns. As consequence, this thesis identifies the best implementation rules for the momentum strategies and whether these strategies give rise to exploitable investment opportunities.

The existence of profitable momentum strategies is inconsistent with the weak-from of the EMH. Advocates of the EMH argue that the momentum anomaly may well not exist once account is taken of the costs of implementation and the associated risks. One of the objectives of this study to establish whether the weak-form of EMH holds in developed stock markets
by testing the two momentum strategies using different implementation methods when the transaction costs and standard risk factors are taken into account.

A number of detailed research questions will be addressed in this thesis which we believe have not been adequately covered in the existing finance literature:

1. How do time-series and cross-sectional momentum strategies perform in terms of (i) before-transaction costs (raw) returns, (ii) after-transaction cost (net) returns and (iii) net returns adjusted for risk?
2. Which of cross-sectional and time-series momentum strategies yields the superior investment performance?
3. Why does the performance of the two momentum strategies differ?
4. Does the absolute and relative performance of the two momentum strategies vary through the market cycle?
5. A further by-product of our research is that it provides insights as to the optimal way to implement the momentum strategies.

The study makes a number of important contributions to the literature relating to momentum and delivers empirical information on the profitability of momentum investment in international markets. It extends the study the time-series momentum strategy into equity markets and minimises data-mining bias by presenting results in an international context of 24 stock markets and by testing numerous implementation strategies in each market.

The study is of interest because it tests the viability of both momentum strategies and aims to find an optimal implementation strategy for each equity market. By considering the transaction costs of the two momentum strategies and incorporating risk factors, the empirical
results provide further evidence on the market efficiency theory across international stock markets over the last two decades.

### 1.5. Structure of the thesis

The remainder of this thesis is organised as follows:

Chapter 2 (The momentum anomaly) provides the theoretical framework underpinning this study by synthesising the extant literature on the momentum anomaly.

Chapter 3 (Data) discusses data sources, data collection and data filtering procedures.

Chapter 4 (Momentum trading strategies) explains methods that have been applied to examine the research questions. For example, procedures of the time-series and crosssectional momentum strategies, transaction cost measurement (discussed in more details in Chapter Seven) and standard risk factors models (discussed in more details in Chapter 8).

Chapter 5 (Comparison of returns between time-series and cross-sectional momentum strategies) focuses on testing the performances of the time-series and cross-sectional momentum strategies in 24 stock markets and on providing a comprehensive comparison of the performances based on the two forms of momentum strategy.

Chapter 6 (Closer examination of time-series and cross-sectional momentum strategies under optimal implementation approach) undertakes a close comparison of returns of the time-series and cross-sectional momentum strategies based on the "optimal" implementation approaches.

Chapter 7 (Time-series and cross-sectional momentum strategies after transaction costs) compares the profitability of the time-series and cross-sectional momentum strategies across 24 markets after accounting for the transaction costs.

Chapter 8 (Time-series and cross-sectional momentum strategies after risk adjustment) examines and compares the Sharpe ratio and Fama-French alpha of the time-series and crosssectional momentum strategies on after-transaction costs basis.

Chapter 9 (Conclusions) concludes the thesis by synthesising the main findings and discussing their implications.

## Chapter 2 - The Momentum anomaly

### 2.1. Introduction

This chapter synthesises the literature relating to the momentum anomaly. It commences with a discussion of its existence, followed by a discussion of the postulated causes of momentum that have been offered to explain its persistence. Section 2.2 discusses the momentum effect in different financial markets. Section 2.3 outlines the possible explanations and causes of the momentum anomaly, while the conclusions are presented in Section 2.4.

### 2.2. Momentum in the international market

Momentum investment involves going long stocks that have been rising and going short stocks that have been falling, betting that those patterns will continue. The fact that the return of momentum investment strategy is difficult to explain by means of standard risk factors indicates that this anomaly is the most stubborn challenge to the rationality of financial markets and market efficiency (Jegadeesh \& Titman, 1993, 2001). Various explanations have been proposed in the literature and some studies have questioned whether it is an anomaly at all (Lesmond et al., 2004). This chapter summaries the empirical findings relating to the momentum anomaly and discusses the theories postulated to explain its existence and persistence.

### 2.2.1. Cross-sectional momentum strategies in stock markets

The cross-sectional momentum strategy is first documented in academic literature by Jegadeesh and Titman (1993). The authors examine 16 trading strategies with buying the past $\mathrm{J}(\mathrm{J}=$ three, six, nine and 12 months) winner stocks, and shorting the past J month loser
stocks and holding the positions of the two portfolios for the next $\mathrm{H}(\mathrm{H}=$ three, six, nine and 12 months). They find that the momentum strategies yield returns varying between about $0.3 \%$ and $1.5 \%$ per month in the US market.

Similarly strong momentum patterns have been found not only out of sample time periods in the US stock markets, but also in international markets. Jegadeesh and Titman (2001) extend their momentum study and find that the momentum anomaly beyond the period examined in their initial study. Further evidence of the existence of the momentum anomaly in the US stock markets is provided by Grundy and Martin (2001), Ji (2012), Lee and Swaminathan (2000) and Lewellen (2002).

Literature has investigated whether the cross-sectional momentum strategy is profitable in international markets. Many researchers have found that the profitability of momentum strategies is not confined to the US markets. Rouwenhorst (1998) studies the use of the momentum strategy in 12 European stock markets over the period 1980-1995 and finds that a medium-term (six months) momentum strategy generates an excess return of $1 \%$ per month. These returns are robust to adjustment for risk and firm size. This study observes a common momentum pattern between the US and European markets that profit is only persistent for almost one-year holding period and is stronger in smaller firms. Further evidence of a strong momentum pattern in developed European markets is presented by Bird and Casavecchia (2006, 2007), Doukas and McKnight (2005), Nijman, Swinkels, and Verbeek (2004) and Pan and Hsueh (2007). Evidence of the momentum in European markets has been presented on an individual country basis for Italy (Mengoli, 2004), Sweden (Parmler \& Gonzalez, 2007), Spain (Muga \& Santamaría, 2009), Switzerland (Rey \& Schmid, 2007), Germany (Glaser \& Weber, 2003; Schiereck, De Bondt, \& Weber, 1999) and the UK (Aarts \& Lehnert, 2005; Galariotis, Holmes, \& Ma, 2007; Li et al., 2009; Siganos, 2010).

There is considerable evidence in the literature of significant abnormal returns based on the cross-sectional momentum strategy in many other stock markets. For example, Hou and McKnight (2004) and Kryzanowski and Zhang (1992) provide evidence of significant momentum profits in Canada. Drew, Veeraraghavan, and Ye (2007) report that the abnormal momentum returns vary from $0.3 \%$ to $7 \%$ per month in Australia. Bettman, Maher, and Sault (2009) also find that momentum return remain significant and positive after controlling for short selling restrictions, liquidity constraints and transaction costs in the Australian stock market. Robust evidence for the continuation of returns is documented in New Zealand by Gunasekarage and Kot (2007).

Compared with westen markets, the evidence of momentum is relatively weak in some Asian stock markets, particularly in East Asian (Griffin, Ji, \& Martin, 2005). Hameed and Kusnadi (2002) draw the conclusion that there is weak evidence of a momentum effect in some markets in Asia by presenting small but statistically significant momentum returns in six Pacific Basin stock markets. They find that the profits disappear after adjusting for firm size and turnover. Cheng and Wu (2010) find that the profitability of momentum strategies is insignficant in the Hong Kong market. Du, Huang, and Liao (2009) find that momentum strategy is not a profitable strategy in the Taiwanese stock market.

Studies in the Japanese market do not find evicence that momentum strategies are effective. Liu and Lee (2001) observe momentum strategy in the Japanese market is not profitable as the momentum strategy loses around $0.5 \%$ per month. The finding indicates that the momentum pattern reverses in the first month of the holding period among small firms in Japan. Chui, Titman, and Wei (2000) find momentum profits in eight Asian markets, but with the notable exception of markets in Japan and Korea. These authors suggest that the disappearance of the momentum effect may be due to cultural and instituitonal differences
between these countries and western countries. In addtion, Fama and French (2012), when studying in international stock markets from 1989 to 2011, report that momentum returns occur everywhere, except in Japan.

### 2.2.2. Cross-sectional momentum extension

Studies investigating the momentum effect are not confined to stock markets; they have also been conducted in different asset classes. Asness et al. (2013) present the application of momentum strategies to equity indexes, currencies, commodities and bond futures. Menkhoff et al. (2012) examine exchange rates expressed in US dollars for 48 currencies from 1976 to 2010 and find a significant excess returns of up to $10 \%$ p.a. with small loadings on risk factors in currency markets.

Even though most studies have used a stock selection framework based on the cross-sectional momentum strategy (Jegadeesh \& Titman, 1993), several authors have found alternative stock selection methods to also yield profits. For example, Moskowitz and Grinblatt (1999) find that a momentum strategy applied at the industry level can generate higher returns than one applied at the stock level. George and Hwang (2004) document that a momentum strategy based upon a stocks proximity to its 52 -week high/low price outperforms one based upon the stock's recent returns. Bird and Casavecchia (2007) find that momentum profitability is enhanced when portfolios are formed based on the degree of price acceleration of each stock.

### 2.2.3. Time-series momentum strategy

The studies discussed above all use a cross-sectional based momentum strategy. In the recent literature, Moskowitz et al. (2012) introduce a time-series momentum strategy which uses a different stock selection framework. Stocks (or assets) are selected based on their own
performance rather than this performance relative to that of other stocks (or assets) (Section 1.3 for an explanation of the difference between the two momentum strategies). This section summarises the extant studies on the time-series momentum strategy.

Moskowitz et al. (2012) examine a time-series momentum strategy of taking a long position in securities with recent positive returns and a short position in securities with recent negative returns across 58 futures markets encompassing equity indexes, currencies, commodities and bond. Their study demonstrates the existence of the time-series abnormal returns over the holding periods of one to 12 months, followed by partial reversal over longer horizons. In addition, they observe that speculators extract wealth from hedgers using a timeseries momentum strategy in the futures market. Hurst et al. (2012) examine the use of the time-series momentum strategy in the futures market all the way back to 1903 and conclude that this trend-following investment strategy has been consistently profitable with a return after fees of in excess of $14 \%$ p.a. over the past 110 years with a Sharpe ratio of 1.0.

Menkhoff et al. (2012) report that over the period from 1976 to 2010, both time-series and cross-sectional strategies are profitable in currency markets after adjusting for transaction costs. However, they find that the average excess return and the Sharpe ratio from the crosssectional momentum strategy are twice high as those from the time-series momentum strategy. Marshall, Nguyen, and Visaltanachoti (2013) examine the time-series momentum strategy and moving average investment strategy in the US stock market, and point out that the two strategies are most profitable for the largest quintile stocks. However, a moving average strategy produces larger returns, Sharpe ratios and Jensen Alphas than those realised from a time-series momentum strategy.

Previous studies have investigated momentum strategies in numerous market settings but by far the bulk of these studies have concentrated on equity markets. Therefore, it is somewhat
surprising that we are yet to see a comprehensive study that compares the use of crosssectional and time-series momentum strategies in this arena. To my best knowledge, this is the first study provides empirical comparisons between the cross-sectional momentum and time-series momentum strategies in international stock markets.

### 2.3. Causes of the momentum effect

While the literature generally accepts the existence of a significant momentum effect in financial markets, there is a sizeable debate on its causes. Explanations can be broadly categorised into two camps. One group argues that the momentum anomaly is more apparent than real and can be explained by rational means, such as, model mis-specification (Wang \& Wu, 2011), time-varying unsystematic risk (Li, Miffre, Brooks, \& O'Sullivan, 2008), and transaction costs (Lesmond et al., 2004). The other group argues that the momentum anomaly is caused by irrational behaviour such as under-reaction (Jegadeesh \& Titman, 1993, 2001), over-confidence (Daniel, Hirshleifer, \& Subrahmanyam, 1998), individualism (Chui, Titman, \& Wei, 2010). This section outlines the main arguments postulated to explain the momentum anomaly.

### 2.3.1. Rational explanations

Advocates of standard finance theory argue that the apparent momentum anomaly is principally attributable to methodological flaws in research design. Conrad and Kaul (1998) find that momentum profitability results from cross-sectional variations in expected returns, rather than from predictable time-series variations in returns. Their finding indicates that cross-sectional firm-specific risk is a major factor explaining the momentum profit.

For the hypothesis of Conrad and Kaul (1998) to be true, momentum profits would not be reversed in any post-ranking period. Jegadeesh and Titman (1999) show that momentum
profits increase monotonically for approximately one year, followed by four years of decline. The momentum strategy yields an average profit of $1 \%$ per month over the first year; however, the momentum gains turn negative over the next four years. Such findings are at odds with Conrad and Kaul (1998) hypothesis and are more consistent with the behavioural explanation that momentum profits will eventually reverse due to under- or over-reaction (Hong \& Stein, 1999; Kent, Hirshleifer, \& Subrahmanyam, 1998). In addition, Jegadeesh and Titman (2001) argue that Conrad and Kaul (1998) results are driven by small sample biases in their tests and bootstrap experiments, and conclude that the cross-sectional variation component explains little of the momentum profits.

### 2.3.1.1. Model mis-specification

Fama and French (1996) observe that the unconditional three-factor model cannot capture momentum returns. The three factors in their model proxy for firm-specific risk (beta), firm size risk (the higher risk and lower liquidity of small firms), and firm distress risk (high minus low book-to-market). Grundy and Martin (2001) apply rolling regression of the threefactor model adjusting market conditions based on risk factors and find that risk-adjusted momentum profitability is very close to, or actually higher than, raw returns. Ahn, Conrad, and Dittmar (2003) provide consistent findings that the three-factor model magnifies raw returns.

Wang and Wu (2011), on the other hand, argue that running full-sample time-series FamaFrench three-factor regressions, as has been done in some research, is an inappropriate approach in momentum studies as it fails to account for the systematic dynamics of momentum portfolio factor loadings. They argue that using constant factor beta leads to an underestimation of the risk factors which apply to the profitability of momentum. After circumventing the difficulty of beta dynamics modelling in momentum studies, they find that
the three-factor model can explain $40 \%$ of the excess returns generated by the momentum strategy (Jegadeesh \& Titman, 1993) and almost $100 \%$ of the excess returns generated by the style momentum strategy ${ }^{10}$.

Moskowitz et al. (2012) apply the three-factor risk model in their study of the time-series momentum strategy and conclude that risk factors explain little about the returns from the time-series momentum strategy in the futures market. Since the majority of momentum studies in stock markets are based on the cross-sectional momentum strategy (Jegadeesh \& Titman, 1993), it is important to determine whether the failure of the risk models is a more robust phenomenon when examining the standard risk factors which may affect time-series momentum returns (Moskowitz et al., 2012).

### 2.3.1.2. Data mining

A criticism typically levelled at any study that claims to have unearthed a profitable investment strategy is that the results are due to data mining. Fama (1998) states "splashy results get more attention, and this creates an incentive to find them". If momentum strategies were found to yield large negative abnormal returns, one could draw infer that a contrary strategy would be profitable because it is unlikely that either momentum or contrary strategies would result in excess return of zero. ${ }^{11}$

The literature provides considerable evidence that momentum profitability is robust across different time horizons, stock markets, assets classes, and implementation strategies. However, prior studies which test the momentum effect have almost all been based on a cross-sectional

[^7]momentum strategy. The study contributes to the growing literature on momentum strategies by providing empirical evidence about whether the momentum effect is still robust if one uses the time-series momentum strategy.

### 2.3.1.3. Transaction costs and short-selling constraints

Momentum strategies involve high portfolio turnover, often of small stocks, and this could result in prohibitive transaction costs. Moreover, momentum profits are generated taking long position in winner stocks and short position in losing stocks but in many markets short selling is prohibited or restricted (Lesmond et al., 2004). For example, according to the Regulatory Guide 192 in the Australia Securities and Investments Commission (ASIC), covered short sales are permitted but naked short sales are prohibited except where ASIC has given relief.

## Transaction costs

Lesmond et al. (2004) argue that the significant momentum returns reported in the literature are dependent on an underestimation of transaction costs. They find that in US markets the cross-sectional momentum strategy documented by Jegadeesh and Titman (1993) produces significant profit ranging from $0.45 \%$ to $1.30 \%$ per month, but, the majority of the gains (ranging from $53 \%$ to $70 \%$ ) are generated by short selling stocks in the loser portfolio. Furthermore, the study characterises such stocks as small, low in price, low in liquidity, high beta (market risk), and off-NYSE stocks. Obviously, the trading costs involved with these stocks are high.

Lesmond et al. (2004) apply four measures to estimate transaction costs and point out that costs exceed the momentum profits in almost all cases. Using their cost measurement model, they find that transaction costs for large stocks generally ranges from $1 \%$ to $2 \%$ and for small stocks they range from $5 \%$ to $9 \%$. They argue that most "profit" found in prior momentum studies would be diluted by high transaction costs if those costs were estimated correctly
(Lesmond et al., 2004). Therefore, according to Lesmond et al. (2004), the EMH is still valid as it is impossible for the momentum strategy to consistently make excess abnormal returns after considering the transaction costs.

The transaction costs could be reduced by using alternative procedures in momentum strategies, for example by increasing holding periods and applying buy-and-holding rather than monthly rebalancing in order to decrease the frequency of turnover of stocks in the portfolio, or by focusing on investing in low transaction-cost stocks. Agyei (2007) reports that momentum strategies with holding periods of more than six months are capable of generating statistically significant after-transaction cost returns, while Li et al. (2009) draw similar conclusions when concentrating on low transaction-cost stocks in the UK stock market. Siganos (2010) demonstrates that small investors can also make profit from momentum investment after accounting for transaction costs by selecting a relatively small number of stocks to form the winner and loser portfolios as well as using a relatively long holding period (more than six months) in order to minimise transaction costs.

The transaction costs measure (LOT model) used in Lesmond et al. (1999) may not be an optimal model to percisely capture the transaction costs. Goyenko et al. (2009) compares the transaction costs estimates measured by different liquidity measurements (including the LOT model) with the transaction costs estimated using actual data in the US markets. They show that the LOT model is not an optimal model for measuring the transaction costs and recommend that the extended version of the LOT model, named LOT Y-split model has more accuracy for inferring the transaction costs.

## Short-selling constraints

Short-sale constraints are particularly important in view of the dominant contribution of the loser portfolio to momentum returns in the momentum literature because stocks in loser
portfolios that are supposed to be short-sell according to momentum strategies may not all be able to be sold due to market restriction or other factors. Thus, the "profit" of momentum strategy in the studies may not be "true" profit in reality.

Alexander (2000) points out that momentum studies are biased toward rejecting EMH as such investment ignores short-sale constraints. Jones and Lamont (2002) observe that overpriced shares tend to be expensive to short-sell. Furthermore, Chen, Hong, and Stein (2002) find that the majority of stocks have no short sale interest outstanding at any time and Barber and Odean (2008) find that only $0.29 \%$ of individual investors take short-selling positions. Momentum returns are attributed to short-sale loser portfolio, however it constraints prevent arbitrage of excess returns (Ali \& Trombley, 2006).

Market resistances such as bid-ask spreads, short-selling constraints and illiquidity are more pronounced in small and emerging markets than in developed markets. DeRoon, Nijman, and Werker (2001) show that anomalous returns in emerging markets cannot be achieved due to short-sale constraints and transaction costs.

In fact, short-sale restrictions do not necessarily prevent momentum investors for generating returns. Griffin et al. (2005) in a study that cover 40 markets find that small momentum traders can still be profitable without taking short positions. Fong, Wong, and Lean (2005) investigate momentum strategies in 24 countries and find that it is only buying stocks in winner portfolios that generate significant abnormal returns after considering the transaction costs. Phua, Chan, Faff, and Hudson (2010) demonstrate that in Australia the continuation of momentum returns is mainly concentrated in past winners.

In sum, there are three main questions about momentum effect in the literature that need to be considered: i) whether momentum strategies under alternative implementations all produce positive after-transaction cost returns, ii) whether the measures of the transaction costs are
appropriate and accurate, and iii) whether short-sale constrains impact momentum performance. From the perspective of investors, it is important to determine the viability of momentum strategies. Therefore, this thesis compares the performance of time-series and cross-sectional momentum strategies under different implementation approaches after considering the transaction costs and short-sale impacts across developed markets.

### 2.3.2. Behavioural explanations

Behavioural finance provides an alternative view of the market to that is described by standard market theory. Behavioural finance recognises that investors behave irrationally in the market resulting in them making systematic errors in their investment decision making. Their irrationality could be attributed to psychological factors such as greed, fear, regret and overconfidence.

Black (1986) examines the impact of "noise" on financial economics and concludes that trading in financial markets is a consequence of the behaviour of noise traders ${ }^{12}$. Markets are inefficient and speculators are able to benefit from these inefficiencies, for example, the irrationality from which investors suffer may push price away from fundamentals and therefore, allow profitable mispricing to survive (Li et al., 2008).

Momentum studies find that momentum profits are short-term (around one year) and profitability reverses in the long - term (around three - five years) (Jegadeesh \& Titman, 1993). The behavioural camp argues that this pattern could be caused by investors' underreactions and/ or overreaction (Hong, Lim, \& Stein, 1998; Hong \& Stein, 1999; Jegadeesh \& Titman, 1993). This section discusses the literature that explains the momentum anomaly from a behavioural finance perspective.

[^8]
### 2.3.2.1. Under-reaction

Under-reaction happens when prices react insufficiently to firm-specific news. This causes positive serial correlation that gradually results in the price adjusting towards its fundamental level. Jegadeesh and Titman (1993) decompose the momentum profitability using Lo and MacKinlay (1990) model and show that the momentum strategy is not explained by systematic risk factors, implying market inefficiency. They find profit reversion in the crosssectional momentum strategy with approximately half of the profits generated in the first six months dissipating over the subsequent 24 months. They argue that the momentum anomaly can be reasonable explained by delayed price reactions (under-reaction). Jegadeesh and Titman (2001) and Lee and Swaminathan (2000) report consistent results when extending the time-horizon in the US market.

Daniel et al. (1998) show that investors under-react to public information and over-react to private information. Hong and Stein (1999) investigate the relationship between news diffusion and momentum anomalies by assuming two types of investors, news watchers and momentum traders (technical analysts). News watchers intend to trade only based on fundamental information, ignoring past price movements, whereas the momentum traders behave in the opposite manner. Hong and Stein (1999) demonstrates that it is the gradual news diffusion among the news watchers that results in market under-reaction which causes trends in price behaviour and so momentum profits to be profitable. The momentum traders, then extrapolate on the basis of historical prices, and push the prices of past winners (losers) above (below) their fundamental values further by continue to buy winners and sell losers even in the face of contrary information.

### 2.3.2.2. Overconfidence

Odean and Barber (1999) point out that overconfident traders sell winners prematurely, trade more frequently, hold losers for too long and make bigger losses. Overconfidence misleads investors into believing that they have superior abilities or information. Barberis, Shleifer, and Vishny (1998) posit that investors are overconfident about the value of their private signals and therefore they overact to information. Their study applies the idea of the "representative heuristic", as described by Tversky and Kahneman (1974). According to this idea investors behave as if recent events are typical of the return-generating process without considering the laws of probability. Barberis et al. (1998) argue that investors react too quickly to firm-specific information because of overconfidence, which leads a price to move away from its fundamental level and to correct (reverse) in the long-term.

Daniel et al. (1998) argue that the momentum anomaly may be caused by continuing overreaction by overconfident investors who put too much weight on their own private news and too little on public information. This tendency is reinforced by self-attribution bias ${ }^{13}$. Therefore, investors over-react to private information and under-react to public information. Due to self-attribution bias, investors adjust gradually when there is a contradiction between public information and their private beliefs and they continue to overreact if the information confirms their beliefs. Therefore, overconfidence causes an on-going overreaction with share prices moving away from their fundamental level.

Chui et al. (2010) demonstrate that momentum returns are positively correlated to the investor's degree of individuality trait which is positively correlated with overconfidence and self-attribution bias. According to Chui et al. (2010), it is cultural differences that explain the

[^9]momentum anomaly across countries. In countries where there are low levels of individuality, as is the case in Asian countries, market participants are less likely to be overconfident biased momentum investors. Cooper et al. (2004) explain momentum returns that are predicted by behavioural models (Barberis et al., 1998; Daniel et al., 1998), and conclude that the momentum effect should be greater when markets have been performing strongly (positively) because of the reduced risk aversion that accompanies profitable wealth and the increased overconfidence. Asem and Tian (2010) find varying levels of momentum profitability under different market conditions.

Although the debate about behavioural explanations for the momentum anomaly is still in progress, there is a general acceptance in the literature of the view that investors' beliefs could influence the momentum effect, and that their behaviour will be impacted on by different ex-ante market conditions (Cooper et al., 2004). Regarding the efficiency on the two momentum strategies, it is important to determine which one of the two momentum strategies (time-series and cross-sectional momentum strategies) produce better performance under different market conditions.

### 2.4. Conclusion

This chapter synthesises the literature relating to the momentum strategies in the international financial market. In the literature there is no consensus on the optimal implementation rules in the international stock markets. Thus, it is somewhat surprising that we are yet to see a comprehensive study that compares cross-sectional and time-series momentum strategies in stock markets.

Advocates of market efficiency argue that the momentum strategies may not be implementable due to the transaction costs. Therefore, it is important to assess the performances of two momentum strategies using various implementation methods and an
appropriate transaction cost measure. As a consequence, this thesis determines which one of the two strategies produces better outcomes, and what the optimal implementation approaches are across markets in developed countries.

Proponents of behavioural finance suggest that the decisions of market participants are asymmetric and influenced by ex-ante market conditions, such as "up" or "down" markets. In terms of the essential characteristics of the two momentum strategies, somewhat by construction we have already seen that relative number of stocks held in the winner and loser portfolios is likely to vary through the market condition with the time-series momentum strategy whereas these holding will remain constant with the cross-sectional momentum strategy. Thus, it is important to compare the two momentum strategies under different market conditions, as this may provide some insights for why one strategy is better than the other.

## Chapter 3 - Data

### 3.1. Introduction

This chapter outlines the data employed in testing the existence of the momentum effect and the analysis of the two momentum strategies. The quality of the data is always important in any research. The data filtering and cleaning processes are described in this chapter. Section 3.2 presents details of the samples that are used in the analysis. Section 3.3 describes the procedures of data filtering and Section 3.4 concludes the chapter.

Thomson Datastream is used as the primary source of international data because of its comprehensive coverage of time periods and countries. Ince and Porter (2006) report that, "We know of no source comparable to TDS (Thomson Datastream) in terms of number of markets covered and number of securities covered in each market." Gupta et al. (2010) use stock price data from Datastream to investigate momentum profitability across 52 international stock markets and indices. Liu et al. (2011) investigate international momentum profitability by using returns and market capitalisation in 20 major stock markets using data sourced from Datastream. Antoniou, Lam, and Paudyal (2007) find that the profitability of the momentum strategy can be explained by business-cycle variables and behavioural biases when using data sourced from Datastream. Griffin, Ji, and Martin (2003) use Datastream as a data source to analyse the effect of macroeconomic factors on the momentum anomaly in an international context.

### 3.2. Data retrieved

Datastream provides broad data sources on international markets. Our sample is retrieved from two categories, equities and interest rates in Datastream as this research focuses on the momentum strategies at the stock level from 1990 to 2012. The types of the samples include:
i. adjusted price of each stock in local currency

Both monthly and daily adjusted stock price are retrieved across the 24 countries.
ii. market value of each stock in local currency

We use the market value of each stock as the input for calculating market-value weighted momentum portfolio returns.
iii. book-to-market ratio of each stock in local currency

Book-to-market ratio is calculated as the reverse of the market-to-book value which was retrieved from Datastream. According to Datastream, market-to-book value is defined as the market value of the ordinary (common) equity divided by the balance sheet value of the ordinary (common) equity in the company.
iv. risk-free or equivalent interest rate for each country

Risk-free rates or equivalent interest rates for each country, (e.g. three-month treasury bills for each country) are downloaded from the interest rates in Datastream.

Some countries contain more than one stock exchange market. The historical data of stocks listed in these exchanges may not always be available in Datastream due to low liquidity. Based on the literature, main stock exchanges within a country are investigated in this research. Three main stock markets in the US, the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX) and NASDAQ are used to retrieve data for the US, whereas only the main stock exchange is examined for the remaining countries.

### 3.3. Data filtering

Simple returns allow for cross-sectional aggregation to estimate the winner and loser portfolio returns in momentum studies. The return for each stock i is calculated as follows:

$$
R_{i, t}=\frac{P_{i, t}}{P_{i, t-1}}-1
$$

where $R_{i, t}$ is the simple return for stock i in period t , and $P_{i, t}$ is the adjusted close price for stock i in period t. According to Datastream, adjusted close provides the closing price for the requested month, adjusted for all applicable splits and dividend distributions.

### 3.3.1. Data problems in Datastream

Although Datastream is widely used source of data in the academic finance domain, a few potential issues exist in the raw data which suggest that the data set cannot be directly used in the analysis. Ince and Porter (2006) emphasise the importance of handling data from Datastream with caution, and report that results may be distorted if potential issues are ignored.

According to the literature, the major issues with data from Datastream are:
i. problems related to delisted firms
ii. problems related to non-trading days
iii. problems primarily related to small stocks, e.g. small-cap stocks
iv. data recording errors (high spurious returns).

Care has been taken in this study to check for each of the data issues identified in the literature and to implement remedial actions in accordance with previous studies to reduce the impacts of data error. Some bias in the samples may still remain undetected after filtering;
however the risk is low. The process of data filtering undertaken to limit the impacts of above four major data issues is explained subsequently.

### 3.3.2. Screening for delisted firms

One of the serious issues in Datastream lies in a faulty approach to recording data. Datastream keeps repeating the price of dead stocks as the last valid traded price prior to delisting through to the end of the sample. To give an actual example: the stock price for Minara Resources (130560) remained recorded at the last trading price of $\$ 0.87$ on the Australia stock market (ASX) after it was delisted on 26 October 2011.

|  | MINARA RESOURCES DEAD |  |
| :---: | :---: | :---: |
| Name | - DELIST.26/10/11 |  |
| Date | Datastream Price | Actual Price |
| $1 / 06 / 2011$ | 0.75 | 0.75 |
| $1 / 07 / 2011$ | 0.73 | 0.73 |
| $1 / 08 / 2011$ | 0.69 | 0.69 |
| $1 / 09 / 2011$ | 0.88 | 0.88 |
| $1 / 10 / 2011$ | 0.87 | 0.87 |
| $1 / 11 / 2011$ | 0.87 | - |
| $1 / 12 / 2011$ | 0.87 | - |
| $1 / 01 / 2012$ | 0.87 | - |
| $1 / 02 / 2012$ | 0.87 | - |
| $1 / 03 / 2012$ | 0.87 | - |
| $1 / 04 / 2012$ | 0.87 | - |
| $1 / 05 / 2012$ | 0.87 | - |
| $1 / 06 / 2012$ | 0.87 | - |
| $1 / 07 / 2012$ | 0.87 | - |
| $1 / 08 / 2012$ | 0.87 | - |
| $1 / 09 / 2012$ | 0.87 | - |
| $1 / 10 / 2012$ | 0.87 | - |
| $1 / 11 / 2012$ | 0.87 | - |
| $1 / 12 / 2012$ | 0.87 | - |

Datastream provides the exact date that firms are delisted from the equity markets for some stocks, as is in the case of Minara Resources (26/10/2011); however, this is not true for all delisted firms. For some stocks, Datastream only records the words Dead, Delisted, or Suspended at the end of the stock name without the exact delisting date. For example, "Macquarie Goodman Indl. Dead - Merger W/503969" in Datastream shows that Macquarie Goodman Industrial (152489) was merged into the Goodman Group (503969) but no actual date for this event is given.

### 3.3.2.1. $\quad$ Exact date of stock delisting is given

Datastream provides information on the status of each stock, such as active, dead or suspended. Stocks can be easily divided into two categories, active or non-active (dead and suspended) by sorting the status of each stock in the market. If the exact date is given when a stock is delisted or suspended, all observations after this date (or month) are deleted.

### 3.3.2.2. Exact date of stock delisting is not given

If the exact date for the delisting of a stock is not given, we follow the approach recommended by Ince and Porter (2006) where all observations for a stock are dropped from the end of the sample period back to the first non-zero return. In the following example for Macquarie Goodman Industrial, all zero returns are dropped from the end of the sample period until $1 / 02 / 2005$ because in that month the return is $-0.42 \%$ (which is a non-zero return).

| Name | MACQUARIE GOODMAN INDL. DEAD <br> - MERGER W/503969 |  |
| :---: | :---: | :---: |
| Date | Price | Return |
| 1/11/2004 | 2 | 11.73\% |
| 1/12/2004 | 2.07 | 3.50\% |
| 1/01/2005 | 2.37 | 14.49\% |
| 1/02/2005 | 2.36 | -0.42\% |
| 1/03/2005 | 2.36 | 0.00\% |
| 1/04/2005 | 2.36 | 0.00\% |
|  | $\vdots$ |  |
| 1/09/2012 | 2.36 | 0.00\% |
| 1/10/2012 | 2.36 | 0.00\% |
| 1/11/2012 | 2.36 | 0.00\% |
| 1/12/2012 | 2.36 | 0.00\% |

### 3.3.3. Screening for non-trading day

This study uses monthly and daily stock data. The issue of non-trading days only appears in the daily data. The stock price remains unchanged over weekends and public holidays
because the security market is closed on those days. Datastream usually skips recording on weekends, but public holidays may not be identified or skipped. This is dealt with by dropping the data for any day where in excess of $90 \%$ of the stocks record a zero return (Lee, 2011). Although this approach is not as good as manually checking public holidays for each country, this is an efficient method for identifying public holidays.

### 3.3.4. Screening for small firms

Ince and Porter (2006) find some inconsistencies in the returns reported for the smaller capitalisation stocks. This is dealt with in many studies by excluding all stocks in each country in each period that are below the fifth percentile of stocks by market (Chui et al., 2010; Hong, Lee, \& Swaminathan, 2003). Another approach is to use multiple types of portfolio weights, such as market value weighted returns and equal weighted returns. In this study, the monthly return is treated as missing if the market value of a stock is below the fifth percentile of the entire market and the main results for the momentum returns are also presented separately under different portfolio weighting schemes.

### 3.3.5. Screening for highly spurious returns

A number of recording faults in Datastream show stock prices as suddenly increasing or decreasing when this did not happen. For example, QKL stores (274512) listed on the Nasdaq exchange market, was trading at $\$ 22.89$ in March 2000 but increased rapidly to $\$ 206.03$ in April 2000. The return is about $800 \%$ in a month. The return suddenly reverts to $\$ 0.05$ in July 2000. The return becomes $-100 \%$ in a month. This may be true in the real world but such cases are rare.

One approach to handling this problem is to exclude extreme observations such as those that are above $300 \%$ (Ince \& Porter, 2006). A problem with this is that it introduces
discontinuities in the data series which can be overcome by winsorising rather than excluding stocks with extreme values. We choose to winsorise both daily and monthly returns with involves determining the returns that lie at the top and bottom percentile in each country and then setting any returns that lie outside this range at the boundary (David McLean, Pontiff, \& Watanabe, 2009).

### 3.4. Conclusion

The quality of data is always important in the research. The literature finds that data records from Datastream contain flaws. Most are faults with delisted firms, and non-trading days, small stocks and high spike returns. Following suggestions in the literature, the data has been carefully and appropriately filtered. The range of monthly and daily raw stock returns for each market before and after data cleaning are reported in Table 3.1.

## Table 3.1. Summaries of raw returns before and after filtering

This table reports the maximum and minimum daily and monthly returns before and after data filtering. The data for listed and delisted firm was obtained from Datastream from 1990 to 2012 for each market. Following Ince and Porter (2006), data is filtered for delisted firms, non-trading days and excludes stocks whose market capitalization is in the lowest $5 \%$ of all stocks in each month, and then is winsorised the monthly (daily) return for each market.

|  | Raw monthly return |  | Screened monthly return |  | Raw daily return |  | Screened daily return |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Country | Maximum | Minimum | Maximum | Minimum | Maximum | Minimum | Maximum | Minimum |
| AUSTRALIA | 7900\% | -100\% | 83\% | -42\% | 8467\% | -100\% | 18.23\% | -14.89\% |
| AUSTRIA | 2705\% | -98\% | 39\% | -31\% | 9886\% | -99\% | 8.34\% | -7.80\% |
| BELGIUM | 920\% | -98\% | 34\% | -26\% | 904700\% | -100\% | 7.39\% | -6.79\% |
| CANADA | 74900\% | -100\% | 82\% | -41\% | 211900\% | -100\% | 21.60\% | -16.68\% |
| DENMARK | 1288\% | -100\% | 38\% | -29\% | 2877\% | -100\% | 8.82\% | -8.33\% |
| FINLAND | 1043\% | -94\% | 43\% | -29\% | 625\% | -94\% | 10.00\% | -8.86\% |
| FRANCE | 8433\% | -100\% | 57\% | -35\% | 43423\% | -100\% | 10.00\% | -9.59\% |
| GERMANY | 312400\% | -100\% | 66\% | -42\% | 312400\% | -99\% | 16.26\% | -13.49\% |
| GREECE | 1382\% | -93\% | 68\% | -36\% | 1382\% | -94\% | 10.02\% | -9.44\% |
| HONGKONG | 2977\% | -98\% | 82\% | -41\% | 2957\% | -98\% | 14.26\% | -11.12\% |
| IRELAND | 14653\% | -90\% | 56\% | -39\% | 13378\% | -99\% | 12.90\% | -11.99\% |
| ISRAEL | 10727\% | -100\% | 59\% | -37\% | 10727\% | -99\% | 10.03\% | -10.00\% |
| ITALY | 957\% | -100\% | 39\% | -28\% | 813\% | -99\% | 8.08\% | -6.72\% |
| JAPAN | 972\% | -100\% | 41\% | -28\% | 597\% | -99\% | 9.35\% | -7.78\% |
| NETHERLANDS | 1299\% | -98\% | 39\% | -31\% | 675\% | -97\% | 9.08\% | -8.18\% |
| NEWZEALAND | 30900\% | -96\% | 50\% | -33\% | 17900\% | -96\% | 11.09\% | -10.00\% |
| NORWAY | 1400\% | -99\% | 52\% | -38\% | 1602\% | -89\% | 12.17\% | -10.69\% |
| PORTUGAL | 5900\% | -98\% | 65\% | -35\% | 414300\% | -100\% | 10.00\% | -9.05\% |
| SINGAPORE | 500\% | -98\% | 59\% | -33\% | 10431\% | -99\% | 14.15\% | -11.22\% |
| SPAIN | 2786\% | -100\% | 38\% | -28\% | 2400\% | -100\% | 7.35\% | -6.28\% |
| SWEDEN | 11899\% | -99\% | 63\% | -40\% | 11899\% | -100\% | 16.66\% | -13.87\% |
| SWITZERLAND | 15533\% | -99\% | 31\% | -26\% | 3791\% | -99\% | 7.41\% | -6.91\% |
| UK | 2495\% | -99\% | 56\% | -38\% | 198825\% | -99\% | 10.01\% | -8.86\% |
| US | 10284143\% | -100\% | 55\% | -36\% | 10208705\% | -100\% | 12.58\% | -10.80\% |

In total, 34697 eligible stocks listed on the major stock exchange(s) in each country are downloaded from Datastream after removing stocks that failed to meet the certain criteria that have been discussed previously. The remaining stocks include active, dead and suspended firms in order to avoid survivorship bias. Domestic and foreign firms are also included in the sample. A list of major stock exchange(s) in 24 developed countries and the number of stocks within the sample period from 1990 to 2012 are reported in Table 3.2.

## Table 3.2. List of 24 developed countries

This table reports major stock exchange market(s) for each developed country. The data with listed and de-listed firm are obtained from Datastream from 1990 to 2012 for each country in order to avoid survivorship bias. The two right-hand columns report the total number of stocks and the number of average monthly stocks in each country after data filtering.

| COUNTRY | MAIN STOCK <br> EXCHANGE MARKET(S) | NO. OF <br> STOCKS | AVERAGE MONTHLY <br> STOCKS |
| :--- | :---: | :---: | :---: |
| AUSTRALIA | AUSTRALIAN | 2880 | 1141 |
| AUSTRIA | VIENNA STOCK EXCHANGE | 218 | 96 |
| BELGIUM | EURONEXT BRUSSELS | 335 | 157 |
| CANADA | TORONTO | 3020 | 1200 |
| DENMARK | COPENHAGEN STOCK EXCHANGE | 360 | 195 |
| FINLAND | HELSINKI | 213 | 106 |
| FRANCE | EURONEXT PARIS | 1991 | 828 |
| GERMANY | FRANKFURT | 1450 | 663 |
| GREECE | ATHENS | 415 | 224 |
| HONGKONG | HONG KONG | 1404 | 715 |
| IRELAND | DUBLIN | 131 | 58 |
| ISRAEL | TEL AVIV | 843 | 475 |
| ITALY | MILAN | 543 | 241 |
| JAPAN | TOKYO STOCK EXCHANGE | 2990 | 2096 |
| NETHERLANDS | EURONEXT AMSTERDAM | 304 | 160 |
| NEWZEALAND | NEW ZEALAND | 279 | 115 |
| NORWAY | OSLO STOCK EXCHANGE | 479 | 165 |
| PORTUGAL | EURONEXT LISBON. | 198 | 92 |
| SINGAPORE | SINGAPORE | 792 | 367 |
| SPAIN | MADRID SIBE | 281 | 145 |
| SWEDEN | STOCKHOLM | 906 | 308 |
| SWITZERLAND | SIX SWISS | 412 | 235 |
| UK | LONDON | 4212 | 1601 |
| US |  | 10041 | 4232 |
| TOTAL |  | 34697 |  |

The summaries (mean and standard deviation) of monthly stock returns, market value and book-to-market ratio across the 24 markets are shown in Table 3.3. EW, MV and IVOL indicate equal-weighted, market-weighted and inversed-volatility weighted market indexes
from 1992 to 2012. ${ }^{14}$ The time-series and cross-sectional momentum strategies start at 1990; however, we only report the momentum results from 1992 to 2012 in order to have the same time length for numerous momentum strategies with different formation and holding periods.

## Table 3.3. Summaries of monthly returns across 24 markets

This table reports the average and the standard deviation of monthly market returns based on equal weight (EW), market weight (MW) and inversed-volatility weight (IVOL), and the average and standard deviations of monthly market value and monthly book-to-market value for each market. Monthly returns, market value and book-to-market ratio are reported in local currencies. Similar to the method employed in Moskowitz et al. (2012), IVOL ( $3,6,9$ and 12) indicate the size of the stock in the portfolio is set to be inversely proportional to its ex-ante volatility over three, six, nine and 12 months, respectively, at each month. Implementations with different formation periods ( $\mathrm{J}=3,6,9$ and 12 months) have different length of time periods, e.g. the implementation approach using $\mathrm{J}=3$ months, the strategy has three months less in the total time period compared with the approach using $\mathrm{J}=6$ months. In order to compare the strategies across different implementation approaches in the same time term, momentum results are reported from 1992 to 2012 in the study.

| COUNTRY | MONTHLY RETURN |  |  |  |  |  |  |  |  |  |  |  | MONTHLY <br> MARKET VALUE |  | MONTHLY BOOK-TO-MARKET |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | EW |  | MV |  | IVOL3 |  | IVOL6 |  | IVOL9 |  | IVOL12 |  |  |  |  |  |
|  | Mean | Std | Mean | Std | Mean | Std | Mean | Std | Mean | Std | Mean | Std | Mean | Std | Mean | Std |
| AUSTRALIA | 1.33\% | 5.52\% | 1.14\% | 5.22\% | 0.82\% | 1.55\% | 0.88\% | 1.77\% | 0.91\% | 1.84\% | 0.91\% | 1.87\% | 795.16 | 497.76 | 0.74 | 0.21 |
| AUSTRIA | 0.43\% | 3.45\% | 1.14\% | 5.40\% | 0.31\% | 1.13\% | 0.28\% | 1.17\% | 0.31\% | 1.22\% | 0.32\% | 1.28\% | 771.28 | 374.16 | 1.48 | 0.27 |
| BELGIUM | 0.63\% | 2.94\% | 1.17\% | 5.04\% | 0.61\% | 2.03\% | 0.62\% | 2.29\% | 0.60\% | 2.38\% | 0.63\% | 2.48\% | 1581.74 | 924.82 | 1.24 | 0.57 |
| CANADA | 1.69\% | 5.47\% | 1.81\% | 4.57\% | 0.72\% | 3.16\% | 0.81\% | 3.38\% | 0.82\% | 3.44\% | 0.81\% | 3.50\% | 874.93 | 468.99 | 0.88 | 0.26 |
| DENMARK | 0.59\% | 3.91\% | 1.55\% | 4.85\% | 0.57\% | 2.92\% | 0.57\% | 3.05\% | 0.60\% | $3.27 \%$ | 0.59\% | 3.31\% | 3509.55 | 1984.36 | 0.90 | 0.19 |
| FINLAND | 1.19\% | 5.77\% | 1.85\% | 8.52\% | 1.10\% | 4.95\% | 1.14\% | 5.15\% | 1.17\% | 5.21\% | 1.19\% | 5.23\% | 1049.72 | 541.44 | 0.73 | 0.26 |
| FRANCE | 0.96\% | 3.99\% | 1.43\% | 5.01\% | 0.43\% | 1.49\% | 0.41\% | 2.11\% | 0.51\% | 2.28\% | 0.56\% | 2.47\% | 1365.10 | 336.04 | 0.81 | 0.19 |
| GERMANY | 0.42\% | 4.31\% | 1.33\% | 5.31\% | 0.28\% | 2.02\% | 0.34\% | 2.38\% | 0.31\% | 2.59\% | 0.35\% | 2.70\% | 1182.44 | 350.02 | 1.71 | 1.16 |
| GREECE | 1.07\% | 9.85\% | 1.39\% | 9.45\% | 0.91\% | 8.50\% | 0.82\% | 8.62\% | 0.93\% | 8.85\% | 0.94\% | 8.95\% | 2205.63 | 2992.13 | 1.03 | 0.63 |
| HONGKONG | 1.38\% | 8.38\% | 1.98\% | 7.75\% | 1.02\% | 5.90\% | 1.23\% | 6.19\% | 1.28\% | 6.48\% | 1.41\% | 6.60\% | 7220.63 | 3236.50 | 1.41 | 0.41 |
| IRELAND | 1.02\% | 5.78\% | 1.61\% | 6.05\% | 1.02\% | 4.41\% | 0.88\% | 4.58\% | 0.80\% | 4.73\% | 0.80\% | 4.77\% | 827.88 | 523.89 | 0.92 | 0.55 |
| ISRAEL | 1.19\% | 6.73\% | 1.67\% | 6.47\% | 0.93\% | 5.56\% | 0.91\% | 5.83\% | 0.89\% | 5.92\% | 0.87\% | 5.99\% | 1443.25 | 3154.75 | 1.14 | 8.73 |
| ITALY | 0.33\% | 5.73\% | 1.35\% | 6.89\% | 0.27\% | 4.58\% | 0.35\% | 4.81\% | 0.37\% | 5.01\% | 0.38\% | 5.10\% | 53971.55 | 80471.27 | 0.91 | 0.25 |
| JAPAN | 0.27\% | 5.82\% | 0.71\% | 5.43\% | 0.03\% | 4.74\% | 0.12\% | 4.93\% | 0.16\% | 5.01\% | 0.18\% | 5.07\% | 168479.61 | 35707.23 | 0.99 | 0.34 |
| NETHERLANDS | 0.72\% | 4.77\% | 1.33\% | 5.18\% | 0.73\% | 3.66\% | 0.77\% | 3.95\% | 0.80\% | 4.00\% | 0.82\% | 4.08\% | 2609.86 | 1139.69 | 0.96 | 0.34 |
| NEWZEALAND | 1.05\% | 3.87\% | 1.47\% | 4.13\% | 1.55\% | 6.03\% | 1.00\% | 3.30\% | 0.97\% | 3.35\% | 0.98\% | 3.39\% | 386.18 | 57.50 | 0.84 | 0.15 |
| NORWAY | 1.22\% | 5.95\% | 1.91\% | 6.33\% | 1.05\% | 4.36\% | 1.06\% | 4.69\% | 1.04\% | 4.84\% | 1.06\% | 4.94\% | 4335.38 | 2709.93 | 0.95 | 0.35 |
| PORTUGAL | 0.78\% | 3.98\% | 1.26\% | 6.36\% | 0.83\% | 1.05\% | 0.69\% | 1.30\% | 0.54\% | 1.55\% | 0.56\% | 1.82\% | 1181.20 | 606.41 | 1.30 | 0.31 |
| SINGAPORE | 1.10\% | 8.11\% | 1.36\% | 6.02\% | 0.93\% | 6.25\% | 0.91\% | 6.73\% | 0.98\% | 6.87\% | 0.96\% | 7.00\% | 1205.81 | 328.57 | 1.06 | 0.33 |
| SPAIN | 0.71\% | 4.77\% | 1.06\% | 5.57\% | 0.63\% | 3.05\% | 0.69\% | 3.31\% | 0.66\% | 3.41\% | 0.71\% | 3.44\% | 4280.14 | 2242.08 | 0.80 | 0.19 |
| SWEDEN | 1.15\% | 6.35\% | 1.92\% | 6.78\% | 1.04\% | 4.96\% | 1.12\% | 5.16\% | 1.17\% | 5.24\% | 1.18\% | 5.29\% | 5979.49 | 2114.60 | 0.92 | 0.77 |
| SWITZERLAND | 0.79\% | 3.86\% | 1.19\% | 4.36\% | 0.80\% | 2.41\% | 0.77\% | 2.65\% | 0.77\% | 2.74\% | 0.79\% | 2.78\% | 3534.89 | 1515.28 | 1.24 | 0.37 |
| UK | 0.66\% | 4.62\% | 1.39\% | 4.29\% | 0.24\% | 2.87\% | 0.43\% | 3.17\% | 0.49\% | 3.31\% | 0.61\% | 3.55\% | 814.17 | 275.46 | 0.73 | 0.21 |
| US | 1.52\% | 5.36\% | 1.65\% | 4.60\% | 1.05\% | 4.09\% | 0.99\% | 3.99\% | 1.03\% | 4.00\% | 1.02\% | 4.00\% | 2671.34 | 1139.96 | 0.62 | 0.13 |

[^10]
## Chapter 4 - Momentum trading strategies

### 4.1. Introduction

The primary aim of this research is to compare before-transaction cost (raw) returns, aftertransaction cost (net) returns and risk-adjusted net returns obtained using time-series and cross-sectional momentum strategies under various implementation approaches across the 24 markets. The more successful momentum strategies will be those based on implementation methods that result in identifying winners (and losers) early in their up - (and down -) cycles and reversing these positions in close to an optimum fashion.

The question as to what implementation rules will produce the best outcome is purely an empirical one. This chapter sets out the various implementation procedures and portfolio formation algorithms that are used to examine the cross-sectional momentum strategy, which selects stocks based on their relative performance, and the time-series momentum strategy which selects stocks based on their absolute performance. Section 4.2 explains the crosssectional and time-series momentum strategies. Section 4.3 discusses the implementation approaches that are used in each strategy. Section 4.4 briefly explains the model used to calculate transaction cost (see Section 7.3 for more details) and the standard risk-adjusted model utilised (see Sections 8.2 and 8.3 for more details), and section 4.5 concludes the chapter.

### 4.2. Momentum strategies

### 4.2.1. Cross-sectional momentum strategy

To examine the cross-sectional momentum strategy returns, this research follows Jegadeesh and Titman (1993) approach which involves ranking stocks on the basis of their performance
over the last J months and then identifying as winners those stocks that rank in the top $\mathrm{x} \%$ of the distribution, and as losers those stocks that rank in the bottom $\mathrm{x} \%$. One value for x that is examined in this study is $50 \%$ which results in all stocks being designated as either the winners or the losers. This cut-off would suggest that past performance provides a good signal for future performance across the whole range of performance outcomes. Dating back to the original study of Jegadeesh and Titman (1993), the strength of the information signal has been shown to degrade as one proceeds down the rankings. In order to account for this, this study also examines the situations where the cut-off ( $\mathrm{x} \%$ ) is set at $16 \%$, at $30 \%$ and at 50\%.

The procedures of the cross-sectional momentum strategy can be divided into five steps, and the implementations will be explained in Section 4.3.

Step 1 - Stock selection (formation periods): At the end of each month $t$ if using month rebalancing or at the end of each holding period $\mathrm{t}+\mathrm{H}$ ( H is the holding period) if using buy-and-hold, all eligible stocks are ranked based on their J -month ( $\mathrm{J}=$ three, six, nine and 12 months) formation returns which are average returns over the last J months (t-J to t-1).

Step 2 - Stock selection (cut off points): The winner portfolio then contains the top $\mathrm{x} \%$ of stocks and the loser portfolio contains the bottom $\mathrm{x} \%$ according to different cut-offs, for which $\mathrm{x} \%$ equals $16 \%, 30 \%$ and $50 \%$, respectively.

Step 3 - Portfolio weighting schemes: The returns of winner and loser portfolios are calculated using different portfolio weighting schemes, such as equal weight, market weight and inversed-volatility weight.

Step 4 - Holding periods: Winner and loser portfolios are held for H -months $(\mathrm{H}=$ three, six, nine and 12 months). If there is no gap between the formation and holding periods, the
holding periods for winners and losers are from t to $\mathrm{t}+\mathrm{H}-1$ months, whereas, holding periods are from $\mathrm{t}+1$ to $\mathrm{t}+\mathrm{H}$ months if using implementation with one-month gap between the formation and holding periods. Monthly momentum return is then generated by buying the winners and selling the losers at the end of each month.

Two types of portfolio constructions, buy-and-hold (Step 5a) and monthly rebalancing (Step $5 b)$ are examined in the study.

Step 5(a) - Portfolio constructions (buy-and-hold): For buy-and-hold, the procedures from 1 to 4 are repeated and rolled forward at the end of holding period to produce new winner, loser and momentum portfolios at the end of each month.

Step 5(b) - Portfolio constructions (monthly rebalancing): For monthly rebalancing, the procedures from 1 to 4 are repeated and rolled forward at the end of each month to produce new winner and loser portfolios.

### 4.2.2. Time-series momentum strategy

For the time-series momentum strategy, the cut-off for identifying winners and losers is an absolute/pre-determined level of returns. Moskowitz et al. (2012) use a method where all stocks that realise a positive (greater than zero) past return were identified as winners and those that realise a negative (smaller than zero) return were identified as losers. Another similar method that is used with time-series momentum strategy is to set the cut-off as the market return over the formation period. For example, if the market return is $2 \%$, then all stocks that return more than $2 \%$ would be classified as winners and all those that return less than $2 \%$ would be classified as losers. Of course, the two rules discussed to date for the timeseries momentum strategy result in every stock in the investment universe being classified as either a winner or a loser portfolio. In order to match the situation where the cut-offs under
the cross-sectional momentum are set at $16 \%$ (30\%), the study sets symmetric upper and lower cut-offs for the time-series momentum strategy which result on average in $32 \%$ (60\%) of the investment stocks being classified as either winners or losers when measured across the whole sample period.

The time-series momentum strategy procedure can be classified into the same five steps as the cross-sectional momentum strategy except for the procedure of stock selection, which is the second step. The alternative procedures when using pre-determined cut-off(s) in step two for the time-series momentum strategy are: using a single cut-off (step 2 a ) and double cutoffs (steps 2 b and 2 c ) in order to make comparisons between with the cross-sectional momentum strategy and investing in whole samples or partial samples ( $32 \%$ and $60 \%$ ). ${ }^{15}$

Step 2 (a) - Stock selection (single cut-off point): For a single cut-off, stocks are included in the winner portfolio if formation returns are above $\mathrm{x} \%$ and the loser portfolio is they are below $\mathrm{x} \%$. Moskowitz et al. (2012) use the single cut-off level when $\mathrm{x} \%$ is zero. An alternative single cut-off is based on the market index over the holding period where winners are stocks that outperform the market index and loser stocks are those that underperform. Under both methods, all stocks are included in either the winner or loser portfolio.

Step 2 (b) - Stock selection (in-sample upper and lower cut-off points): We first estimate the returns for each stock over the formations periods, named formation return and then calculate the mean and standard deviation of these returns over the whole sample period. Assuming these returns are normal distributed, we determine the cut-offs that will result in the required number of stocks being allocated to either winner or loser portfolios across the

[^11]whole sample period. For example, if the number of stocks required is $32 \%$, then the cut-offs would be set at plus and minus one standard deviation from the mean. ${ }^{16}$

Step 2 (c) - Stock selection (out-of-sample upper and lower cut-off points): Rather than using the entire sample period to determine the cut-offs and then applying them each time portfolio is formed, we set the cut-offs by using the mean plus and minus one standard deviation based on the sample where return of each stock over the formation period at each period. Although out-of-sample method leads the upper and lower levels to vary over different time periods, the total number of stocks (i.e. number of stocks in winner and loser portfolios) in the time-series momentum strategy across the whole testing period is similar with that using in-sample method with investing in approximately one-third of the sample.

### 4.3. Momentum implementation approaches

Lee and Swaminathan (2000) suggest that the prices of securities oscillate around their fair values. The success of any momentum strategy will depend on it being based on implementation rules that are in harmony with the periodicity of the pricing cycles. As momentum investment signals are based on recent pricing movements, they will always be late in identifying winning and losing securities. The more successful momentum strategies will be those based on implementation rules that results in identifying winners and losers early in their up or down cycle and reversing these positions in close to an optimum fashion.

One of the important objectives of this thesis is to provide some insights into the optimal implementation rules in the international market and to demonstrate over a particular sample period how they might vary both across markets and across time. This section explains the

[^12]implementation strategies that are examined in the study. The two strategies with different implementation approaches are discussed below in terms of the contribution they make to the two parts of the investment process: stock selection and portfolio structure, followed by specified examples of both strategies.

### 4.3.1. Stock selection

Stock selection involves identifying the stocks in which to invest or short-sell. For both momentum strategies, stock selection has the following components:

## Specifying the prior period over which to measure stock returns (the formation period)

The important consideration in marking this decision is to use a period long enough to identify true trends in markets but not so long as to generate trade signals that are too late in a stock's cycle. Jegadeesh and Titman (1993) apply three, six, nine and 12 months as formation periods in cross-sectional momentum studies, and report the strategy yields optimal return when the formation and holding periods are both set at six months. However, Moskowitz et al. (2012) claim the time-series momentum time period is optimal when the formation period is set 12 months. This study examines four formation points (J) of three, six, nine and 12 months.

## Specifying the cut-off rule that identifies stocks as being winners or losers

## Cross-sectional momentum strategy

In the cross-sectional momentum strategy, applying the cut-off rule involves ranking stocks on the basis of their performance over the last J months and then identifying as winners those stocks that rank in the top $\mathrm{x} \%$ of the distribution, and as losers those stocks that rank in the bottom $\mathrm{x} \%$. Values for x that are examined are $16 \%, 30 \%$ and $50 \%$. (See Section 4.2.1)

## Time-series momentum strategy

Under the time-series momentum strategy, the cut-offs for identifying winners and losers are using use either one or two cut-off numbers. The procedures for finding those cut-offs are explained in Section 4.2.2 above.

### 4.3.2. Portfolio constructions

The portfolio construction decisions involve determining each time the portfolios are rebalanced, the weights allocated to the winners and the losers in their respective portfolios. There are three separate decisions that are considered here that in combination determine the weightings of stocks in both the winner and loser portfolios:

## The holding period

This is a rule common to both momentum strategies that determines the length of time we hold a stock once it is included in either the winner or the loser portfolio. For example, if the holding period is six months, then a stock will be sold six months after it was acquired. As mentioned earlier, the implementation rules have to produce portfolios that are in harmony with the periodicity of the oscillations of the typical stock. In other words, the aggregate of the formation and holding periods should approximate the periodicity of the upward and downward cycles for the typical stock.

For the momentum strategy, studies find that the momentum return may be the product of investors' irrationality in the medium horizon and the irrationality may be corrected in the long run. Chui et al. (2010) and Jegadeesh and Titman (2001) observe that momentum profitability is driven by slow information diffusion that may lead to under-reaction and persistence in returns. The initial under-reaction may be followed by an over-reaction that expands the drift in momentum returns that will be corrected over the long run.

The question of what an optimal holding period is across different markets is an empirical one. Momentum profitability will disappear if a longer holding period is used. On the other hand, transaction costs will be increased if portfolio trading occurs frequently due to a short holding period. Following Jegadeesh and Titman (1993), this research examines holding periods $(\mathrm{H})$ of three, six, nine and 12 months.

## The period for portfolio rebalancing

One portfolio rebalancing strategy examined is a buy-and-hold strategy where the portfolio is rebalanced at the end of each holding period (BHAR). For example, if the holding period is six months then the portfolio is rebalanced every six months with the portfolio acquired six months ago being sold and replaced by a new portfolio. The alternative approach is to rebalance the portfolio every month irrespective of the holding period for the stocks (CAR). If the holding period $(\mathrm{H})$ is six months, then with monthly rebalancing, the portfolio holding acquired six months previously will be replaced with new holdings, which means that approximately one-sixth of the portfolio will be turned over each month.

In the context of momentum studies, Moskowitz et al. (2012) examine the time-series momentum strategy with a monthly rebalancing procedure, whereas Jegadeesh and Titman (1993) consider these two strategies for rebalancing and find monthly rebalancing to be superior.

A further matter to take into account is the role that the bid-ask spread plays in explaining momentum. It is quite possible that stocks that have performed well (poorly) over the formation period are near the top (bottom) of the bid-ask spread. This being the case, shortterm future performance in particular may be eroded by prices moving back towards the midpoint of the bid-ask spread. This raises the possibility that better performance might be realised by delaying trading for a short time after a stock has been identified as a winner or a
loser. This study also looks at buy-and-hold strategies and monthly rebalancing where trading is delayed by one month. This means that in total the study considers four rebalancing strategies: BHAR (0), BHAR (1), CAR (0) and CAR (1) ${ }^{17}$.

## The determination of the weights assigned to stocks

Once it is determined what stocks to include in a portfolio, it is then necessary to allocate portions of the total funds invested to each of the stocks. The two most common methods for doing this in the academic literature are: to equally weight each stock (EW) or to apportion funds to stocks based on the market weight of the stock's equity (MW). An important difference between these two methods is that by equally weighting them, the portfolio holdings are made more skewed towards stock in smaller companies. A third method of weighting stocks is to base the proportion of funds allocated to each stock on the inverse of the volatility of the returns of the stocks to be included in each portfolio (IVOL).

The use of equal weights and market weights have been commonly used in many other studies with IVOL being similar to the method employed in Moskowitz et al. (2012). This method tilts the portfolios towards lower volatility stocks and so produces investment portfolios with lower risk.

The IVOL return is estimated as:

$$
\begin{equation*}
R_{p, t}=\frac{\sum_{i=1}^{N} R_{i, t} * 1 / \sigma_{i, t}}{\sum_{i=1}^{N} 1 / \sigma_{i, t}} \tag{1}
\end{equation*}
$$

[^13]where $R_{p, t}$ is the return of the winner (loser) portfolio at time $\mathrm{t}, \mathrm{N}$ is the number of stocks in the winner (loser) portfolio, $R_{i, t}$ is the monthly stock return at time t in the winner (loser) portfolio, and $\sigma_{i, t}$ is the monthly stock standard deviation based on its past daily returns $r$.
\[

$$
\begin{equation*}
\sigma_{i}(t, D)^{2}=\frac{1}{D-1} \sum_{a=1}^{D}\left(r_{i, t-a}-\bar{r}_{l}\right)^{2} \tag{2}
\end{equation*}
$$

\]

where $\bar{r}_{l}=\frac{1}{D} \sum_{a=1}^{D} r_{i, t-a}$, D is the total number of trading days over the last $\mathrm{J}(\mathrm{J}=3,6,9$ and 12) months.

The literature lacks consensus on the optimum implementation strategies in international markets. Therefore, it is surprising that we are yet to see a comprehensive study that compares cross-sectional and time-series momentum strategies in this arena. As a consequence by investigating the two strategies under alternative implementations, this study seeks to find which one offers the best performance, and to identify the optimal rules for their implementation across developed stock markets.

### 4.4. Transaction cost and risk measurements

In order to determine whether the time-series and cross-sectional momentum strategies are profitable and, which strategy produces the superior profits, this study assesses the profitability of these two strategies after accounting for transaction costs and standard risk factors. Lesmond et al. $(1999,2004)$ apply what they refer to as the LOT model to infer that trading costs from the buyer's and seller's perspective. The transaction cost estimates from the LOT model include not only the percentage of bid-ask quote spread, but also the
percentage of the effective spread, the percentage price impact, and the percentage realised spread. ${ }^{18}$

Goyenko et al. (2009) compare the results from numerous cost measures widely employed in the literature using real data from the US markets, and conclude that amended version, named the LOT Y-split model, is more accurate that the original model for capturing the transaction costs. Therefore, this study applies the LOT Y-split model to estimate transaction costs based on daily stock returns. These transaction costs estimate will then be used to calculate aftertransaction costs (net) monthly returns for the time-series and cross-sectional momentum strategies across all implementation approaches.

Finally, the Fama-French three-factor model will be applied to these net returns to capture standard risk-adjusted returns for the two momentum strategies. A second risk-adjusted procedure that we will apply is to use the new returns as the basis for calculating the Sharpe ratio. The methods of transaction cost measurement and risk-adjustment will be discussed and explained in Chapter 7 and Chapter 8, respectively.

### 4.5. Conclusion

This chapter explains the procedures for the implementation of the time-series and crosssectional momentum strategies that are investigated in this thesis. A summary of all of the implementation strategies to be examined are set out in Table 4.1. Overall, 960 time-series and 576 cross-sectional implementation approaches are examined in each stock market. ${ }^{19}$

[^14]Table 4.1. Cross-sectional and time-series momentum strategies: summary of implementation options

| Stock selection | Stock selection criteria |  | Cross-sectional momentum | Time-series momentum |
| :---: | :---: | :---: | :---: | :---: |
|  | Formation periods |  | $\mathrm{J}=3,6,9$ and 12 months |  |
|  | Cut-off <br> Point(s) | Invest in whole sample | Winner and loser portfolios each contain top and bottom $50 \%$ of stocks in the entire market | An absolute cut off point of winner and loser portfolios is a $x \%$ return ( $x$ is zero or market index). |
|  |  | Invest in approx. 32\% (60\%) of sample | Winner and loser portfolios each contain top and bottom $16 \% ~(30 \%)$ of stocks in the entire market | Winner and loser portfolios each contain stocks above the pre-defined upper level and below the pre-defined lower level. ${ }^{20}$ |
| Portfolio structure | Portfolio weights |  | Equal weight (EW) <br> Market value weight (MW) <br> Inversed-volatility weight (IVOL) |  |
|  | Holding periods |  | $\mathrm{H}=3,6,9$ and 12 months |  |
|  | $\begin{gathered} \text { Portfolio } \\ \text { construction } \end{gathered}$ |  | $\begin{gathered} \mathrm{CAR}(0) \text { and CAR }(1) \\ \operatorname{BHAR}(0) \text { and } \operatorname{BHAR}(1) \\ \hline \end{gathered}$ |  |

[^15]
## Chapter 5 - Comparison of returns between time-series and cross-sectional momentum strategies

### 5.1. Introduction

In this chapter we report and discuss the performance of the time-series and cross-sectional momentum strategies across stock markets in 24 developed countries. The chapter is organised as follows. Sections 5.2 and 5.3 present the returns pertaining to the time-series and cross-sectional momentum strategies under the different implementation approaches discussed in Chapter 4. Section 5.4 compares the performances of the two momentum strategies when using an optimal implementation approach. Conclusions are drawn in Section 5.5.

### 5.2. Returns of time-series momentum strategies

In Table 5.1 contained in Appendix 3, we report the average monthly returns for 16 ( $\mathrm{J} \times \mathrm{H}$ ) time-series momentum strategies across the 24 stock markets along with an indication of whether the returns are significant at the $1 \%, 5 \%$ and $10 \%$ levels and associated Newey-West t-statistics (in italics) ${ }^{22}$. The strategy used is to form a long portfolio consisting of the identified winning stocks and a short portfolio consisting of the identified losing stocks with the average monthly returns reported being the difference between the monthly returns on the two portfolios. The results all relate to an implementation in which the cut-offs for selecting the stocks to be included in the cross-sectional momentum portfolios were set at $16 \%{ }^{23}$

[^16]In order to determine the cut-offs for the time-series momentum strategy for each market, as discussed in Chapter 4, the matrix of the formation returns for all stocks across the entire sample period in each market is generated and the cut-offs are then at $\mathrm{x} \%$ standard deviation above, and $\mathrm{x} \%$ standard deviation below, the mean. ${ }^{24}$ For example, the cut-offs set for Australia are $5.99 \%$ for the upper bound and $-4.14 \%$ for the lower band, resulting in all stocks in each period realising returns of $5.99 \%$ and above being classified as winning stocks, and stocks realising $-4.14 \%$ and below being classified as a losing stocks. ${ }^{25}$ Panels A, B and C of Table 5.1 present the monthly time-series momentum strategies when the portfolio weights are based on EW, MW and IVOL, respectively.

### 5.2.1. Returns of time-series momentum strategies

Table 5.2 provides an analysis of the returns realised under the numerous implementations of the time-series momentum strategy across the 24 markets. We report that $94 \%$ of the implementations considered yield positive returns of which $61 \%$ are significant. In contrast, none of the $6 \%$ of implementations that yield negative returns prove to be significant. Therefore, there is overwhelming evidence to suggest that over our sample period the timeseries momentum strategy provides the basis for a very good investment strategy. However, the extent of their success varied across the markets with there not being a single implementation that yields a negative return in Canada, Denmark, Germany, Sweden and the UK. At the other end of the scale, in excess of $20 \%$ of the implementation examined yield negative returns in Greece, Israel and Spain.

[^17]Chart 5.1 reports the average monthly return of time-series momentum strategies calculated across the 192 implementation approaches. The average returns range from $0.28 \%$ per month in Spain to $1.5 \%$ per month in Sweden with the average return across the 24 markets being in $0.91 \%$ per month. The markets that outperform this average by in excess of $25 \%$ are Canada, Denmark, the Netherlands, New Zealand, Sweden and the UK. In contrast, in Greece, Israel, Japan, Norway, Spain and the US, the average monthly return generated across the implementation strategies realise a return less than half the average monthly return across all markets.

## Table 5.2. Numbers of implementations yield positive/negative time-series momentum returns

This table reports the numbers of implementations that yield positive and negative average monthly time-series momentum returns for each market. The SIGNIFICANT column indicates the aggregate numbers of implementations that generate average monthly returns at the $1 \%, 5 \%$, or $10 \%$ significant level, whereas the NON-SIGNIFICANT column indicates the numbers of strategies that produce average monthly returns over the $10 \%$ significance level.

|  |  | POSITIVE |  |  |  | NEGATIVE |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | IMPLEMENTATION APPROACHES | SIGNIFICANT | PERCENTAGE | NON <br> SIGNIFICANT | PERCENTAGE | SIGNIFICANT | PERCENTAGE | NON <br> SIGNIFICANT | PERCENTAGE |
| AUSTRALIA | 192 | 125 | 65\% | 54 | 28\% | 0 | 0\% | 13 | 7\% |
| AUSTRIA | 192 | 138 | 72\% | 52 | 27\% | 0 | 0\% | 2 | 1\% |
| BELGIUM | 192 | 170 | 89\% | 21 | 11\% | 0 | 0\% | 1 | 1\% |
| CANADA | 192 | 178 | 93\% | 14 | 7\% | 0 | 0\% | 0 | 0\% |
| DENMARK | 192 | 183 | 95\% | 9 | 5\% | 0 | 0\% | 0 | 0\% |
| FINLAND | 192 | 139 | 72\% | 51 | 27\% | 0 | 0\% | 2 | 1\% |
| FRANCE | 192 | 114 | 59\% | 66 | 34\% | 0 | 0\% | 12 | 6\% |
| GERMANY | 192 | 179 | 93\% | 13 | 7\% | 0 | 0\% | 0 | 0\% |
| GREECE | 192 | 15 | 8\% | 121 | 63\% | 0 | 0\% | 56 | 29\% |
| HONGKONG | 192 | 74 | 39\% | 101 | 53\% | 0 | 0\% | 17 | 9\% |
| IRELAND | 192 | 53 | 28\% | 116 | 60\% | 0 | 0\% | 23 | 12\% |
| ISRAEL | 192 | 54 | 28\% | 84 | 44\% | 2 | 1\% | 52 | 27\% |
| ITALY | 192 | 168 | 88\% | 23 | 12\% | 0 | 0\% | 1 | 1\% |
| JAPAN | 192 | 13 | 7\% | 174 | 91\% | 0 | 0\% | 5 | 3\% |
| NETHERLANDS | 192 | 169 | 88\% | 22 | 11\% | 0 | 0\% | 1 | 1\% |
| NEWZEALAND | 192 | 167 | 87\% | 23 | 12\% | 0 | 0\% | 2 | 1\% |
| NORWAY | 192 | 87 | 45\% | 104 | 54\% | 0 | 0\% | 1 | 1\% |
| PORTUGAL | 192 | 27 | 14\% | 134 | 70\% | 1 | 1\% | 30 | 16\% |
| SINGAPORE | 192 | 135 | 70\% | 50 | 26\% | 0 | 0\% | 7 | 4\% |
| SPAIN | 192 | 39 | 20\% | 113 | 59\% | 1 | 1\% | 39 | 20\% |
| SWEDEN | 192 | 169 | 88\% | 23 | 12\% | 0 | 0\% | 0 | 0\% |
| SWITZERLAND | 192 | 172 | 90\% | 19 | 10\% | 0 | 0\% | 1 | 1\% |
| UK | 192 | 186 | 97\% | 6 | 3\% | 0 | 0\% | 0 | 0\% |
| US | 192 | 68 | 35\% | 111 | 58\% | 0 | 0\% | 13 | 7\% |
| POOLED SAMPLE | 192 | 118 | 61\% | 63 | 33\% | 0 | 0\% | 12 | 6\% |

## Chart 5.1 Average time-series momentum returns across implementations for each market

This chart reports the pooled average monthly returns for 192 time-series momentum strategies for each market. The dashed line shows the average monthly returns across the 24 developed markets.


### 5.2.2. The weighting methods

Table 5.3 reports the pooled returns (t-statistics in italic) of average time-series momentum monthly returns for each market when implementations are using equal weights (EW), market weights (MW) and inverse volatility weights (IVOL). The implementations using MW produce the greatest outcomes in ten markets, whereas other two weighting schemes yield the highest returns in seven markets each. Over all markets, the average return for MW proves slightly superior with an average monthly return of $0.96 \%$, compared to $0.94 \%$ for IVOL, and $0.84 \%$ for EW. All three weighting schemes produce relatively poor returns in Greece, Japan and the US.

Table 5.3. Time-series momentum return based on three weights
This table reports the pooled average monthly time-series momentum returns using equal weight (EW), market weight (MW) and inversed volatility weight (IVOL) for each market. T-statistics are reported in italics. The highest return is highlighted in green and the lowest return is marked in red.

|  |  | EW |  | MW |  | IVOL |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| AUSTRALIA | $0.27 \%$ | 6.9961 | $1.53 \%$ | 22.1688 | $0.78 \%$ | 16.5708 |
| AUSTRIA | $1.05 \%$ | 27.6351 | $0.74 \%$ | 14.3792 | $1.05 \%$ | 31.2568 |
| BELGIUM | $1.13 \%$ | 34.6241 | $0.95 \%$ | 20.9260 | $1.10 \%$ | 26.2520 |
| CANADA | $0.95 \%$ | 22.3287 | $1.88 \%$ | 27.8333 | $1.29 \%$ | 24.3764 |
| DENMARK | $1.44 \%$ | 42.2548 | $1.28 \%$ | 29.7733 | $1.38 \%$ | 37.7092 |
| FINLAND | $0.94 \%$ | 19.6530 | $1.55 \%$ | 23.7333 | $1.01 \%$ | 21.7778 |
| FRANCE | $0.76 \%$ | 22.3039 | $0.23 \%$ | 7.3412 | $0.81 \%$ | 20.2468 |
| GERMANY | $1.09 \%$ | 33.8434 | $1.31 \%$ | 29.6823 | $1.26 \%$ | 35.7024 |
| GREECE | $0.36 \%$ | 4.7452 | $0.37 \%$ | 5.2758 | $0.46 \%$ | 5.8896 |
| HONGKONG | $0.33 \%$ | 7.1432 | $1.07 \%$ | 18.9594 | $0.54 \%$ | 10.6977 |
| IRELAND | $0.56 \%$ | 7.3645 | $1.07 \%$ | 10.4331 | $0.64 \%$ | 8.3217 |
| ISRAEL | $0.08 \%$ | 1.8824 | $1.06 \%$ | 13.6355 | $0.17 \%$ | 3.3812 |
| ITALY | $1.35 \%$ | 27.2860 | $1.27 \%$ | 20.3594 | $1.25 \%$ | 27.2933 |
| JAPAN | $0.23 \%$ | 12.7582 | $0.48 \%$ | 21.0948 | $0.26 \%$ | 15.8305 |
| NETHERLANDS | $1.63 \%$ | 42.3633 | $0.97 \%$ | 19.2116 | $1.58 \%$ | 34.3010 |
| NEWZEALAND | $1.28 \%$ | 22.2580 | $1.30 \%$ | 16.1999 | $1.54 \%$ | 23.4382 |
| NORWAY | $0.83 \%$ | 16.4406 | $0.79 \%$ | 17.8877 | $0.89 \%$ | 18.3339 |
| PORTUGAL | $0.24 \%$ | 4.2879 | $0.63 \%$ | 8.6450 | $0.48 \%$ | 7.9924 |
| SINGAPORE | $0.83 \%$ | 20.5356 | $0.86 \%$ | 17.0309 | $1.09 \%$ | 27.2685 |
| SPAIN | $0.48 \%$ | 12.5638 | $-0.03 \%$ | -0.4602 | $0.38 \%$ | 9.3087 |
| SWEDEN | $1.53 \%$ | 25.2874 | $1.30 \%$ | 23.1607 | $1.67 \%$ | 26.8186 |
| SWITZERLAND | $1.24 \%$ | 28.2021 | $0.79 \%$ | 18.2514 | $1.10 \%$ | 27.4184 |
| UK | $1.38 \%$ | 37.5991 | $1.07 \%$ | 26.3088 | $1.51 \%$ | 39.1080 |
| US | $0.29 \%$ | 9.8281 | $0.51 \%$ | 20.5771 | $0.33 \%$ | 14.9429 |
| POOLED SAMPLE | $0.84 \%$ | 8.7100 | $0.96 \%$ | 10.4588 | $0.94 \%$ | 10.1932 |
|  |  |  |  |  |  |  |

### 5.2.3. The formation ( J ) and holding periods $(\mathrm{H})$ :

The main consideration when setting the formation and holding periods in a particular market is for them to be in synchronised with the typical periodicity of a stock's pricing cycle in that market. Table 5.4 summarises the pooled average monthly time-series momentum returns ( t statistics in italics) across different implementations for each market when formation (J) and holding $(\mathrm{H})$ periods are three, six, nine and 12 months, respectively.

The findings as reported in Table 5.4 suggest that the best combination for most markets (17 of the 24 markets) would involve a three-month holding period in combination with either a nine-month or 12-month formation period. For Finland, Japan, Singapore and Spain, the optimal formation period remains in the range of nine to 12 months but the holding period is
slightly longer at about six months. Portugal has the highest average return under time-series momentum strategies when the holding period is nine months.

These results suggest that the best aggregation of formation and holding periods should be somewhere between 12 months and 15 months. A particular consideration in setting the formation period is to have it long enough to avoid false signals but not too long to cause undue delays in introducing stocks into the portfolio and foregoing significant potential returns as a result. The findings would appear to confirm that it is best to be conservative when identifying momentum stocks by having a relatively long formation period. In contrast in almost all cases, a three-month holding period tends to prove optimum with a monotonic reduction in performance when this holding period is extended.

## Table 5.4. Time-series momentum return based on formation (J) and holding (H) periods

This table reports the pooled average monthly time-series momentum returns based on the formation $J$ ( $\mathrm{J}=$ three, six, nine and 12 months) and the holding H ( $\mathrm{H}=$ three, six, nine and 12 months) for each market. T-statistics are reported in italics. The highest return is highlighted in green and the lowest return is highlighted in red.

| AUSTRALIA | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | AUSTRIA | H = 3 | H=6 | $\mathrm{H}=9$ | $\mathrm{H}=12$ | BELGIUM | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{J}=3$ | 1.05\% | 0.77\% | 0.76\% | 0.56\% | $\mathrm{J}=3$ | 0.99\% | 0.85\% | 0.97\% | 0.73\% | $\mathrm{J}=3$ | 0.96\% | 0.82\% | 0.68\% | 0.83\% |
|  | 5.9342 | 5.6020 | 5.0801 | 4.3057 |  | 6.7767 | 12.5687 | 12.1980 | 21.8169 |  | 15.5818 | 11.4521 | 7.7414 | 11.0912 |
| $\mathrm{J}=6$ | 1.40\% | 1.21\% | 0.78\% | 0.43\% | $\mathrm{J}=6$ | 1.14\% | 1.06\% | 0.95\% | 0.94\% | $\mathrm{J}=6$ | 1.25\% | 0.93\% | 0.94\% | 0.98\% |
|  | 7.0928 | 5.5065 | 4.1974 | 2.7010 |  | 17.7278 | 26.1388 | 13.2265 | 12.3804 |  | 15.0667 | 8.3430 | 16.6619 | 24.7499 |
| $\mathrm{J}=9$ | 1.60\% | 1.23\% | 0.89\% | 0.69\% | $\mathrm{J}=9$ | 1.33\% | 1.17\% | 0.97\% | 0.96\% | $\mathrm{J}=9$ | 1.22\% | 1.41\% | 1.12\% | 1.07\% |
|  | 6.7033 | 5.7195 | 6.1504 | 4.2910 |  | 24.8356 | 13.9602 | 17.7388 | 11.7234 |  | 12.9760 | 27.1462 | 22.8543 | 17.0064 |
| $\mathrm{J}=12$ | 1.05\% | 0.73\% | 0.37\% | 0.25\% | $\mathrm{J}=12$ | 1.18\% | 0.90\% | 0.79\% | 0.24\% | $\mathrm{J}=12$ | 1.54\% | 1.37\% | 1.02\% | 0.85\% |
|  | 5.4970 | 4.0555 | 2.6264 | 1.8751 |  | 11.0208 | 8.5752 | 8.0069 | 1.8049 |  | 26.8299 | 34.3446 | 8.9230 | 12.6828 |
| CANADA | H=3 | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | DENMARK | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | FINLAND | H = 3 | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | 1.38\% | 1.07\% | 1.20\% | 0.89\% | $\mathrm{J}=3$ | 1.20\% | 1.16\% | 0.88\% | 1.02\% | $\mathrm{J}=3$ | 0.94\% | 0.50\% | 1.14\% | 1.05\% |
|  | 12.9881 | 13.7176 | 12.9416 | 11.1342 |  | 18.0055 | 26.0158 | 7.9399 | 26.7201 |  | 18.3463 | 3.6389 | 9.4005 | 8.5323 |
| $\mathrm{J}=6$ | 1.81\% | 1.69\% | 1.63\% | 0.90\% | $\mathrm{J}=6$ | 1.56\% | 1.49\% | 1.30\% | 1.36\% | $\mathrm{J}=6$ | 1.27\% | 1.44\% | 0.98\% | 1.03\% |
|  | 15.8552 | 11.0352 | 8.4043 | 6.7418 |  | 44.2394 | 30.3792 | 19.2892 | 23.0971 |  | 17.5733 | 12.6545 | 5.1514 | 7.9129 |
| $\mathrm{J}=9$ | 2.13\% | 1.72\% | 1.39\% | 0.93\% | $\mathrm{J}=9$ | 1.80\% | 1.66\% | 1.47\% | 1.20\% | $\mathrm{J}=9$ | 1.45\% | 1.36\% | 1.07\% | 0.68\% |
|  | 13.2250 | 12.9908 | 9.0221 | 8.3490 |  | 40.9754 | 39.1501 | 43.1542 | 29.8647 |  | 20.8114 | 13.2262 | 10.5799 | 5.4375 |
| $\mathrm{J}=12$ | 1.84\% | 1.48\% | 1.13\% | 0.79\% | $\mathrm{J}=12$ | 1.62\% | 1.66\% | 1.22\% | 1.26\% | $\mathrm{J}=12$ | 1.66\% | 1.69\% | 1.20\% | 1.22\% |
|  | 13.1257 | 7.7201 | 8.3121 | 5.7916 |  | 29.9081 | 34.5808 | 12.8336 | 29.8162 |  | 20.9808 | 9.6237 | 9.0007 | 6.3971 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FRANCE | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | GERMANY | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | GREECE | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | 0.21\% | 0.38\% | 0.51\% | 0.37\% | $\mathrm{J}=3$ | 1.34\% | 1.23\% | 1.22\% | 0.80\% | $\mathrm{J}=3$ | 0.63\% | 0.88\% | 0.47\% | 0.69\% |
|  | 1.5374 | 5.7924 | 7.0387 | 5.8703 |  | 22.0693 | 16.6752 | 13.2057 | 11.0741 |  | 8.1918 | 4.6121 | 3.5739 | 2.9283 |
| $\mathrm{J}=6$ | 0.63\% | 0.61\% | 0.58\% | 0.49\% | $\mathrm{J}=6$ | 1.30\% | 1.43\% | 1.22\% | 1.00\% | $\mathrm{J}=6$ | 0.89\% | 0.68\% | 0.31\% | -0.02\% |
|  | 4.9082 | 6.3188 | 3.8954 | 6.8029 |  | 30.5845 | 25.0652 | 21.4726 | 15.4131 |  | 6.8667 | 5.2489 | 5.9264 | $-0.4860$ |
| $\mathrm{J}=9$ | 0.81\% | 0.78\% | 0.78\% | 0.67\% | $\mathrm{J}=9$ | 1.63\% | 1.46\% | 1.02\% | 1.06\% | $\mathrm{J}=9$ | 0.73\% | 0.70\% | -0.10\% | 0.60\% |
|  | 5.5311 | 6.3956 | 8.8028 | 11.8284 |  | 42.8603 | 21.8040 | 10.7132 | 18.4611 |  | 3.7419 | 4.2799 | -1.8682 | 2.7888 |
| $\mathrm{J}=12$ | 0.73\% | 0.78\% | 0.74\% | 0.53\% | $\mathrm{J}=12$ | 1.55\% | 1.25\% | 1.18\% | 0.85\% | $\mathrm{J}=12$ | 0.39\% | -0.24\% | 0.13\% | -0.41\% |
|  | 4.1172 | 7.3481 | 9.9476 | 7.2748 |  | 25.9078 | 18.4993 | 14.2533 | 11.6656 |  | 3.7972 | -2.5757 | 1.0605 | -4.5258 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| HONGKONG | H = 3 | $\mathrm{H}=6$ | H =9 | $\mathrm{H}=12$ | IRELAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | ISRAEL | $\mathrm{H}=3$ | H=6 | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | 0.75\% | 0.70\% | 0.39\% | 0.36\% | $\mathrm{J}=3$ | 0.65\% | -0.29\% | -0.20\% | 0.36\% | $\mathrm{J}=3$ | -0.10\% | -0.13\% | -0.05\% | -0.12\% |
|  | 5.4405 | 4.4519 | 3.6799 | 3.7556 |  | 4.4732 | -1.1782 | -1.0524 | 3.9462 |  | -1.2505 | -1.4443 | -0.4036 | -1.4401 |
| $\mathrm{J}=6$ | 1.36\% | 1.05\% | 0.67\% | 0.38\% | $\mathrm{J}=6$ | 0.56\% | 0.92\% | 0.12\% | 1.44\% | $\mathrm{J}=6$ | 0.56\% | 0.46\% | 0.15\% | 0.29\% |
|  | 10.7792 | 13.1766 | 8.3599 | 4.1462 |  | 3.0317 | 4.7725 | 0.4946 | 4.8406 |  | 3.1948 | 2.2896 | 1.0677 | 2.1521 |
| $\mathrm{J}=9$ | 1.15\% | 0.71\% | 0.65\% | 0.42\% | $\mathrm{J}=9$ | 0.95\% | 1.05\% | 1.26\% | 0.93\% | $\mathrm{J}=9$ | 0.67\% | 0.63\% | 0.47\% | 0.67\% |
|  | 8.4735 | 5.4460 | 5.6553 | 3.5254 |  | 11.4091 | 22.8281 | 11.2009 | 11.5604 |  | 2.8686 | 3.1082 | 2.9368 | 3.3111 |
| $\mathrm{J}=12$ | 0.78\% | 0.56\% | 0.31\% | 0.08\% | $\mathrm{J}=12$ | 1.53\% | 1.06\% | 1.07\% | 0.73\% | $\mathrm{J}=12$ | 1.09\% | 1.08\% | 0.61\% | 0.73\% |
|  | 4.6552 | 4.0142 | 2.6212 | 0.5404 |  | 28.3592 | 18.7598 | 10.6889 | 11.2361 |  | 6.4676 | 6.8226 | 5.0314 | 3.5045 |


| ITALY | H=3 | H = 6 | $\mathrm{H}=9$ | $\mathrm{H}=12$ | JAPAN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H =9 | $\mathrm{H}=12$ | NETHERLANDS | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{J}=3$ | 1.09\% | 0.68\% | 1.04\% | 0.82\% | $\mathrm{J}=3$ | 0.31\% | 0.21\% | 0.24\% | 0.43\% | $\mathrm{J}=3$ | 1.66\% | 1.25\% | 0.91\% | 1.36\% |
|  | 13.0417 | 5.1507 | 14.8987 | 9.9562 |  | 7.8190 | 5.6869 | 5.9479 | 4.2647 |  | 24.5504 | 12.1146 | 7.0082 | 15.4132 |
| $\mathrm{J}=6$ | 1.42\% | 1.32\% | 1.22\% | 0.74\% | $\mathrm{J}=6$ | 0.35\% | 0.34\% | 0.34\% | 0.40\% | $\mathrm{J}=6$ | 1.41\% | 1.36\% | 1.28\% | 1.50\% |
|  | 25.5544 | 17.8232 | 16.8939 | 6.5600 |  | 7.1064 | 5.3253 | 10.5459 | 5.3784 |  | 9.5285 | 11.0256 | 11.7475 | 8.8433 |
| $\mathrm{J}=9$ | 1.66\% | 1.59\% | 1.51\% | 1.19\% | $\mathrm{J}=9$ | 0.37\% | 0.47\% | 0.32\% | 0.22\% | $\mathrm{J}=9$ | 1.86\% | 1.78\% | 1.34\% | 1.33\% |
|  | 29.7538 | 18.6927 | 33.5872 | 20.5972 |  | 10.8264 | 11.9041 | 13.1587 | 4.2489 |  | 13.5074 | 12.2666 | 10.6445 | 12.9602 |
| $\mathrm{J}=12$ | 1.82\% | 1.80\% | 1.42\% | 1.35\% | $\mathrm{J}=12$ | 0.46\% | 0.36\% | 0.21\% | 0.13\% | $\mathrm{J}=12$ | 1.51\% | 1.60\% | 1.20\% | 0.92\% |
|  | 37.2283 | 23.3430 | 25.7823 | 13.6365 |  | 15.4887 | 7.4684 | 4.7112 | 2.5056 |  | 15.0842 | 14.3260 | 10.6767 | 6.1273 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NEWZEALAND | $\mathrm{H}=3$ | H = 6 | H = 9 | $\mathrm{H}=12$ | NORWAY | H = 3 | $\mathrm{H}=6$ | H =9 | H = 12 | PORTUGAL | H = 3 | H = 6 | H = 9 | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | 1.49\% | 1.06\% | 0.87\% | 0.45\% | $\mathrm{J}=3$ | 0.69\% | 1.00\% | 0.67\% | 0.58\% | $\mathrm{J}=3$ | 0.18\% | 0.80\% | 0.82\% | 0.72\% |
|  | 12.2369 | 10.7340 | 11.9405 | 3.5514 |  | 10.5918 | 11.1221 | 5.7153 | 6.0985 |  | 1.1809 | 7.1342 | 6.0655 | 5.6568 |
| $\mathrm{J}=6$ | 1.97\% | 1.40\% | 1.10\% | 0.95\% | $\mathrm{J}=6$ | 1.01\% | 0.97\% | 0.72\% | 0.79\% | $\mathrm{J}=6$ | 0.72\% | 0.91\% | 0.98\% | 0.76\% |
|  | 18.4533 | 12.4688 | 10.0954 | 10.5654 |  | 10.2526 | 16.0362 | 7.9671 | 10.0221 |  | 4.1636 | 5.6924 | 6.3444 | 4.7088 |
| $\mathrm{J}=9$ | 1.87\% | 1.44\% | 1.50\% | 1.11\% | $\mathrm{J}=9$ | 1.31\% | 0.98\% | 0.73\% | 0.46\% | $\mathrm{J}=9$ | -0.01\% | 0.45\% | 0.48\% | 0.35\% |
|  | 23.2164 | 10.1890 | 34.0677 | 10.8680 |  | 8.1046 | 16.0942 | 19.3718 | 5.6366 |  | -0.1178 | 5.6586 | 4.4426 | 5.6898 |
| $\mathrm{J}=12$ | 2.28\% | 1.86\% | 1.44\% | 1.16\% | $\mathrm{J}=12$ | 1.19\% | 1.08\% | 0.68\% | 0.57\% | $\mathrm{J}=12$ | 0.06\% | -0.03\% | 0.14\% | -0.08\% |
|  | 22.5480 | 13.5227 | 17.3451 | 30.2964 |  | 12.8206 | 9.0846 | 8.7367 | 4.5967 |  | 0.5625 | -0.3692 | 2.1721 | -1.0008 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SINGAPORE | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | SPAIN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | SWEDEN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | 0.99\% | 0.98\% | 1.05\% | 0.40\% | $\mathrm{J}=3$ | 0.03\% | -0.17\% | 0.27\% | 0.41\% | $\mathrm{J}=3$ | 1.13\% | 1.25\% | 0.99\% | 0.89\% |
|  | 12.7695 | 7.5114 | 27.9637 | 2.9532 |  | 0.4553 | -1.0501 | 3.9666 | 7.7828 |  | 14.6372 | 19.2166 | 17.1060 | 9.9696 |
| $\mathrm{J}=6$ | 1.15\% | 1.02\% | 1.03\% | 0.71\% | $\mathrm{J}=6$ | -0.15\% | 0.06\% | 0.43\% | 0.08\% | $\mathrm{J}=6$ | 2.00\% | 1.73\% | 1.35\% | 1.16\% |
|  | 16.5619 | 14.8019 | 13.7946 | 19.2804 |  | -1.4250 | 0.4192 | 4.1625 | 0.7001 |  | 31.6441 | 37.1525 | 18.6574 | 21.6374 |
| $\mathrm{J}=9$ | 1.16\% | 0.99\% | 0.86\% | 0.43\% | $\mathrm{J}=9$ | 0.11\% | 0.32\% | 0.60\% | 0.24\% | $\mathrm{J}=9$ | 2.17\% | 1.83\% | 1.50\% | 0.92\% |
|  | 11.1915 | 11.7737 | 10.3989 | 3.0270 |  | 0.5900 | 2.9931 | 7.2942 | 3.5527 |  | 21.5157 | 18.6958 | 24.6766 | 9.3367 |
| $\mathrm{J}=12$ | 1.13\% | 1.19\% | 1.04\% | 0.74\% | $\mathrm{J}=12$ | 0.59\% | 0.76\% | 0.45\% | 0.41\% | $\mathrm{J}=12$ | 2.15\% | 1.76\% | 1.58\% | 1.58\% |
|  | 21.8321 | 15.9877 | 12.1285 | 8.6827 |  | 6.1235 | 7.6673 | 5.8814 | 14.2098 |  | 14.8210 | 18.3267 | 18.9082 | 10.8100 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SWITZERLAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | UK | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | US | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | 0.76\% | 0.98\% | 0.66\% | 1.03\% | $\mathrm{J}=3$ | 1.16\% | 1.23\% | 1.08\% | 1.09\% | $\mathrm{J}=3$ | 0.26\% | 0.49\% | 0.25\% | 0.29\% |
|  | 7.2147 | 15.3196 | 9.0850 | 10.6901 |  | 7.9914 | 15.6721 | 11.0522 | 26.4864 |  | 5.0511 | 8.4356 | 5.4919 | 8.5172 |
| $\mathrm{J}=6$ | 1.28\% | 1.36\% | 0.86\% | 0.99\% | $\mathrm{J}=6$ | 1.56\% | 1.40\% | 1.23\% | 1.19\% | $\mathrm{J}=6$ | 0.53\% | 0.48\% | 0.39\% | 0.27\% |
|  | 12.1017 | 15.8269 | 6.6240 | 11.2797 |  | 11.6769 | 14.2682 | 26.1124 | 28.7418 |  | 12.5713 | 10.7721 | 6.9323 | 5.0274 |
| $\mathrm{J}=9$ | 1.43\% | 1.39\% | 1.00\% | 0.77\% | $\mathrm{J}=9$ | 1.66\% | 1.65\% | 1.44\% | 1.14\% | $\mathrm{J}=9$ | 0.68\% | 0.60\% | 0.40\% | 0.19\% |
|  | 12.6504 | 15.0748 | 8.3505 | 14.7949 |  | 14.2017 | 26.9394 | 34.9239 | 26.6439 |  | 21.5740 | 16.1101 | 8.1891 | 3.4034 |
| $\mathrm{J}=12$ | 1.51\% | 1.15\% | 0.75\% | 0.77\% | $\mathrm{J}=12$ | 1.70\% | 1.47\% | 1.23\% | 0.92\% | $\mathrm{J}=12$ | 0.50\% | 0.35\% | 0.25\% | 0.09\% |
|  | 31.8450 | 28.6809 | 12.5575 | 13.0448 |  | 12.9621 | 16.3989 | 24.8527 | 14.1191 |  | 15.6661 | 6.7397 | 3.7214 | 1.0709 |

### 5.2.4. The rebalancing methods:

Table 5.5 reports the pooled average returns of time-series momentum strategies under different implementation approaches using four rebalancing methods: CAR (0), BHAR (0), CAR (1), and BHAR (1). There is little difference between the returns realised under the four approaches nor is there any evidence to support the superiority of implementations involving lagging portfolio acquisition by a month. Looking at performance on a market-by-market basis, CAR (0) is the best performing generating the highest returns in 12 markets with BHAR (0) being the next best with five markets. In terms of the average returns across the 24 markets, the strategies involve using CAR (0) and CAR (1) yield $0.93 \%$ and $0.92 \%$ per month, whereas using BHAR (0) and BHAR (1) produce $0.92 \%$ and $0.89 \%$ per month.

Despite Jegadeesh and Titman (1993) suggesting the superiority of monthly rebalancing and the utilisation of a one-month lag, we find differences of only few basis points between the investment outcomes across all four methods and so see little reason to favour one over the others.

Table 5.5. Time-series momentum return based on portfolio constructions
This table reports the pooled average monthly time-series momentum returns based on four rebalancing methods: monthly-rebalancing with zero gap (CAR (0)), monthly-rebalancing with 1-month gap (CAR (1)), buy-and-hold with zero gap (BHAR (0)), and buy-and-hold with 1-month gap (BHAR (1)). T-statistics are reported in italics. The highest return is highlighted in green and the lowest return is highlighted in red.

|  | CAR (0) |  | CAR (1) |  | BHAR (0) |  | BHAR (1) |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $0.96 \%$ | 9.8928 | $0.92 \%$ | 9.9801 | $0.83 \%$ | 8.3174 | $0.73 \%$ | 7.5825 |
| AUSTRALIA | $0.98 \%$ | 23.6070 | $0.96 \%$ | 20.9950 | $0.96 \%$ | 16.3530 | $0.90 \%$ | 14.4926 |
| AUSTRIA | $1.13 \%$ | 32.5487 | $1.13 \%$ | 29.1885 | $0.99 \%$ | 16.7125 | $1.00 \%$ | 19.3390 |
| BELGIUM | $1.42 \%$ | 19.0625 | $1.36 \%$ | 18.0069 | $1.40 \%$ | 14.2535 | $1.32 \%$ | 14.7031 |
| CANADA | $1.44 \%$ | 49.3548 | $1.41 \%$ | 43.2048 | $1.25 \%$ | 22.5371 | $1.36 \%$ | 26.3513 |
| DENMARK | $1.21 \%$ | 20.1596 | $1.20 \%$ | 19.5272 | $1.13 \%$ | 12.9204 | $1.13 \%$ | 13.7626 |
| FINLAND | $0.54 \%$ | 10.0216 | $0.72 \%$ | 16.0317 | $0.48 \%$ | 7.9730 | $0.65 \%$ | 11.7681 |
| FRANCE | $1.26 \%$ | 32.1995 | $1.23 \%$ | 28.6094 | $1.22 \%$ | 24.5469 | $1.17 \%$ | 23.7623 |
| GERMANY | $0.15 \%$ | 3.5603 | $0.12 \%$ | 2.6475 | $0.57 \%$ | 6.0343 | $0.75 \%$ | 7.0552 |
| GREECE | $0.78 \%$ | 11.4652 | $0.65 \%$ | 8.8019 | $0.72 \%$ | 9.5388 | $0.43 \%$ | 6.1402 |
| HONGKONG | $0.84 \%$ | 14.0122 | $0.83 \%$ | 15.5630 | $0.73 \%$ | 5.0734 | $0.63 \%$ | 4.9339 |
| IRELAND | $0.33 \%$ | 4.3098 | $0.39 \%$ | 5.3157 | $0.50 \%$ | 4.6901 | $0.54 \%$ | 4.8229 |
| ISRAEL | $1.45 \%$ | 30.0403 | $1.41 \%$ | 32.9050 | $1.17 \%$ | 15.6672 | $1.14 \%$ | 18.1901 |
| ITALY | $0.26 \%$ | 13.9653 | $0.28 \%$ | 12.0013 | $0.42 \%$ | 14.8662 | $0.33 \%$ | 10.5679 |
| JAPAN | $1.42 \%$ | 26.6903 | $1.29 \%$ | 24.8728 | $1.49 \%$ | 19.7965 | $1.36 \%$ | 16.5201 |
| NETHERLANDS | $1.54 \%$ | 24.2346 | $1.38 \%$ | 25.0574 | $1.40 \%$ | 14.3759 | $1.18 \%$ | 12.8381 |
| NEWZEALAND | $0.80 \%$ | 21.8733 | $0.74 \%$ | 15.4617 | $0.92 \%$ | 12.8146 | $0.90 \%$ | 15.7309 |
| NORWAY | $0.21 \%$ | 4.7798 | $0.44 \%$ | 12.0386 | $0.47 \%$ | 5.2444 | $0.69 \%$ | 6.7606 |
| PORTUGAL | $1.05 \%$ | 33.8020 | $0.98 \%$ | 27.4378 | $0.92 \%$ | 14.8131 | $0.76 \%$ | 11.4605 |
| SINGAPORE | $0.35 \%$ | 6.9314 | $0.38 \%$ | 10.2233 | $0.19 \%$ | 2.1557 | $0.20 \%$ | 3.5377 |
| SPAIN | $1.54 \%$ | 26.0457 | $1.52 \%$ | 24.2078 | $1.40 \%$ | 18.0049 | $1.53 \%$ | 17.9888 |
| SWEDEN | $1.04 \%$ | 20.0429 | $0.99 \%$ | 20.8679 | $1.09 \%$ | 17.5848 | $1.06 \%$ | 17.0588 |
| SWITZERLAND | $1.32 \%$ | 24.4876 | $1.29 \%$ | 31.3181 | $1.37 \%$ | 23.3649 | $1.31 \%$ | 24.1997 |
| UK | $0.37 \%$ | 13.1790 | $0.40 \%$ | 11.1489 | $0.40 \%$ | 13.1828 | $0.33 \%$ | 9.4651 |
| US | $0.93 \%$ | 9.8703 | $0.92 \%$ | 10.7287 | $0.92 \%$ | 11.6773 | $0.89 \%$ | 11.7039 |
| POOLED SAMPLE |  |  |  |  |  |  |  |  |

### 5.3. Returns of cross-sectional momentum strategies

Table 5.6 in Appendix 3 reports the average monthly returns and associated Newey-West tstatistics from 16 ( $\mathrm{J} \times \mathrm{H}$ ) cross-sectional momentum strategies across 24 markets. The specific strategy used was to form a long portfolio consisting of the identified winning stocks and a short portfolio consisting of the identified losing stocks with the average monthly returns being the difference between the monthly returns on the two portfolios. The reported results all relate to an implementation where the cut-offs are set at $16 \%$. In each rebalancing period the top $16 \%$ were identified as winning stocks and the bottom $16 \%$ as losing stocks. The study reports in Panels A, B and C of Table 5.6 the monthly cross-sectional returns when the portfolio weights are based on EW, MW and IVOL, respectively.

### 5.3.1. Returns of cross-sectional momentum strategies

Table 5.7 summarises the numbers of cross-sectional momentum strategies that yield positive and negative returns across the 24 markets. As is the case with the time-series momentum strategy, the analysis establishes that there are many implementations of the cross-sectional momentum strategy in the majority of markets that would have yielded excellent investment outcomes over the sample period from 1992 to 2012.

We find that $88 \%$ across all of the markets generated positive returns with more than half of them producing significant positive returns. Consistent with our findings for the time-series momentum strategy, only a very few cross-sectional momentum strategy yields significant positive in Greece, Japan and the US. On a more positive note, there are seven markets where in excess of $80 \%$ of the implementations yield significant positive returns.

## Table 5.7. Numbers of implementations yield positive/negative cross-sectional momentum returns

This table reports the numbers of implementations yielding positive and negative average monthly crosssectional momentum returns for each market. The SIGNIFICANT column indicates the aggregate numbers of implementations that generate average monthly returns at the $1 \%, 5 \%$, or $10 \%$ significance level, whereas the NON-SIGNIFICANT column indicates the numbers of strategies producing average monthly returns over $10 \%$ significance level.

|  |  | POSITIVE |  |  |  | NEGATIVE |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\qquad$ | SIGNIFICANT | PERCENTAGE | NON <br> SIGNIFICANT | PERCENTAGE | SIGNIFICANT | PERCENTAGE | NON <br> SIGNIFICANT | PERCENTAGE |
| AUSTRALIA | 192 | 102 | 53\% | 73 | 38\% | 0 | 0\% | 17 | 9\% |
| AUSTRIA | 192 | 118 | 61\% | 67 | 35\% | 0 | 0\% | 7 | 4\% |
| BELGIUM | 192 | 168 | 88\% | 22 | 11\% | 0 | 0\% | 2 | 1\% |
| CANADA | 192 | 143 | 74\% | 47 | 24\% | 0 | 0\% | 2 | 1\% |
| DENMARK | 192 | 183 | 95\% | 9 | 5\% | 0 | 0\% | 0 | 0\% |
| FINLAND | 192 | 154 | 80\% | 38 | 20\% | 0 | 0\% | 0 | 0\% |
| FRANCE | 192 | 94 | 49\% | 73 | 38\% | 0 | 0\% | 25 | 13\% |
| GERMANY | 192 | 171 | 89\% | 20 | 10\% | 0 | 0\% | 1 | 1\% |
| GREECE | 192 | 6 | 3\% | 142 | 74\% | 0 | 0\% | 44 | 23\% |
| HONGKONG | 192 | 17 | 9\% | 89 | 46\% | 9 | 5\% | 77 | 40\% |
| IRELAND | 192 | 39 | 20\% | 124 | 65\% | 0 | 0\% | 29 | 15\% |
| ISRAEL | 192 | 25 | 13\% | 102 | 53\% | 1 | 1\% | 64 | 33\% |
| ITALY | 192 | 172 | 90\% | 20 | 10\% | 0 | 0\% | 0 | 0\% |
| JAPAN | 192 | 0 | 0\% | 36 | 19\% | 1 | 1\% | 155 | 81\% |
| NETHERLANDS | 192 | 125 | 65\% | 56 | 29\% | 0 | 0\% | 11 | 6\% |
| NEWZEALAND | 192 | 177 | 92\% | 14 | 7\% | 0 | 0\% | 1 | 1\% |
| NORWAY | 192 | 145 | 76\% | 47 | 24\% | 0 | 0\% | 0 | 0\% |
| PORTUGAL | 192 | 33 | 17\% | 150 | 78\% | 1 | 1\% | 8 | 4\% |
| SINGAPORE | 192 | 36 | 19\% | 138 | 72\% | 0 | 0\% | 18 | 9\% |
| SPAIN | 192 | 128 | 67\% | 55 | 29\% | 0 | 0\% | 9 | 5\% |
| SWEDEN | 192 | 125 | 65\% | 53 | 28\% | 0 | 0\% | 14 | 7\% |
| SWITZERLAND | 192 | 156 | 81\% | 36 | 19\% | 0 | 0\% | 0 | 0\% |
| UK | 192 | 136 | 71\% | 54 | 28\% | 0 | 0\% | 2 | 1\% |
| US | 192 | 2 | 1\% | 131 | 68\% | 0 | 0\% | 59 | $31 \%$ |
| POOLED SAMPLE | 192 | 102 | 53\% | 67 | 35\% | 1 | 0\% | 23 | 12\% |

## Chart 5.2. Summaries of cross-sectional momentum return across markets

This chart reports the pooled average monthly returns for 192 cross-sectional momentum strategies for each market. The dashed line shows the average monthly returns across the 24 developed markets.


Chart 5.2 reports the average monthly cross-sectional momentum returns across 192 implementation approaches for each market. Compared with the pooled return from the average time-series momentum monthly returns across the 24 markets, the pooled return of the average cross-sectional momentum monthly returns is lower by approximately $0.23 \%$ per month, $0.91 \%$ per month compared to $0.68 \%$ per month. The cross-sectional momentum returns range from $-0.13 \%$ per month in Japan to $1.25 \%$ per month in Denmark. In general, the performance of time-series momentum strategy seems to be better than the performance of cross-sectional momentum strategy over the testing period. In Section 5.4 and the next chapter, a closer analysis will be undertaken to compare the relative performances of the two momentum strategies.

### 5.3.2. The weighting methods

Table 5.8 outlines the average monthly returns (t-statistics in italics) of all implementations of cross-sectional momentum strategies for each of the three different portfolio weighting schemes: equal weight (EW), market weight (MW) and inverse volatility (IVOL) weight.

Based on the findings summarised in Table 5.3, we conclude that MW provides the best investment outcomes and EW produces the worst outcomes in the case of time-series momentum strategy. Similarly for cross-sectional momentum strategy, MW yields the highest returns of the three, in ten markets, whereas the strategies using IVOL and EW produce the highest returns in eight and six markets, respectively. However, we obtain a slightly different picture when we look at the average returns across the 24 markets with IVOL yielding the highest return of $0.74 \%$ per month, compared with the performances using EW ( $0.66 \%$ per month) and MW ( $0.65 \%$ per month).

## Table 5.8. Cross-sectional momentum return based on three weights

This table reports the pooled average monthly cross-sectional momentum returns for each market using equal weight (EW), market weight (MW) and inversed volatility weight (IVOL) for each market. T-statistics are reported in italics. The highest return is highlighted in green and the lowest return is highlighted in red.

|  | EW |  | MW |  | IVOL |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| AUSTRALIA | $0.25 \%$ | 7.0778 | $1.15 \%$ | 19.6631 | $0.71 \%$ | 15.3687 |
| AUSTRIA | $0.90 \%$ | 27.0270 | $0.42 \%$ | 10.4853 | $0.96 \%$ | 27.8379 |
| BELGIUM | $1.17 \%$ | 31.7460 | $0.85 \%$ | 16.2799 | $1.12 \%$ | 26.6987 |
| CANADA | $0.66 \%$ | 17.9078 | $1.40 \%$ | 26.2589 | $0.93 \%$ | 21.3127 |
| DENMARK | $1.30 \%$ | 35.2329 | $1.16 \%$ | 30.6922 | $1.30 \%$ | 34.3466 |
| FINLAND | $0.82 \%$ | 24.3617 | $1.45 \%$ | 31.8624 | $0.87 \%$ | 25.3838 |
| FRANCE | $0.65 \%$ | 18.6061 | $0.21 \%$ | 6.3814 | $0.58 \%$ | 12.7077 |
| GERMANY | $0.92 \%$ | 28.7380 | $1.09 \%$ | 28.9323 | $1.06 \%$ | 24.9748 |
| GREECE | $0.11 \%$ | 2.4722 | $0.56 \%$ | 10.0614 | $0.23 \%$ | 4.7895 |
| HONGKONG | $-0.13 \%$ | -3.4014 | $0.48 \%$ | 9.9660 | $-0.02 \%$ | -0.3273 |
| IRELAND | $0.51 \%$ | 11.7774 | $0.30 \%$ | 3.4392 | $0.65 \%$ | 13.4941 |
| ISRAEL | $-0.04 \%$ | -1.9781 | $0.74 \%$ | 14.8199 | $0.04 \%$ | 1.3800 |
| ITALY | $1.04 \%$ | 38.5665 | $0.94 \%$ | 23.2819 | $0.96 \%$ | 37.8547 |
| JAPAN | $-0.16 \%$ | -7.9805 | $-0.08 \%$ | -3.6968 | $-0.15 \%$ | -8.0806 |
| NETHERLANDS | $1.18 \%$ | 40.9944 | $0.16 \%$ | 6.3412 | $1.07 \%$ | 36.1738 |
| NEWZEALAND | $1.20 \%$ | 27.4084 | $1.03 \%$ | 23.2423 | $1.34 \%$ | 28.9816 |
| NORWAY | $0.83 \%$ | 23.8389 | $0.89 \%$ | 17.7318 | $0.87 \%$ | 22.9060 |
| PORTUGAL | $0.29 \%$ | 8.4966 | $0.61 \%$ | 15.9200 | $0.66 \%$ | 20.2409 |
| SINGAPORE | $0.39 \%$ | 11.7226 | $0.20 \%$ | 6.9797 | $0.46 \%$ | 13.8557 |
| SPAIN | $0.72 \%$ | 26.9760 | $0.37 \%$ | 6.6461 | $0.78 \%$ | 23.8108 |
| SWEDEN | $1.04 \%$ | 25.9284 | $0.41 \%$ | 6.5307 | $1.08 \%$ | 26.1557 |
| SWITZERLAND | $0.94 \%$ | 35.7678 | $0.57 \%$ | 18.8627 | $0.88 \%$ | 32.1360 |
| UK | $1.15 \%$ | 31.5340 | $0.51 \%$ | 15.6855 | $1.24 \%$ | 32.9874 |
| US | $0.04 \%$ | 1.5237 | $0.23 \%$ | 7.5748 | $0.04 \%$ | 1.6700 |
| POOLED SAMPLE | $0.66 \%$ | 6.9674 | $0.65 \%$ | 7.6915 | $0.74 \%$ | 8.3433 |
|  |  |  |  |  |  |  |

### 5.3.3. The formation (J) and holding periods (H)

Table 5.9 reports the pooled average monthly returns of cross-sectional momentum strategies across implementations when using formation periods ( $\mathrm{J}=$ three, six, nine and 12 months) and holding periods ( $\mathrm{H}=$ three, six, nine and 12 months). As is the case with the time-series momentum strategy for short formation periods, returns tend to increase as the holding period is increased while for longer formation periods the returns tend to decrease as the holding period is lengthened. The optimum aggregate of the formation and holding periods for crosssectional momentum strategy would appear to lie in the range of 12 to 15 months, typically involving a longer formation period combined with a short holding period.

## Table 5.9. Cross-sectional momentum return based on formation (J) and holding (H) periods

This table reports the pooled average monthly cross-sectional momentum returns based on the formation J ( $\mathrm{J}=$ three, six, nine and 12 months) and the holding H ( $\mathrm{H}=$ three, six, nine and 12 months) for each market. T-statistics are reported in italics. The highest return is highlighted in green and the lowest return is highlighted in red.

| AUSTRALIA | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | AUSTRIA | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | BELGIUM | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{J}=3$ | 0.91\% | 0.90\% | 0.63\% | 0.49\% | $\mathrm{J}=3$ | 0.53\% | 0.43\% | 0.50\% | 0.37\% | $\mathrm{J}=3$ | 0.71\% | 0.69\% | 0.51\% | 0.66\% |
|  | 6.9360 | 7.9105 | 6.0427 | 5.0801 |  | 4.3507 | 6.1579 | 7.6269 | 4.7060 |  | 10.0026 | 15.8035 | 4.3970 | 15.0085 |
| $\mathrm{J}=6$ | 1.28\% | 1.01\% | 0.57\% | 0.40\% | $\mathrm{J}=6$ | 0.94\% | 0.81\% | 0.80\% | 0.81\% | $\mathrm{J}=6$ | 1.24\% | 1.30\% | 1.19\% | 1.03\% |
|  | 9.3466 | 7.3891 | 5.0164 | 4.3521 |  | 16.3269 | 9.6797 | 10.9821 | 11.0050 |  | 48.4851 | 55.1252 | 52.2443 | 25.3196 |
| $\mathrm{J}=9$ | 1.19\% | 0.94\% | 0.62\% | 0.33\% | $\mathrm{J}=9$ | 1.18\% | 1.09\% | 0.93\% | 0.79\% | $\mathrm{J}=9$ | 1.40\% | 1.45\% | 1.25\% | 0.96\% |
|  | 9.1481 | 8.1931 | 7.0807 | 3.9713 |  | 22.8059 | 14.6062 | 13.2057 | 9.7769 |  | 25.6207 | 27.1855 | 24.6837 | 15.8503 |
| $\mathrm{J}=12$ | 1.04\% | 0.64\% | 0.21\% | 0.14\% | $\mathrm{J}=12$ | 1.05\% | 0.88\% | 0.64\% | 0.44\% | $\mathrm{J}=12$ | 1.42\% | 1.19\% | 1.07\% | 0.65\% |
|  | 8.5427 | 5.6659 | 2.5303 | 1.7145 |  | 12.2709 | 11.9866 | 7.1680 | 6.7964 |  | 18.5751 | 16.9922 | 16.2602 | 7.9778 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CANADA | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | DENMARK | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | FINLAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | 1.11\% | 0.78\% | 0.98\% | 0.70\% | $\mathrm{J}=3$ | 1.07\% | 1.01\% | 0.92\% | 1.00\% | $\mathrm{J}=3$ | 0.87\% | 0.74\% | 1.09\% | 0.66\% |
|  | 11.9262 | 8.1938 | 10.7682 | 9.7521 |  | 32.0631 | 31.4990 | 25.7083 | 33.3667 |  | 10.8357 | 8.7919 | 11.2028 | 8.4516 |
| $\mathrm{J}=6$ | 1.31\% | 1.27\% | 1.15\% | 0.85\% | $\mathrm{J}=6$ | 1.55\% | 1.34\% | 1.21\% | 1.24\% | $\mathrm{J}=6$ | 1.16\% | 1.20\% | 1.27\% | 1.12\% |
|  | 11.9273 | 12.2178 | 9.6581 | 9.8551 |  | 53.4558 | 38.0526 | 21.0360 | 32.1581 |  | 28.9135 | 22.4621 | 9.4986 | 12.7501 |
| $\mathrm{J}=9$ | 1.55\% | 1.28\% | 1.03\% | 0.65\% | $\mathrm{J}=9$ | 1.64\% | 1.42\% | 1.36\% | 0.93\% | $\mathrm{J}=9$ | 1.36\% | 1.29\% | 0.98\% | 0.81\% |
|  | 13.3334 | 12.4891 | 9.5000 | 8.7431 |  | 37.9899 | 26.1463 | 46.1512 | 12.5205 |  | 26.9858 | 9.6486 | 9.0164 | 6.2772 |
| $\mathrm{J}=12$ | 1.35\% | 1.00\% | 0.66\% | 0.29\% | $\mathrm{J}=12$ | 1.72\% | 1.50\% | 1.24\% | 0.88\% | $\mathrm{J}=12$ | 1.19\% | 1.09\% | 1.04\% | 0.86\% |
|  | 20.7952 | 10.5010 | 8.7599 | 3.7335 |  | 31.1574 | 47.3614 | 38.3905 | 19.3193 |  | 18.7792 | 11.1854 | 7.2098 | 7.4442 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FRANCE | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | GERMANY | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | GREECE | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | 0.00\% | 0.17\% | 0.38\% | 0.17\% | $\mathrm{J}=3$ | 0.92\% | 0.80\% | 0.90\% | 0.55\% | $\mathrm{J}=3$ | 0.47\% | 0.70\% | 0.30\% | 0.63\% |
|  | 0.0388 | 2.2949 | 6.4584 | 1.5502 |  | 15.8514 | 16.3116 | 21.4451 | 5.4974 |  | 6.3870 | 8.6790 | 7.5508 | 5.3485 |
| $\mathrm{J}=6$ | 0.49\% | 0.59\% | 0.49\% | 0.52\% | $\mathrm{J}=6$ | 1.28\% | 1.30\% | 1.16\% | 0.98\% | $\mathrm{J}=6$ | 0.72\% | 0.61\% | 0.35\% | 0.31\% |
|  | 5.1808 | 8.4576 | 6.2249 | 10.6797 |  | 47.1035 | 24.2726 | 31.7484 | 19.5888 |  | 8.5056 | 8.6522 | 6.4295 | 5.2626 |
| $\mathrm{J}=9$ | 0.55\% | 0.54\% | 0.64\% | 0.45\% | $\mathrm{J}=9$ | 1.41\% | 1.22\% | 1.03\% | 0.78\% | $\mathrm{J}=9$ | 0.65\% | 0.41\% | 0.14\% | -0.13\% |
|  | 4.6202 | 5.2534 | 7.3898 | 7.3524 |  | 40.1617 | 29.1006 | 31.3215 | 14.6400 |  | 7.9576 | 9.8289 | 1.7797 | -1.9744 |
| $\mathrm{J}=12$ | 0.78\% | 0.73\% | 0.66\% | 0.49\% | $\mathrm{J}=12$ | 1.37\% | 1.11\% | 0.89\% | 0.67\% | $\mathrm{J}=12$ | 0.32\% | 0.01\% | -0.15\% | -0.50\% |
|  | 9.8976 | 14.4880 | 14.4560 | 15.8630 |  | 27.6324 | 31.4911 | 22.5728 | 18.2025 |  | 4.6887 | 0.0966 | -2.5650 | -4.7078 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| HONGKONG | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | IRELAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | ISRAEL | H=3 | $\mathrm{H}=6$ | H =9 | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | 0.45\% | 0.33\% | 0.14\% | 0.02\% | $\mathrm{J}=3$ | 0.79\% | 0.03\% | -0.12\% | 0.22\% | $\mathrm{J}=3$ | 0.13\% | 0.13\% | 0.12\% | -0.09\% |
|  | 4.7204 | 4.0372 | 1.6641 | 0.3175 |  | 10.9420 | 0.1534 | -0.7510 | 1.8429 |  | 1.4583 | 1.3676 | 1.0286 | -0.9938 |
| $\mathrm{J}=6$ | 0.70\% | 0.56\% | 0.23\% | -0.07\% | $\mathrm{J}=6$ | 0.81\% | 0.75\% | 0.19\% | 1.03\% | $\mathrm{J}=6$ | 0.54\% | 0.46\% | 0.19\% | 0.23\% |
|  | 7.0324 | 7.1028 | 2.6216 | -1.0381 |  | 11.0702 | 13.5397 | 1.5140 | 6.1426 |  | 4.0424 | 3.9673 | 2.2794 | 2.5304 |
| $\mathrm{J}=9$ | 0.38\% | 0.15\% | -0.02\% | -0.31\% | $\mathrm{J}=9$ | 0.50\% | 0.48\% | 0.63\% | 0.60\% | $\mathrm{J}=9$ | 0.59\% | 0.37\% | 0.25\% | 0.27\% |
|  | 4.6260 | 1.8203 | -0.2686 | -4.1031 |  | 6.0039 | 4.9666 | 11.3208 | 7.1305 |  | 3.5862 | 2.9574 | 2.1151 | 1.7087 |
| $\mathrm{J}=12$ | 0.05\% | -0.03\% | -0.41\% | -0.39\% | $\mathrm{J}=12$ | 0.62\% | 0.55\% | 0.56\% | 0.12\% | $\mathrm{J}=12$ | 0.43\% | 0.29\% | 0.10\% | -0.08\% |
|  | 0.5576 | -0.3158 | -5.3534 | -3.8271 |  | 5.2385 | 5.0709 | 5.9003 | 1.8762 |  | 4.9088 | 4.2246 | 1.2663 | -0.8934 |


| ITALY | H = 3 | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | JAPAN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | NETHERLANDS | H=3 | H=6 | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{J}=3$ | 0.67\% | 0.72\% | 0.96\% | 0.80\% | $\mathrm{J}=3$ | -0.13\% | -0.09\% | -0.11\% | 0.10\% | $\mathrm{J}=3$ | 0.78\% | 0.56\% | 0.60\% | 0.48\% |
|  | 13.2904 | 20.6628 | 16.8526 | 39.9076 |  | -7.2342 | -2.7264 | -2.7569 | 3.3798 |  | 8.4623 | 4.3011 | 5.0855 | 6.0047 |
| $\mathrm{J}=6$ | 0.97\% | 1.00\% | 0.95\% | 0.89\% | $\mathrm{J}=6$ | -0.23\% | -0.25\% | -0.06\% | 0.04\% | $\mathrm{J}=6$ | 0.90\% | 0.90\% | 0.83\% | 0.92\% |
|  | 27.9641 | 18.2133 | 19.9670 | 34.0768 |  | -8.1455 | -5.9756 | -3.2345 | 0.9364 |  | 5.5055 | 5.6740 | 7.3755 | 9.2298 |
| $\mathrm{J}=9$ | 1.27\% | 1.13\% | 1.07\% | 0.73\% | $\mathrm{J}=9$ | -0.16\% | -0.03\% | -0.03\% | -0.14\% | $\mathrm{J}=9$ | 1.01\% | 0.87\% | 0.96\% | 0.76\% |
|  | 27.8605 | 20.4396 | 34.1419 | 9.3346 |  | -5.4185 | -1.4321 | -0.9276 | -4.1379 |  | 6.0647 | 5.8620 | 7.9672 | 6.3594 |
| $\mathrm{J}=12$ | 1.29\% | 1.19\% | 1.13\% | 0.92\% | $\mathrm{J}=12$ | -0.10\% | -0.24\% | -0.34\% | -0.33\% | $\mathrm{J}=12$ | 1.01\% | 0.85\% | 0.78\% | 0.68\% |
|  | 51.0183 | 36.4751 | 20.1533 | 14.9821 |  | -6.6767 | -7.8987 | $-9.5213$ | \#\#\#\#\#\#\# |  | 6.0815 | 5.8812 | 6.0408 | 5.9551 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NEWZEALAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | NORWAY | H = 3 | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | PORTUGAL | H = 3 | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | 1.43\% | 1.27\% | 0.85\% | 0.67\% | $\mathrm{J}=3$ | 0.48\% | 0.59\% | 0.69\% | 0.66\% | $\mathrm{J}=3$ | 0.35\% | 0.64\% | 0.47\% | 0.56\% |
|  | 14.0561 | 21.3443 | 9.9477 | 8.3034 |  | 6.8566 | 10.6968 | 21.8899 | 17.0072 |  | 1.8511 | 7.3472 | 6.7758 | 9.8539 |
| $\mathrm{J}=6$ | 1.61\% | 1.34\% | 1.18\% | 0.80\% | $\mathrm{J}=6$ | 0.86\% | 1.05\% | 1.00\% | 1.00\% | $\mathrm{J}=6$ | 0.44\% | 0.61\% | 0.59\% | 0.53\% |
|  | 18.6725 | 17.4069 | 41.8747 | 8.9594 |  | 14.8466 | 34.0801 | 16.1007 | 11.0724 |  | 4.3972 | 8.6763 | 11.4428 | 10.7702 |
| $\mathrm{J}=9$ | 1.63\% | 1.38\% | 1.20\% | 0.95\% | $\mathrm{J}=9$ | 1.34\% | 1.24\% | 0.86\% | 0.88\% | $\mathrm{J}=9$ | 0.64\% | 0.67\% | 0.66\% | 0.57\% |
|  | 26.8702 | 38.1463 | 25.4640 | 14.7488 |  | 34.1085 | 30.9659 | 23.2041 | 8.3631 |  | 7.8742 | 11.1110 | 8.2174 | 9.3493 |
| $\mathrm{J}=12$ | 1.52\% | 1.30\% | 0.96\% | 0.92\% | $\mathrm{J}=12$ | 1.11\% |  | 0.74\% | 0.40\% | $\mathrm{J}=12$ | 0.53\% | 0.44\% | 0.33\% | 0.29\% |
|  | 31.7747 | 34.5610 | 34.1224 | 19.6719 |  | $29.6617$ | 21.1224 | 16.8373 | 6.0689 |  | 6.3620 | 8.2570 | 5.6803 | 7.8094 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SINGAPORE | $\mathrm{H}=3$ | H = 6 | $\mathrm{H}=9$ | $\mathrm{H}=12$ | SPAIN | H = 3 | $\mathrm{H}=6$ | H =9 | $\mathrm{H}=12$ | SWEDEN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | 0.38\% | 0.32\% | 0.52\% | 0.27\% | $\mathrm{J}=3$ | 0.29\% | 0.11\% | 0.46\% | 0.39\% | $\mathrm{J}=3$ | 1.30\% | 0.84\% | 0.88\% | 0.47\% |
|  | 5.9424 | 4.1549 | 11.1560 | 9.3974 |  | 3.4726 | 1.0531 | 7.0106 | 4.5494 |  | 31.5132 | 9.4480 | 19.4332 | 4.1696 |
| $\mathrm{J}=6$ | 0.77\% | 0.57\% | 0.30\% | 0.33\% | $\mathrm{J}=6$ | 0.41\% | 0.63\% | 0.66\% | 0.58\% | $\mathrm{J}=6$ | 1.39\% | 1.21\% | 0.97\% | 0.65\% |
|  | 14.4273 | 7.5351 | 7.8079 | 6.1057 |  | 3.6851 | 7.2245 | 10.5160 | 30.4137 |  | 19.9050 | 18.6556 | 15.4698 | 9.9279 |
| $\mathrm{J}=9$ | 0.56\% | 0.34\% | 0.34\% | -0.06\% | $\mathrm{J}=9$ | 0.77\% | 0.81\% | 0.76\% | 0.56\% | $\mathrm{J}=9$ | 1.27\% | 0.96\% | 0.71\% | 0.38\% |
|  | 9.0129 | 7.4125 | 6.3295 | -1.2649 |  | 6.8289 | 8.4178 | 10.0197 | 8.7195 |  | 11.9433 | 8.1598 | 6.7428 | 3.6598 |
| $\mathrm{J}=12$ | 0.47\% | 0.35\% | 0.09\% | 0.09\% | $\mathrm{J}=12$ | 0.94\% | 0.95\% | 0.95\% | 0.72\% | $\mathrm{J}=12$ | 0.98\% | 0.74\% | 0.35\% | 0.40\% |
|  | 16.9570 | 7.4281 | 2.3991 | 1.8554 |  | 19.2331 | 32.3799 | 27.7639 | 16.7559 |  | 6.1599 | 5.2449 | 2.5968 | 4.1976 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SWITZERLAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | UK | H = 3 | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | US | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | 0.71\% | 0.61\% | 0.56\% | 0.59\% | $\mathrm{J}=3$ | 0.83\% | 0.77\% | 0.78\% | 0.66\% | $\mathrm{J}=3$ | -0.15\% | 0.01\% | 0.03\% | 0.08\% |
|  | 8.4884 | 8.5015 | 9.4969 | 11.4969 |  | 5.2228 | 6.7662 | 7.9404 | 8.4176 |  | -3.4788 | 0.3134 | 0.5943 | 3.1341 |
| $\mathrm{J}=6$ | 0.92\% | 0.93\% | 0.72\% | 0.86\% | $\mathrm{J}=6$ | 1.20\% | 1.06\% | 0.97\% | 1.00\% | $\mathrm{J}=6$ | 0.16\% | 0.32\% | 0.04\% | 0.23\% |
|  | 11.5823 | 19.5078 | 13.2361 | 13.8545 |  | 8.0072 | 9.9636 | 13.5759 | 15.7913 |  | 4.9414 | 14.0014 | 0.6623 | 3.7955 |
| $\mathrm{J}=9$ | 0.99\% | 0.88\% | 0.84\% | 0.58\% | $\mathrm{J}=9$ | 1.30\% | 1.21\% | 1.05\% | 0.77\% | $\mathrm{J}=9$ | 0.37\% | 0.25\% | 0.20\% | -0.03\% |
|  | 15.9614 | 16.4405 | 18.3691 | 11.7224 |  | 10.8359 | 17.0312 | 17.0691 | 13.2262 |  | 10.5975 | 5.3245 | 3.8220 | -0.6271 |
| $\mathrm{J}=12$ | 1.10\% | 1.06\% | 0.78\% | 0.60\% | $\mathrm{J}=12$ | 1.29\% | 1.11\% | 0.85\% | 0.56\% | $\mathrm{J}=12$ | 0.17\% | 0.15\% | -0.03\% | -0.15\% |
|  | 15.9597 | 20.3406 | 21.1082 | 19.8226 |  | 9.5131 | 12.2849 | 12.2450 | 9.0614 |  | 4.6774 | 3.0666 | -0.6345 | -2.3630 |

### 5.3.4. The rebalancing methods

Table 5.10 below shows average cross-sectional momentum returns based on four types of portfolio constructions: CAR (0), BHAR (0), CAR (1), and BHAR (1). The cross-sectional momentum strategies using CAR (0) produce the best outcome in 12 markets as compared with using BHAR (1) that yields the greatest return in only two markets. However, average returns for the four methods across the 24 markets are very similar with CAR (0) and CAR (1) yielding $0.71 \%$ per month and $0.69 \%$ per month, and for BHAR ( 0 ) and BHAR (1) yielding $0.69 \%$ per month and $0.63 \%$ per month. Again it would appear that there is little reason for favouring one rebalancing method over the others.

## Table 5.10. Cross-sectional momentum return based on portfolio constructions

This table reports the pooled average monthly cross-sectional momentum returns based on four rebalancing methods: monthly-rebalancing with zero gap (CAR (0)), monthly-rebalancing with one-month gap (CAR (1)), buy-and-hold with zero gap (BHAR (0)), and buy-and-hold with one-month gap (BHAR (1)). T-statistics are reported in italics. The highest return is highlighted in green and the lowest return is highlighted in red.

|  | CAR (0) |  |  | CAR (1) |  | BHAR (0) |  | BHAR (1) |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| AUSTRALIA | $0.76 \%$ | 10.3534 | $0.72 \%$ | 9.9358 | $0.70 \%$ | 8.7297 | $0.63 \%$ | 7.9395 |  |
| AUSTRIA | $0.82 \%$ | 17.6583 | $0.76 \%$ | 14.5969 | $0.76 \%$ | 13.1667 | $0.70 \%$ | 11.5878 |  |
| BELGIUM | $1.06 \%$ | 23.5119 | $1.06 \%$ | 22.3689 | $1.05 \%$ | 15.9384 | $1.02 \%$ | 17.1942 |  |
| CANADA | $1.09 \%$ | 16.1903 | $1.02 \%$ | 14.3255 | $0.98 \%$ | 14.5523 | $0.90 \%$ | 13.5202 |  |
| DENMARK | $1.35 \%$ | 36.3750 | $1.28 \%$ | 33.1283 | $1.19 \%$ | 24.8015 | $1.18 \%$ | 24.8415 |  |
| FINLAND | $1.08 \%$ | 20.6948 | $1.07 \%$ | 18.4582 | $1.02 \%$ | 14.5816 | $1.01 \%$ | 16.4649 |  |
| FRANCE | $0.46 \%$ | 9.7012 | $0.60 \%$ | 14.5988 | $0.38 \%$ | 6.3942 | $0.47 \%$ | 8.7864 |  |
| GERMANY | $1.06 \%$ | 28.1905 | $1.03 \%$ | 27.1077 | $1.05 \%$ | 18.9098 | $0.95 \%$ | 21.5367 |  |
| GREECE | $0.30 \%$ | 6.7751 | $0.27 \%$ | 6.0312 | $0.34 \%$ | 4.2846 | $0.31 \%$ | 3.8392 |  |
| HONGKONG | $0.21 \%$ | 3.3986 | $0.13 \%$ | 1.9467 | $0.15 \%$ | 2.3046 | $-0.05 \%$ | -0.8449 |  |
| IRELAND | $0.60 \%$ | 17.9627 | $0.53 \%$ | 12.5493 | $0.51 \%$ | 4.8921 | $0.30 \%$ | 3.4005 |  |
| ISRAEL | $0.24 \%$ | 4.0226 | $0.23 \%$ | 3.9726 | $0.23 \%$ | 3.2832 | $0.28 \%$ | 3.8627 |  |
| ITALY | $1.00 \%$ | 28.4487 | $1.02 \%$ | 34.3066 | $0.96 \%$ | 24.1993 | $0.94 \%$ | 22.4729 |  |
| JAPAN | $-0.17 \%$ | -11.8703 | $-0.10 \%$ | -5.9294 | $-0.08 \%$ | -2.9609 | $-0.18 \%$ | -5.4467 |  |
| NETHERLANDS | $0.86 \%$ | 12.4616 | $0.82 \%$ | 11.8242 | $0.83 \%$ | 10.7581 | $0.71 \%$ | 8.8704 |  |
| NEWZEALAND | $1.25 \%$ | 30.4919 | $1.15 \%$ | 26.6534 | $1.25 \%$ | 20.7591 | $1.11 \%$ | 16.2939 |  |
| NORWAY | $0.83 \%$ | 20.0567 | $0.77 \%$ | 18.0157 | $0.94 \%$ | 17.7793 | $0.90 \%$ | 17.8584 |  |
| PORTUGAL | $0.46 \%$ | 9.6943 | $0.54 \%$ | 17.2247 | $0.50 \%$ | 9.5121 | $0.58 \%$ | 11.0675 |  |
| SINGAPORE | $0.35 \%$ | 10.0186 | $0.30 \%$ | 7.5608 | $0.41 \%$ | 10.7302 | $0.35 \%$ | 7.6080 |  |
| SPAIN | $0.66 \%$ | 16.3123 | $0.68 \%$ | 18.3078 | $0.59 \%$ | 8.1034 | $0.57 \%$ | 10.2238 |  |
| SWEDEN | $0.89 \%$ | 14.6839 | $0.82 \%$ | 12.3780 | $0.87 \%$ | 11.0390 | $0.80 \%$ | 9.8037 |  |
| SWITZERLAND | $0.83 \%$ | 24.1481 | $0.78 \%$ | 24.5525 | $0.85 \%$ | 17.5328 | $0.72 \%$ | 17.2430 |  |
| UK | $1.05 \%$ | 16.6634 | $0.97 \%$ | 17.9141 | $0.97 \%$ | 14.5151 | $0.86 \%$ | 13.7392 |  |
| US | $0.11 \%$ | 3.9741 | $0.14 \%$ | 4.2658 | $0.12 \%$ | 3.3049 | $0.04 \%$ | 1.1454 |  |
| POOLED SAMPLE | $0.71 \%$ | 8.8670 | $0.69 \%$ | 9.1702 | $0.69 \%$ | 9.2340 | $0.63 \%$ | 8.3009 |  |

### 5.4. Time-series and cross-sectional momentum strategies under optimal implementations

The two conclusions that can be drawn from the analysis to date are that with the exception of the markets in Greece, Hong Kong, Israel, Japan, Spain and the US, both forms of momentum seem to realise significant positive returns, and there are a number of similarities in the optimal implementation procedures in most of markets. This section addresses the question of whether one or the other of the investment strategies is preferable with respect to investment outcomes. Table 5.11 below compares the returns of the time-series (TSM) and cross-sectional (CSM) momentum strategies for what we refer to as optimal implementations. The optimum implementation for each market is chosen by aggregating the returns for timeseries and cross-sectional momentum strategies under each implementation and then choosing the one for which this aggregate return is greatest. ${ }^{26}$

In Panel A of Table 5.11 below, the outcomes are presented where the cut-offs for both types of momentum are set to include on average approximately $32 \%$ of the stocks in the investment universe in either the winner or the loser portfolios (i.e. the same strategies reported in Tables 5.1 and 5.6). Columns three to five set out the characteristics of the optimum implementations for each market. For all but the markets in Greece, Ireland, Israel and Japan, the optimum implementation involves a long formation period and a short holding period. The weighting scheme involves using market weights in 11 of the markets and using inversed-volatility weight in ten of the markets. Equal weights are used in the Netherlands, Spain and Switzerland. Finally, a mixture of portfolio construction techniques are used with the most common being the use of a buy-and-hold construction with no lag (BHAR (0)).

[^18]The most important thing that can be seen from Panel A of Table 5.11 is that the time-series momentum strategy outperforms the cross-sectional momentum strategy in all 24 markets, with the extent of the outperformance varying from $0.16 \%$ per month in Belgium to $1.44 \%$ per month in Sweden. This superior performance proves to be significant in 13 of the 24 markets. One piece of additional information that is contained in Panel A of Table 5.11 that provides several valuable insights are the returns on the winner and loser constituent parts of the overall strategy. These are best analysed by measuring the contribution of the winner and loser portfolios, each relative to the market return for the weighting scheme used in the optimum portfolio.

Panel B of Table 5.11 reports the percentage contribution of the winner and loser portfolios to the performances of each of the momentum strategies. The contributions of winner (or loser) portfolios in momentum strategies are calculated as the difference of returns between winner (or loser) portfolios and market index, divided by the momentum return. In the case of timeseries momentum strategies it can be seen that it is the short position in the loser portfolio that contributes the most to superior performance in 19 markets with the exceptions being Australia, Austria, France, New Zealand, Norway, Spain and Switzerland. Indeed, in Greece, Italy and Japan the short portfolio contributes in excess of $100 \%$ of the performance of the momentum strategy, meaning that the long portfolio actually detracts from the performance. In Hong Kong, Ireland, Israel, Portugal and the US, the contribution of the short position is in excess of $80 \%$. For the cross-sectional momentum strategy, it is the short portfolio that makes the greatest contribution in all of the markets except Austria, France and Norway, with this influence being greatest in Hong Kong, Italy, Japan and Portugal (where in both cases the contribution is far in excess of $100 \%$ ) and in Finland, Ireland, Israel and the US. One particular point that can be taken out of this analysis is that the poor performance of momentum in Hong Kong, Ireland, Israel, Italy, Japan, Portugal and the US is almost entirely
due to the extremely poor performance of the long positions in the winning stocks. This is consistent with the finding that in 17 of the 24 markets it is the short portfolio that makes the major contribution to the performances of the two momentum strategies.

## Table 5.11. Monthly returns of time-series and cross-sectional momentum strategies

Panel A. Optimal time-series momentum strategy v. cross-sectional momentum strategy
Panel A reports "optimal" implementations, average monthly returns of losers (L), winners (W), momentum (W-L) portfolios for time-series (TSM) and cross-sectional (CSM) momentum strategies and the return difference between TSM and CSM for each market from 1992 to 2012. The Newey-West adjusted t-statistics are reported below the returns. Based on the momentum returns from Table 5.1 and Table 5.6, the optimum implementation for each market is chosen by aggregating the returns for time-series and cross-sectional momentum under each implementation and then choosing the one for which this aggregate return is greatest.

| COUNTRY | OPTIMAL <br> IMPLEMENTATION |  |  | TSM |  |  | CSM |  |  | DIFFERENCE |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | JxH | Weight | Construction | L | W | W - L | L | W | W-L | TSM - CSM |
| AUSTRALIA | $9 \times 3$ | MW | BHAR(0) | -0.01\% | 2.75\% | 2.76\% | 0.18\% | 2.04\% | 1.86\% | 0.90\% |
|  |  |  |  | -0.0239 | 5.2183 | 6.5381 | 0.2750 | 4.0943 | 3.0971 | 1.7691 |
| AUSTRIA | 12x3 | IVOL | CAR(0) | -0.36\% | 1.21\% | 1.57\% | -0.26\% | 1.14\% | 1.40\% | 0.18\% |
|  |  |  |  | -0.7921 | 3.6148 | 3.2864 | -0.6044 | 3.6849 | 3.2544 | 0.6624 |
| BELGIUM | 12x3 | IVOL | CAR(1) | -0.60\% | 1.19\% | 1.79\% | -0.26\% | 1.37\% | 1.63\% | 0.16\% |
|  |  |  |  | -1.5769 | 3.7349 | 4.7535 | -0.7303 | 4.5639 | 5.5522 | 0.6623 |
| CANADA | 9x3 | MW | BHAR(0) | -0.08\% | 3.04\% | 3.13\% | 0.31\% | 2.37\% | 2.06\% | 1.07\% |
|  |  |  |  | -0.1362 | 5.0350 | 4.9893 | 0.4288 | 3.8698 | 2.6762 | 2.0930 |
| DENMARK | 9x3 | IVOL | BHAR(1) | -0.75\% | 1.30\% | 2.00\% | -0.53\% | 1.21\% | 1.74\% | 0.26\% |
|  |  |  |  | -1.5065 | 3.2469 | 5.3728 | -1.1272 | 3.5026 | 6.1658 | 0.9736 |
| FINLAND | 12x6 | MW | BHAR(0) | 0.01\% | 3.00\% | 2.85\% | 0.24\% | 1.95\% | 1.72\% | 1.13\% |
|  |  |  |  | 0.0136 | 4.4379 | 3.4246 | 0.3644 | 2.6068 | 2.2456 | 1.7965 |
| FRANCE | $9 \times 3$ | IVOL | CAR(1) | -0.09\% | 1.34\% | 1.43\% | 0.15\% | 1.26\% | 1.11\% | 0.33\% |
|  |  |  |  | -0.2374 | 4.1846 | 5.7471 | 0.3631 | 3.7673 | 3.3571 | 2.2335 |
| GERMANY | 12x3 | IVOL | CAR(0) | -0.79\% | 1.05\% | 1.85\% | -0.53\% | 1.09\% | 1.62\% | 0.23\% |
|  |  |  |  | -1.5746 | 3.2953 | 5.4797 | -1.0736 | 3.5006 | 4.6976 | 1.1029 |
| GREECE | 3x12 | MW | BHAR(1) | -0.47\% | 1.31\% | 1.71\% | 0.32\% | 1.70\% | 1.38\% | 0.34\% |
|  |  |  |  | -0.5044 | 1.5279 | 2.1623 | 0.3594 | 1.7414 | 1.5022 | 0.4394 |
| HONGKONG | 6x3 | MW | BHAR(0) | 0.16\% | 2.37\% | $2.21 \%$ | 0.47\% | 1.81\% | 1.34\% | 0.87\% |
|  |  |  |  | 0.2313 | 3.0693 | 3.5306 | 0.6639 | 2.7765 | 2.5864 | 1.7110 |
| IRELAND | 6x12 | MW | BHAR(0) | -1.32\% | 2.26\% | 3.52\% | -0.29\% | 2.07\% | 2.36\% | 1.16\% |
|  |  |  |  | -1.3281 | 2.7749 | 3.3624 | -0.3519 | 2.6551 | 2.3081 | 1.9764 |
| ISRAEL | 9x12 | MW | BHAR(0) | 0.02\% | 2.04\% | 2.02\% | 0.05\% | 1.70\% | 1.66\% | 0.36\% |
|  |  |  |  | 0.0287 | 3.0400 | 3.0968 | 0.0663 | 3.0230 | 3.0009 | 0.7018 |
| ITALY | 12x6 | MW | BHAR(0) | -1.10\% | 1.16\% | 2.26\% | -0.04\% | 1.34\% | 1.38\% | 0.88\% |
|  |  |  |  | -1.9857 | 1.9312 | 3.6685 | -0.0632 | 2.5517 | 2.7298 | 1.6389 |
| JAPAN | 3x12 | MW | BHAR(0) | -0.71\% | 0.38\% | 1.09\% | 0.06\% | 0.31\% | 0.24\% | 0.84\% |
|  |  |  |  | -1.5012 | 0.7806 | 2.9597 | 0.1347 | 0.6389 | 0.7032 | 3.7901 |
| NETHERLANDS | 9x3 | EW | BHAR(1) | -0.99\% | 1.42\% | 2.40\% | -0.32\% | 1.26\% | 1.58\% | 0.81\% |
|  |  |  |  | -1.7333 | 2.6473 | 5.9269 | -0.6239 | 2.7629 | 4.6630 | 2.2939 |
| NEWZEALAND | 12x3 | IVOL | BHAR(0) | -0.18\% | 2.67\% | 2.82\% | -0.01\% | 1.72\% | 1.73\% | 1.09\% |
|  |  |  |  | -0.4835 | 4.1578 | 4.2515 | -0.0263 | 5.3411 | 4.9700 | 1.9447 |
| NORWAY | 9x3 | IVOL | BHAR(0) | 0.22\% | 2.29\% | 2.07\% | 0.41\% | 1.98\% | 1.57\% | 0.50\% |
|  |  |  |  | 0.2767 | 3.6524 | 3.4647 | 0.6702 | 3.4989 | 3.4499 | 0.7758 |
| PORTUGAL | 6x6 | MW | BHAR(1) | -0.60\% | 1.50\% | 2.08\% | -0.49\% | 0.40\% | 0.89\% | 1.19\% |
|  |  |  |  | -0.8703 | 2.3051 | 2.5529 | -0.7313 | 0.7001 | 1.3249 | 1.6662 |
| SINGAPORE | $9 \times 3$ | IVOL | BHAR(0) | -0.19\% | 1.46\% | 1.64\% | 0.47\% | 1.34\% | 0.87\% | 0.77\% |
|  |  |  |  | -0.2631 | 2.5188 | 3.1500 | 0.6523 | 2.5667 | 1.7954 | 2.5193 |
| SPAIN | 12x6 | EW | BHAR(0) | 0.05\% | 1.48\% | 1.29\% | 0.11\% | 1.11\% | 1.00\% | 0.30\% |
|  |  |  |  | 0.0746 | 3.3626 | 2.7071 | 0.2110 | 2.6306 | 2.9540 | 0.7719 |
| SWEDEN | $12 \times 3$ | IVOL | BHAR(1) | -0.81\% | 2.02\% | 2.81\% | 0.27\% | 1.64\% | 1.37\% | 1.44\% |
|  |  |  |  | -1.1073 | 3.7870 | 5.3410 | 0.3928 | 3.1837 | 2.8084 | 3.7071 |
| SWITZERLAND | 12x3 | EW | CAR(0) | -0.06\% | 1.69\% | 1.75\% | 0.14\% | 1.45\% | 1.32\% | 0.44\% |
|  |  |  |  | -0.1311 | 3.8289 | 5.2722 | 0.2892 | 3.7184 | 3.8830 | 1.4036 |
| UK | 12x3 | IVOL | CAR(0) | -0.54\% | 1.61\% | 2.15\% | -0.33\% | 1.52\% | 1.85\% | 0.30\% |
|  |  |  |  | -1.1833 | 4.2870 | 8.8272 | -0.6954 | 4.0934 | 5.8716 | 1.8107 |
| US | 9x3 | MW | CAR(1) | 0.89\% | 1.76\% | 0.87\% | 1.07\% | 1.72\% | 0.64\% | 0.23\% |
|  |  |  |  | 2.2596 | 3.6822 | 2.3207 | 2.4051 | 3.8955 | 1.5217 | 1.1047 |

Panel B. Percentage of contribution from winner and loser portfolios
Panel B reports the market returns which are calculated using the weighting scheme for the optimal portfolio, and the percentage of contribution to time-series (TSM) and cross-sectional (CSM) momentum profits from loser (L) and winner (W) portfolio for each market. The contributions of winner (loser) portfolios in momentum profit are calculated by dividing the difference between the average monthly return between each of the winner (loser) portfolios and market indexes by the average monthly return for the momentum strategy.

|  |  | TSM |  | CSM |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | MARKET INDEX | L | W | L | W |
| AUSTRALIA | 1.14\% | 42\% | 58\% | 51\% | 49\% |
| AUSTRIA | 0.32\% | 43\% | 57\% | 41\% | 59\% |
| BELGIUM | 0.63\% | 69\% | 31\% | 55\% | 45\% |
| CANADA | 1.81\% | 61\% | 39\% | 73\% | 27\% |
| DENMARK | 0.60\% | 68\% | 35\% | 65\% | 35\% |
| FINLAND | 1.85\% | 65\% | 40\% | 94\% | 6\% |
| FRANCE | 0.51\% | 42\% | 58\% | 32\% | 68\% |
| GERMANY | 0.35\% | 62\% | 38\% | 54\% | 46\% |
| GREECE | 1.39\% | 109\% | -5\% | 78\% | 22\% |
| HONGKONG | 1.98\% | 82\% | 18\% | 113\% | -13\% |
| IRELAND | 1.61\% | 83\% | 18\% | 81\% | 19\% |
| ISRAEL | 1.67\% | 82\% | 18\% | 98\% | 2\% |
| ITALY | 1.35\% | 108\% | -8\% | 101\% | -1\% |
| JAPAN | 0.71\% | 130\% | -30\% | 265\% | -165\% |
| NETHERLANDS | 0.72\% | 72\% | 29\% | 66\% | 34\% |
| NEWZEALAND | 0.98\% | 41\% | 60\% | 57\% | 43\% |
| NORWAY | 1.04\% | 40\% | 60\% | 40\% | 60\% |
| PORTUGAL | 1.26\% | 89\% | 11\% | 197\% | -97\% |
| SINGAPORE | 0.98\% | 71\% | 30\% | 59\% | 41\% |
| SPAIN | 0.71\% | 51\% | 60\% | 60\% | 40\% |
| SWEDEN | 1.18\% | 71\% | 30\% | 66\% | 34\% |
| SWITZERLAND | 0.79\% | 49\% | 51\% | 50\% | 50\% |
| UK | 0.61\% | 53\% | 47\% | 51\% | 49\% |
| US | 1.65\% | 87\% | 13\% | 90\% | 10\% |

Table 5.12 examines implementations for both time-series and cross-section momentum strategies when the cut-offs are extended to include more than the $32 \%$ of stocks included in either the winner and loser portfolios. In Panel B, the table reports the results when extending the cut-offs to include $60 \%$ of the stocks while Panels C and D report the results when extending the cut-offs so as to include all of the stocks in the stock universe in either the winner or loser portfolios. ${ }^{27}$

[^19]The first thing that is observed is that in every market the average monthly returns of the two momentum strategies consistently decline as the cut-offs are extended. Comparing the scenarios in which $32 \%$ of stocks and $100 \%$ of stocks are invested, the pooled returns across the 24 markets dropped down approximately $50 \%$ from $2.09 \%$ per month to around $0.89 \%$ per month for the time-series momentum strategy and from $1.43 \%$ per month to around $0.85 \%$ per month for the cross-sectional momentum strategy.

This provides clear evidence that the strongest information that past stock performance provides with respect to future performance is concentrated in the tail of the distribution in the market. One observation that is relevant to future analysis is that when using the timeseries momentum strategy in which all stocks are included in one of the winner or loser portfolios, performance is better when the cut-off is set to zero rather than set to equal the market return for the period. When using the market return there will be an approximately equal number of stocks included in the winner and the loser portfolios for each period whereas this number will be highly variable when the cut-off is set to zero because there will be considerably more winning than losing stocks when markets are performing particularly well and considerably more losing stocks when the markets are performing poorly. Therefore, using a zero cut-off introduces a timing element into the time-series momentum strategy which is something that should be examined in future analysis.

With the original cut-offs, the time-series momentum strategy outperforms the cross-sectional momentum strategy in all markets, with this superior performance being significant in 13 of the 24 markets. This superior performance of time-series momentum strategy is eroded when the cut-off points are widened. As the cut-offs are extended to include $60 \%$ of stocks in one or other portfolio, the performance of time-series momentum strategy in the pooled sample is

[^20]reduced by $30 \%$ from $2.09 \%$ to $1.45 \%$ on average across all of the markets. It is no longer the case that the time-series momentum strategy outperforms in all markets with their now being evidence that the cross-sectional momentum strategy realises the superior return in Israel, Spain and Belgium. Further, there are now only nine markets in which the time-series momentum strategy significantly outperforms (at the $10 \%$ confidence level) and this reduces to seven markets with a zero cut-off where all stocks are included in either the winner or loser portfolio.

The other aspects of Table 5.12 that will be briefly considered are how the characteristics of the optimum portfolios change when the cut-offs are extended. The combinations of formation and holding periods are fairly stable. 13 out of the 24 markets remain unchanged portfolio rebalancing using CAR (0), CAR (1), BHAR (0), or BHAR (1), and 18 out of the 24 markets use the same portfolio weights when investment is extended from $32 \%$ to $60 \%$ of the market. The most unstable aspect is the portfolio weights. In the majority of markets, with the original cut-offs, the optimum implementations involved using market weights. As the cut-off points are extended, there is a movement away from market weights with inverse volatility weights being used in the majority of markets. There is no pattern to what happens to the optimum method for portfolio construction as the cut-offs are extended.

## Table 5.12. Monthly returns of time-series and cross-sectional momentum strategies with extended cut-offs

This table reports the "optimal" implementation approaches, average monthly returns of time-series (TSM) and cross-sectional (CSM) momentum strategies and the return differences between TSM and CSM under different investing scales for each market from 1992 to 2012. Newey - West adjusted t-statistics are reported in the table. For each investing scale, we chose the optimum implementation for each market by aggregating the returns for time-series and cross-sectional momentum strategies under each implementation and then choosing the one for which this aggregate return was greatest. Panel A reports the momentum returns when investing approximately one-third of the market, Panel B reports the momentum returns when investing $60 \%$ stocks of the market, Panels C and D report the momentum returns when investing all stocks of the market. For the TSM in Panel C, we implemented a single cut-off, as does the study in Moskowitz et al. (2012). Any stocks with a positive (negative) average return over $\mathbf{J}(\mathrm{J}=3,6,9$ and 12 months) goes into the winner (loser) portfolio. For the TSM in Panel D, the winner (loser) portfolio contains stocks with average returns over J months above (below) the contemporaneous market index. The momentum returns are estimated by buying the winners and selling the losers.

Panel A. TSM (in sample) VS. CSM $($ winner $=16 \%$, loser $=16 \%)$

|  | JxH |  | Weight | Construction | TSM | $t$-stats | CSM | $t$-stats | TSM - CSM |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $t$-stats |  |  |  |  |  |  |  |  |  |
| AUSTRALIA | $9 \times 3$ | MW | BHAR(0) | $2.76 \%$ | 6.5381 | $1.86 \%$ | 3.0971 | $0.90 \%$ | 1.7691 |
| AUSTRIA | $12 \times 3$ | IVOL | CAR(0) | $1.57 \%$ | 3.2864 | $1.40 \%$ | 3.2544 | $0.18 \%$ | 0.6624 |
| BELGIUM | $12 \times 3$ | IVOL | CAR(1) | $1.79 \%$ | 4.7535 | $1.63 \%$ | 5.5522 | $0.16 \%$ | 0.6623 |
| CANADA | $9 \times 3$ | MW | BHAR(0) | $3.13 \%$ | 4.9893 | $2.06 \%$ | 2.6762 | $1.07 \%$ | 2.0930 |
| DENMARK | $9 \times 3$ | IVOL | BHAR(1) | $2.00 \%$ | 5.3728 | $1.74 \%$ | 6.1658 | $0.26 \%$ | 0.9736 |
| FINLAND | $12 \times 6$ | MW | BHAR(0) | $2.85 \%$ | 3.4246 | $1.72 \%$ | 2.2456 | $1.13 \%$ | 1.7965 |
| FRANCE | $9 \times 3$ | IVOL | CAR(1) | $1.43 \%$ | 5.7471 | $1.11 \%$ | 3.3571 | $0.33 \%$ | 2.2335 |
| GERMANY | $12 \times 3$ | IVOL | CAR(0) | $1.85 \%$ | 5.4797 | $1.62 \%$ | 4.6976 | $0.23 \%$ | 1.1029 |
| GREECE | $3 \times 12$ | MW | BHAR(1) | $1.71 \%$ | 2.1623 | $1.38 \%$ | 1.5022 | $0.34 \%$ | 0.4394 |
| HONGKONG | $6 \times 3$ | MW | BHAR(0) | $2.21 \%$ | 3.5306 | $1.34 \%$ | 2.5864 | $0.87 \%$ | 1.7110 |
| IRELAND | $6 \times 12$ | MW | BHAR(0) | $3.52 \%$ | 3.3624 | $2.36 \%$ | 2.3081 | $1.16 \%$ | 1.9764 |
| ISRAEL | $9 \times 12$ | MW | BHAR(0) | $2.02 \%$ | 3.0968 | $1.66 \%$ | 3.0009 | $0.36 \%$ | 0.7018 |
| ITALY | $12 \times 6$ | MW | BHAR(0) | $2.26 \%$ | 3.6685 | $1.38 \%$ | 2.7298 | $0.88 \%$ | 1.6389 |
| JAPAN | $3 \times 12$ | MW | BHAR(0) | $1.09 \%$ | 2.9597 | $0.24 \%$ | 0.7032 | $0.84 \%$ | 3.7901 |
| NETHERLANDS | $9 \times 3$ | EW | BHAR(1) | $2.40 \%$ | 5.9269 | $1.58 \%$ | 4.6630 | $0.81 \%$ | 2.2939 |
| NEWZEALAND | $12 \times 3$ | IVOL | BHAR(0) | $2.82 \%$ | 4.2515 | $1.73 \%$ | 4.9700 | $1.09 \%$ | 1.9447 |
| NORWAY | $9 \times 3$ | IVOL | BHAR(0) | $2.07 \%$ | 3.4647 | $1.57 \%$ | 3.4499 | $0.50 \%$ | 0.7758 |
| PORTUGAL | $6 \times 6$ | MW | BHAR(1) | $2.08 \%$ | 2.5529 | $0.89 \%$ | 1.3249 | $1.19 \%$ | 1.6662 |
| SINGAPORE | $9 \times 3$ | IVOL | BHAR(0) | $1.64 \%$ | 3.1500 | $0.87 \%$ | 1.7954 | $0.77 \%$ | 2.5193 |
| SPAIN | $12 \times 6$ | EW | BHAR(0) | $1.29 \%$ | 2.7071 | $1.00 \%$ | 2.9540 | $0.30 \%$ | 0.7719 |
| SWEDEN | $12 \times 3$ | IVOL | BHAR(1) | $2.81 \%$ | 5.3410 | $1.37 \%$ | 2.8084 | $1.44 \%$ | 3.7071 |
| SWITZERLAND | $12 \times 3$ | EW | CAR(0) | $1.75 \%$ | 5.2722 | $1.32 \%$ | 3.8830 | $0.44 \%$ | 1.4036 |
| UK | $12 \times 3$ | IVOL | CAR(0) | $2.15 \%$ | 8.8272 | $1.85 \%$ | 5.8716 | $0.30 \%$ | 1.8107 |
| US | $9 \times 3$ | MW | CAR(1) | $0.87 \%$ | 2.3207 | $0.64 \%$ | 1.5217 | $0.23 \%$ | 1.1047 |
| POOLED SAMPLE |  |  | $2.09 \%$ | 4.2577 | $1.43 \%$ | 3.2133 | $0.66 \%$ | 1.6479 |  |

Panel B. TSM (in sample) VS. CSM $($ winner $=30 \%$, loser $=30 \%)$

|  | JxH | Weight | Construction | TSM | $t$-stats | CSM | $t$-stats | DIFFERENCE <br> (TSM - CSM) | $t$-stats |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| AUSTRALIA | 12x3 | IVOL | BHAR(0) | 1.49\% | 5.9765 | 1.47\% | 3.5198 | 0.01\% | 0.0278 |
| AUSTRIA | $9 \times 3$ | IVOL | CAR(0) | 1.23\% | 4.4292 | 1.22\% | 3.3864 | 0.01\% | 0.0291 |
| BELGIUM | $12 \times 3$ | EW | CAR(1) | 1.17\% | 4.8514 | 1.20\% | 4.8604 | -0.03\% | -0.2459 |
| CANADA | $9 \times 3$ | MW | BHAR(0) | 1.76\% | 4.0245 | 1.59\% | 2.8840 | 0.17\% | 0.5472 |
| DENMARK | 12x3 | EW | CAR(0) | 1.55\% | 6.5408 | 1.41\% | 6.3178 | 0.14\% | 1.0073 |
| FINLAND | 3x9 | MW | BHAR(1) | 1.97\% | 3.0162 | 1.85\% | 2.9527 | 0.12\% | 0.3090 |
| FRANCE | $12 \times 3$ | IVOL | BHAR(1) | 1.35\% | 5.5845 | 0.64\% | 1.9401 | 0.72\% | 3.1123 |
| GERMANY | 12x3 | IVOL | CAR(0) | 1.44\% | 6.1749 | 1.30\% | 4.1556 | 0.14\% | 0.8388 |
| GREECE | $12 \times 3$ | MW | BHAR(1) | 1.73\% | 2.1655 | 1.59\% | 2.0095 | 0.15\% | 0.2316 |
| HONGKONG | $6 \times 3$ | MW | BHAR(0) | 1.44\% | 3.3168 | 0.74\% | 1.6769 | 0.70\% | 2.1044 |
| IRELAND | $6 \times 12$ | MW | $\operatorname{BHAR}(0)$ | 1.94\% | 2.5283 | 1.41\% | 1.9847 | 0.53\% | 0.9645 |
| ISRAEL | $6 \times 12$ | MW | $\operatorname{BHAR}(0)$ | 1.22\% | 2.3948 | 1.49\% | 3.8614 | -0.27\% | -0.5531 |
| ITALY | 12x3 | EW | CAR(0) | 1.62\% | 5.9448 | 0.98\% | 3.7944 | 0.64\% | 4.0932 |
| JAPAN | $6 \times 12$ | EW | $\operatorname{BHAR}(0)$ | 0.46\% | 2.2885 | 0.16\% | 0.7794 | 0.30\% | 2.4285 |
| NETHERLANDS | $12 \times 3$ | EW | CAR(0) | 1.57\% | 5.2098 | 1.29\% | 4.3956 | 0.28\% | 1.4267 |
| NEWZEALAND | $3 \times 3$ | IVOL | BHAR(0) | 1.72\% | 2.9026 | 1.68\% | 2.9398 | 0.04\% | 0.3371 |
| NORWAY | 12x3 | IVOL | BHAR(1) | 1.32\% | 3.5351 | 0.89\% | 2.4690 | 0.44\% | 1.3036 |
| PORTUGAL | 6x6 | MW | BHAR(1) | 2.01\% | 3.3998 | 0.94\% | 1.6965 | 1.07\% | 2.3145 |
| SINGAPORE | $6 \times 3$ | IVOL | CAR(0) | 1.37\% | 5.1164 | 0.66\% | 1.9811 | 0.71\% | 3.5528 |
| SPAIN | $12 \times 3$ | IVOL | CAR(0) | 0.84\% | 2.5212 | 0.99\% | 3.2281 | -0.16\% | -0.5957 |
| SWEDEN | 12x3 | IVOL | $\operatorname{BHAR}(0)$ | 1.78\% | 4.9016 | 1.12\% | 2.7531 | 0.66\% | 2.6598 |
| SWITZERLAND | $12 \times 3$ | EW | BHAR(0) | 1.31\% | 5.9279 | 1.06\% | 3.6809 | 0.26\% | 1.2764 |
| UK | 12x3 | IVOL | CAR(0) | 1.64\% | 8.9879 | 1.38\% | 5.2118 | 0.27\% | 1.6962 |
| US | 9x3 | MW | BHAR(1) | 0.77\% | 2.6923 | 0.34\% | 1.0055 | 0.43\% | 2.7335 |
| POOLED SAMPLE |  |  |  | 1.45\% | 4.3513 | 1.14\% | 3.0618 | 0.31\% | 1.3167 |

Panel C. TSM (cut-off $=0 \%)$ VS. CSM $($ winner $=50 \%$, loser $=50 \%)$

|  | JxH | Weight | Construction | TSM | $t$-stats | CSM | $t$-stats | DIFFERENCE <br> (TSM - CSM) | $t$-stats |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| AUSTRALIA | $3 \times 12$ | IVOL | BHAR(1) | 1.31\% | 2.7638 | 0.83\% | 1.6783 | 0.48\% | 1.5184 |
| AUSTRIA | $9 \times 3$ | EW | BHAR(1) | 0.96\% | 3.8673 | 0.86\% | 3.5588 | 0.10\% | 0.9731 |
| BELGIUM | $9 \times 3$ | EW | CAR(1) | 0.90\% | 5.3114 | 0.82\% | 4.8117 | 0.08\% | 1.1228 |
| CANADA | $12 \times 3$ | EW | CAR(0) | 0.83\% | 4.0641 | 0.82\% | 3.4910 | 0.01\% | 0.0784 |
| DENMARK | $12 \times 3$ | EW | CAR(0) | 1.14\% | 6.6052 | 0.98\% | 6.4132 | 0.16\% | 1.7166 |
| FINLAND | $12 \times 12$ | MW | BHAR(1) | 1.80\% | 3.2129 | 1.38\% | 2.7719 | 0.43\% | 1.2030 |
| FRANCE | $12 \times 3$ | IVOL | BHAR(1) | 0.98\% | 3.9281 | 0.45\% | 1.5420 | 0.53\% | 1.8338 |
| GERMANY | $12 \times 3$ | IVOL | CAR(0) | 0.93\% | 4.7073 | 0.82\% | 3.3275 | 0.11\% | 0.5870 |
| GREECE | $3 \times 12$ | MW | BHAR(1) | 0.79\% | 1.1283 | 1.18\% | 1.9159 | -0.39\% | -0.5811 |
| HONGKONG | $6 \times 3$ | IVOL | CAR(0) | 1.05\% | 4.4679 | 0.60\% | 2.1420 | 0.45\% | 2.3205 |
| IRELAND | $12 \times 3$ | MW | $\operatorname{BHAR}(0)$ | 1.65\% | 2.6271 | 1.27\% | 2.0611 | 0.38\% | 0.7853 |
| ISRAEL | $6 \times 3$ | IVOL | BHAR(1) | 0.26\% | 1.2895 | 0.06\% | 0.3069 | 0.20\% | 0.9197 |
| ITALY | 3 x 9 | MW | BHAR(1) | 1.33\% | 4.3059 | 1.00\% | 3.0444 | 0.33\% | 1.6561 |
| JAPAN | $3 \times 12$ | EW | BHAR(1) | 0.19\% | 1.3435 | 0.13\% | 0.9329 | 0.07\% | 1.2577 |
| NETHERLANDS | $12 \times 3$ | EW | CAR(0) | 1.08\% | 5.0515 | 0.83\% | 4.0209 | 0.25\% | 2.1905 |
| NEWZEALAND | $3 \times 3$ | IVOL | $\operatorname{BHAR}(0)$ | 1.31\% | 2.3438 | 1.25\% | 2.2595 | 0.05\% | 0.5910 |
| NORWAY | $12 \times 3$ | IVOL | $\operatorname{BHAR}(0)$ | 0.72\% | 2.8733 | 0.63\% | 2.5174 | 0.09\% | 0.4312 |
| PORTUGAL | $3 \times 3$ | MW | BHAR(1) | 1.10\% | 2.4701 | 1.10\% | 2.9808 | 0.00\% | 0.0044 |
| SINGAPORE | $6 \times 3$ | EW | CAR(1) | 0.82\% | 4.5846 | 0.44\% | 2.0999 | 0.38\% | 3.5462 |
| SPAIN | $3 \times 3$ | IVOL | CAR(0) | 0.51\% | 3.5024 | 0.55\% | 3.2186 | -0.04\% | -0.2802 |
| SWEDEN | $12 \times 3$ | EW | BHAR(1) | 0.99\% | 3.6693 | 0.75\% | 2.7783 | 0.23\% | 1.7456 |
| SWITZERLAND | $12 \times 3$ | EW | BHAR(0) | 0.82\% | 4.2894 | 0.71\% | 3.4010 | 0.11\% | 0.9813 |
| UK | $12 \times 3$ | EW | CAR(0) | 1.09\% | 6.3166 | 0.99\% | 5.2613 | 0.10\% | 1.4027 |
| US | $3 \times 6$ | IVOL | $\operatorname{BHAR}(0)$ | 0.61\% | 1.7509 | 0.61\% | 1.7511 | 0.00\% | 0.0127 |
| POOLED SAMPLE |  |  |  | 0.97\% | 3.6031 | 0.79\% | 2.8453 | 0.17\% | 1.0840 |

Panel C. TSM $($ cut-off $=$ market index $)$ VS. CSM $($ winner $=50 \%$, loser $=50 \%)$

|  |  | JxH | Weight | Construction | TSM | $t$-stats | CSM | $t$-stats | DIFFERENCE <br> (TSM - CSM) |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $t$-stats |  |  |  |  |  |  |  |  |
| AUSTRALIA | $9 \times 9$ | IVOL | BHAR(0) | $1.05 \%$ | 2.3747 | $0.75 \%$ | 1.6800 | $0.31 \%$ | 1.9123 |
| AUSTRIA | $9 \times 3$ | IVOL | CAR(0) | $1.14 \%$ | 3.7571 | $0.95 \%$ | 3.2755 | $0.19 \%$ | 1.5868 |
| BELGIUM | $9 \times 3$ | EW | CAR(1) | $0.89 \%$ | 4.9433 | $0.82 \%$ | 4.8117 | $0.07 \%$ | 1.3747 |
| CANADA | $6 \times 12$ | IVOL | BHAR(0) | $0.90 \%$ | 3.0657 | $0.90 \%$ | 3.2743 | $0.00 \%$ | -0.0411 |
| DENMARK | $12 \times 3$ | EW | BHAR(0) | $0.94 \%$ | 5.1368 | $1.01 \%$ | 6.4064 | $-0.07 \%$ | -0.6802 |
| FINLAND | $6 \times 12$ | MW | BHAR(0) | $1.93 \%$ | 3.5932 | $1.59 \%$ | 2.9374 | $0.34 \%$ | 0.9686 |
| FRANCE | $9 \times 12$ | IVOL | BHAR(0) | $0.86 \%$ | 2.1570 | $1.08 \%$ | 2.7778 | $-0.22 \%$ | -0.5410 |
| GERMANY | $12 \times 3$ | IVOL | CAR(0) | $0.83 \%$ | 3.2706 | $0.82 \%$ | 3.3275 | $0.01 \%$ | 0.0878 |
| GREECE | $3 \times 3$ | MW | BHAR(0) | $0.53 \%$ | 1.2075 | $1.21 \%$ | 2.0349 | $-0.68 \%$ | -1.3644 |
| HONGKONG | $6 \times 3$ | IVOL | BHAR(0) | $0.74 \%$ | 2.1637 | $0.53 \%$ | 1.5575 | $0.21 \%$ | 1.0707 |
| IRELAND | $6 \times 3$ | MW | CAR(0) | $1.09 \%$ | 2.3036 | $1.14 \%$ | 2.2723 | $-0.05 \%$ | -0.2571 |
| ISRAEL | $9 \times 3$ | MW | CAR(1) | $0.99 \%$ | 2.4038 | $0.87 \%$ | 2.1286 | $0.13 \%$ | 0.2522 |
| ITALY | $12 \times 3$ | EW | CAR(0) | $0.84 \%$ | 4.2448 | $0.69 \%$ | 3.9493 | $0.14 \%$ | 1.7969 |
| JAPAN | $3 \times 12$ | EW | BHAR(1) | $0.04 \%$ | 0.2798 | $0.13 \%$ | 0.9329 | $-0.08 \%$ | -1.8138 |
| NETHERLANDS | $12 \times 3$ | EW | CAR(0) | $0.83 \%$ | 3.7853 | $0.83 \%$ | 4.0209 | $0.00 \%$ | 0.0917 |
| NEWZEALAND | $3 \times 3$ | IVOL | BHAR(0) | $1.31 \%$ | 2.3506 | $1.25 \%$ | 2.2595 | $0.05 \%$ | 0.4926 |
| NORWAY | $9 \times 3$ | EW | BHAR(1) | $0.65 \%$ | 2.8133 | $0.62 \%$ | 2.9445 | $0.03 \%$ | 0.3400 |
| PORTUGAL | $6 \times 6$ | IVOL | BHAR(1) | $1.38 \%$ | 2.9737 | $0.82 \%$ | 1.9433 | $0.57 \%$ | 1.9956 |
| SINGAPORE | $6 \times 6$ | IVOL | BHAR(1) | $0.46 \%$ | 2.4828 | $0.50 \%$ | 2.4073 | $-0.04 \%$ | -0.3349 |
| SPAIN | $9 \times 3$ | IVOL | CAR(1) | $0.69 \%$ | 3.1387 | $0.70 \%$ | 3.1227 | $-0.01 \%$ | -0.0874 |
| SWEDEN | $3 \times 9$ | IVOL | BHAR(1) | $0.86 \%$ | 2.3668 | $0.94 \%$ | 2.5404 | $-0.07 \%$ | -0.9841 |
| SWITZERLAND | $12 \times 3$ | EW | BHAR(0) | $0.78 \%$ | 3.4627 | $0.71 \%$ | 3.4010 | $0.07 \%$ | 1.0529 |
| UK | $12 \times 3$ | EW | CAR(0) | $1.03 \%$ | 5.7300 | $0.99 \%$ | 5.2613 | $0.04 \%$ | 0.9285 |
| US | $3 \times 6$ | IVOL | BHAR(0) | $0.58 \%$ | 1.5707 | $0.61 \%$ | 1.7511 | $-0.03 \%$ | -0.2328 |
| POOLED SAMPLE |  |  |  | $0.89 \%$ | 2.9823 | $0.85 \%$ | 2.9591 | $0.04 \%$ | 0.3173 |

### 5.5. Conclusion

Academic papers on the cross-sectional momentum strategy have been published for over 20 years, whereas the time-series momentum strategy is a relatively recent phenomenon. This chapter has focused on evaluating and comparing the performance of the two momentum strategies across the 24 developed security markets. The essential difference between the two momentum strategies is in the way that they choose stocks to be included in the winner and loser portfolios. The time-series momentum strategy chooses stocks based upon their recent absolute performance while the cross-sectional momentum strategy chooses stocks based on their recent relative performance.

This chapter provides comprehensive comparisons of the performances of the two momentum strategies in international stock markets applying 192 approaches to implementation and three different cut-offs. The first thing that has been found is that momentum returns reduce as the number of stocks in momentum portfolios are increasing. With the extension of the cut-offs to increase the number of stocks in the momentum portfolio from $32 \%$ to the whole sample, the return of the momentum strategies fall by approximately $50 \%$.

This study mainly focuses on comparisons between a cross-sectional momentum strategy with cut-offs of $16 \%$ and a time-series momentum strategy in which symmetric cut-offs are set so that the comparisons involve (almost) the same number of stocks under both momentum strategies. Over the last two decades, both time-series and cross-sectional momentum strategies have been significantly profitable under numerous implementations in the majority of developed stock markets with the major exceptions being Greece, Israel, Japan, Hong Kong, Portugal, Spain and the US. Very few of the implementations that have
been examined for these two momentum strategies yield significant negative returns over the testing period.

The underpinning of momentum strategies is that stocks trend in both directions which suggest that they cycle between being overvalued and undervalued (Barberis et al., 1998; Hong et al., 1998). The best implementation strategies are those that produce stock holdings (i.e. stock purchases and sales) that are most in tune with these cycles. The study evaluates numerous different implementations across the 24 markets and finds that the optimal combination for the formation and holding periods most commonly aggregated to between 12 and 15 months. This suggests that the up and down cycles for the typical stock lie in this range. In most markets, it proves better to take a conservative approach by utilising a long formation period and a relative short holding period. Other implementation options examined included the weighting scheme with market weights performing the best in most markets, and rebalancing strategies where the four examine had minimum impact on performance.

Across almost all implementations, the time-series momentum strategy is found to outperform the cross-sectional momentum strategy. Based on the optimal implementations for both types of momentum strategies with selecting $32 \%$ of stocks in the two strategies, the superiority of the time-series momentum is statistically significant in 13 markets: Australia ( $0.90 \%$ per month), Canada ( $1.07 \%$ per month), Finland ( $1.13 \%$ per month), France ( $0.33 \%$ per month), Hong Kong ( $0.87 \%$ per month), Ireland ( $1.16 \%$ per month), Japan ( $0.84 \%$ per month), the Netherlands ( $0.81 \%$ per month), New Zealand (1.09\% per month), Portugal (1.19\% per month), Singapore ( $0.77 \%$ per month), Sweden ( $1.44 \%$ per month) and the UK ( $0.30 \%$ per month), and economically significant for the remaining countries, at around $0.66 \%$ per month on average. The best implementations of the time-series momentum strategy perform better than the best cross-sectional momentum strategy. In the next chapter, we examine more
closely why it is that the time-series momentum strategy outperforms the cross-sectional momentum strategy.

## Chapter 6 - Closer examination of time-series and cross-sectional momentum under optimal implementation approach

### 6.1. Introduction

In Chapter 5, the study finds that the time-series momentum strategy outperforms the crosssectional strategy under "optimal" implementations across the 24 markets from 1992 to 2012. In order to gain some insights into why this might be the case, this chapter further investigates and compares the two momentum strategies under the optimal implementations identified in Table 5.11. Section 6.2 applies regression analysis to test the momentum return from each strategy in isolation from the other. Section 6.3 takes a closer snapshot of basic portfolio characteristics of the two strategies, Section 6.4 compares performance of the two momentum strategies under different market conditions, and performances of the stocks included in the time-series and cross-sectional portfolios. Conclusions are drawn in Section 6.5.

### 6.2. The performance of individual time-series and cross-sectional momentum stocks

The characteristic of the two momentum strategies considered is the performance of the individual stocks included in the winner and loser portfolios. Following the procedure of George and Hwang (2004) based on Fama and MacBeth (1973) cross-sectional regression, the study runs the following regression:

$$
R_{i t}=b_{0 j t}+b_{1 j t} \operatorname{Ln}(\text { Size })_{i, t-1}+b_{2 j t} \text { CSH }_{i, t}+b_{3 j t} \text { CSL }_{i, t}+b_{4 j t} T S H_{i, t}+b_{5 j t} T S L_{i, t}+e_{i, t}
$$

where $\mathrm{Rit}_{\mathrm{it}}$ is the return on stock i in month t ; Ln (Size) is the market capitalisation of stock i at time, $\mathrm{t}-1$; CSHit is a dummy that equals one if stock i is in the cross-sectional momentum winner portfolio in month t ; CSLit is a dummy that equals one if stock i is in the crosssectional momentum loser portfolio in month $t$; TSHit is a dummy that equals one if stock i is in the time-series momentum winner portfolio in month $t$; TSLit is a dummy that equals one if stock i is in the time-series momentum loser portfolio in month t . The constant, $\mathrm{b}_{0 \mathrm{j} \text { t, }}$, is the average monthly return of a portfolio consisting of stocks that do not appear in either the winner or loser portfolios that has hedged out the effect of size, while coefficient attached to each of the other variables reflects the incremental return attached to that type of stock. For example the coefficient, b 1 jt represents the return in excess of bojt that can be earned on the average stock invested included in a cross-sectional momentum loser portfolio. The other coefficients have similar interpretations.

It should be emphasised that the findings only relate to the average performance of the stocks held in the portfolio and not to the performance of the portfolios themselves. The findings would only reflect the performance of the portfolios if an equal weight was assigned to each of the stocks included in the portfolio which is not the case in any of our optimum portfolios. Therefore, the findings reflect the contribution to the performance of the stock selection embedded in the momentum strategies but not the contribution of the portfolio construction.

Table 6.1 reports the coefficient estimates from the regression analysis based on optimal implementation approaches of two momentum strategies for all 24 markets. ${ }^{28}$ The first thing to observe is that stock selection under both the time-series and cross-sectional momentum strategies add value in that TSH - TSL and CSH - CSL are positive in all markets, except in Ireland where the coefficient for the cross-sectional momentum strategy is not positive.

[^21]In the case of time-series momentum strategy, the difference (TSH - TSL) is significant in all markets with the exceptions of Greece, Italy, Japan, Norway, Portugal and Singapore, while in the case of cross-sectional momentum this outperformance is significant in 14 out of 24 markets. The last column in the table shows the difference between time-series and crosssectional momentum strategies (TSM - CSM). Based on this analysis, the time-series momentum strategy is superior to the cross-sectional momentum strategy in 16 of the markets with the exceptions being Belgium, France, Germany, Greece, Italy, Japan, Norway and Singapore.

The findings show that in general both momentum strategies produce positive returns, with time-series momentum strategy being the better of the two. However in the results reported in Table 6.1, the returns are not as strong as those reported in Table 5.11. This shows that the time-series momentum strategy is superior in all markets and its advantage is significant in 13 markets. As suggested previously, the performance reported in Table 6.1 only reflects the stock selection element of the momentum strategies while those reported in Table 5.11 also encompass the value added by portfolio construction.

## Table 6.1. Regression analysis

Based on an optimal implementation for each market from Table 5.11, this table reports the comparisons between time-series (TSM) and cross-sectional (CSM) momentum strategies by using a regression model for 1992 to 2012. The Newey-West adjusted t-statistics are reported below the coefficients for each market. Following the procedure of George and Hwang (2004), we run the cross-sectional regression, $\mathrm{R}_{\mathrm{it}}=\mathrm{b}_{0 \mathrm{jt}}+$ $\mathrm{b}_{1 \mathrm{j} \mathrm{t}} \operatorname{Ln}(\mathrm{SIZE})_{\mathrm{i}, \mathrm{t}-1}+\mathrm{b}_{2 \mathrm{jt}} \mathrm{CSH}_{\mathrm{it}}+\mathrm{b}_{3 \mathrm{jt}} \mathrm{CSL}_{\mathrm{it}}+\mathrm{b}_{4 \mathrm{jt}} \mathrm{TSH}_{\mathrm{it}}+\mathrm{b}_{5 \mathrm{it}} \mathrm{TSL}_{\mathrm{it}}+e_{\mathrm{it},}$ where Rit is the return on stock i in month t ; Ln (Size) is the market capitalisation of stock i at time, $\mathrm{t}-1$; CSHit is a dummy that equals one if stock i is in the cross-sectional momentum winner portfolio in month $t$; CSLit is a dummy that equals one if stock $i$ is in the cross-sectional momentum loser portfolio in month $t$; TSHit is a dummy that equals one if stock $i$ is in the timeseries momentum winner portfolio in month t ; TSLit is a dummy that equals one if stock i is in the time-series momentum loser portfolio in month $t$. The constant, $b_{0} \mathrm{j} t$, is the average monthly return of a portfolio consisting of stocks that do not appear in either the winner or loser portfolios that have hedged out the effect of size, while the coefficient attached to each of the other variables reflects the incremental return attached to that type of stock. The difference of coefficients between TSH (CSH) and TSL (CSL) dummies represent the return of timeseries (cross-sectional) momentum strategy after controlling for other explanatory variables. The last column in the table shows the return difference between time-series and cross-sectional momentum strategies.

|  | INTERCEPT LN(SIZE) |  | TSH | TSL | TSH-TSL | CSH | CSL | CSH-CSL | TSM - CSM |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| AUSTRALIA | 2.16\% | -0.28\% | 0.16\% | -0.38\% | 0.54\% | 0.11\% | -0.29\% | 0.40\% | 0.13\% |
|  | 3.5108 | -4.0975 | 0.7190 | -1.6507 | 1.7547 | 0.5217 | -1.2086 | 1.2800 | 0.2643 |
| AUSTRIA | 0.13\% | 0.04\% | 0.54\% | -0.48\% | 1.01\% | 0.22\% | -0.32\% | 0.54\% | 0.48\% |
|  | 0.5078 | 0.6962 | 2.5345 | -1.4357 | 2.7084 | 1.3683 | -1.5442 | 1.9021 | 1.0979 |
| BELGIUM | 0.58\% | 0.01\% | 0.08\% | -0.65\% | 0.73\% | 0.50\% | -0.63\% | 1.13\% | -0.40\% |
|  | 3.2368 | 0.2327 | 0.4948 | -2.6299 | 2.2797 | 3.7875 | -3.2500 | 4.5700 | -1.0044 |
| CANADA | 3.02\% | -0.38\% | 0.81\% | -0.54\% | 1.36\% | -0.05\% | -0.28\% | 0.23\% | 1.12\% |
|  | 4.8737 | -5.8566 | 2.8043 | -2.5526 | 4.0170 | -0.1777 | -0.9336 | 0.5128 | 1.6993 |
| DENMARK | 0.53\% | 0.00\% | 0.72\% | $-0.58 \%$ | 1.30\% | 0.26\% | $-0.59 \%$ | $0.85 \%$ | 0.45\% |
|  | 1.4049 | 0.0261 | 2.9333 | -1.8625 | 3.3683 | 1.7455 | -2.2060 | 2.6499 | 0.7912 |
| FINLAND | 1.59\% | -0.08\% | 0.88\% | -0.26\% | 1.14\% | -0.12\% | -0.51\% | 0.39\% | 0.75\% |
|  | 2.8623 | -1.2394 | 2.5337 | -0.6454 | 2.0613 | -0.4784 | -1.8844 | 0.9416 | 0.9782 |
| FRANCE | 1.13\% | -0.06\% | 0.26\% | -0.21\% | 0.47\% | 0.21\% | -0.64\% | 0.86\% | -0.38\% |
|  | 3.6626 | -1.7131 | 2.3510 | -1.1467 | 2.1558 | 1.7175 | -3.3963 | 3.4712 | -1.1839 |
| GERMANY | 0.30\% | 0.01\% | -0.02\% | -0.57\% | 0.56\% | 0.50\% | -0.62\% | 1.12\% | -0.56\% |
|  | 0.8182 | 0.2182 | -0.1039 | -2.2611 | 1.9468 | 2.9859 | -3.3338 | 4.2946 | -1.4621 |
| GREECE | 1.74\% | -0.20\% | -0.26\% | -0.31\% | 0.06\% | 0.53\% | -0.48\% | 1.01\% | -0.95\% |
|  | 1.3042 | -1.4265 | -0.8129 | -1.0352 | 0.1394 | 2.6387 | -1.9528 | 2.9642 | -1.4876 |
| HONGKONG | 3.15\% | -0.27\% | -0.01\% | -0.84\% | 0.84\% | 0.23\% | -0.34\% | 0.57\% | 0.26\% |
|  | 2.8421 | -2.5444 | -0.0282 | -2.5200 | 1.9562 | 0.8975 | -1.4733 | 1.4398 | 0.4148 |
| IRELAND | 1.83\% | -0.15\% | 1.08\% | -1.65\% | 2.73\% | -0.52\% | -0.16\% | -0.36\% | 3.09\% |
|  | 2.7142 | -1.9075 | 1.7829 | -2.7683 | 3.3709 | $-1.1407$ | -0.2633 | -0.5121 | 2.2774 |
| ISRAEL | 1.83\% | -0.16\% | 0.30\% | -0.52\% | 0.81\% | -0.11\% | -0.20\% | 0.09\% | 0.72\% |
|  | 2.8714 | -2.3818 | 1.1338 | -1.6885 | 2.2171 | -0.4762 | -1.1065 | 0.3174 | 1.3263 |
| ITALY | 0.14\% | 0.02\% | 0.14\% | -0.29\% | 0.43\% | 0.45\% | -0.81\% | 1.26\% | -0.83\% |
|  | 0.2881 | 0.6370 | 0.5505 | -0.7494 | 0.9656 | 2.3639 | -2.9626 | 3.6397 | -1.2668 |
| JAPAN | 1.36\% | -0.11\% | -0.19\% | -0.21\% | 0.02\% | 0.15\% | -0.14\% | 0.29\% | -0.27\% |
|  | 1.3801 | -1.7007 | -1.3029 | -1.5506 | 0.0907 | 1.2143 | -1.0251 | 1.4787 | -0.9635 |
| NETHERLANDS | 0.55\% | 0.04\% | 0.19\% | -1.06\% | 1.26\% | 0.47\% | -0.64\% | 1.11\% | 0.15\% |
|  | 1.3733 | 1.0333 | 0.6553 | -3.4139 | 3.3356 | 2.1977 | -2.8840 | 3.2439 | 0.2488 |
| NEWZEALAND | 1.04\% | -0.04\% | 1.13\% | -0.70\% | 1.83\% | 0.35\% | -0.21\% | 0.57\% | 1.27\% |
|  | 2.4823 | -0.5912 | 2.3505 | -1.9094 | 3.0472 | $1.0297$ | $-0.5078$ | $1.0386$ | $1.2487$ |
| NORWAY | 1.67\% | -0.11\% | 0.88\% | 0.00\% | 0.88\% | 0.88\% | -0.36\% | 1.24\% | -0.36\% |
|  | 2.6215 | -1.7511 | 1.8893 | -0.0025 | 1.2945 | 2.9913 | $-0.9608$ | 2.6254 | $-0.3617$ |
| PORTUGAL | 1.32\% | -0.15\% | -0.28\% | -0.76\% | 0.48\% | 0.45\% | 0.20\% | 0.25\% | 0.23\% |
|  | 4.6750 | -2.5555 | -0.6691 | -1.6214 | 0.7531 | 1.4440 | 0.4539 | 0.4227 | 0.2097 |
| SINGAPORE | 1.69\% | -0.14\% | 0.06\% | -0.26\% | 0.32\% | 0.25\% | -0.51\% | 0.75\% | -0.43\% |
|  | 1.7763 | -1.5978 | 0.2182 | $-1.0791$ | 0.8210 | 1.2001 | -1.9756 | 1.9542 | -0.9260 |
| SPAIN | 0.84\% | -0.02\% | 0.50\% | -0.36\% | 0.86\% | 0.11\% | -0.32\% | 0.43\% | 0.43\% |
|  | 1.7785 | -0.3636 | 1.9841 | -0.9272 | 1.8101 | 0.5983 | -1.1925 | 1.2944 | 0.6205 |
| SWEDEN | 1.36\% | -0.05\% | 0.56\% | -1.47\% | 2.03\% | 0.12\% | -0.50\% | 0.62\% | 1.41\% |
|  | 1.7787 | -0.7103 | 2.4640 | -3.5811 | 4.1814 | 0.4737 | -1.7919 | 1.4902 | 1.9946 |
| SWITZERLAND | 0.75\% | 0.00\% | 0.57\% | -0.45\% | 1.01\% | 0.43\% | -0.39\% | 0.82\% | 0.19\% |
|  | 2.4152 | 0.0449 | 2.3802 | -1.9839 | 3.6521 | 3.2176 | -2.2894 | 3.4199 | 0.4952 |
| UK | 0.35\% | 0.04\% | 0.56\% | -0.55\% | 1.11\% | 0.58\% | -0.30\% | 0.88\% | 0.23\% |
|  | 0.8790 | 0.9412 | 4.8350 | -3.5133 | 6.5043 | 3.3687 | -1.8080 | 3.1691 | 0.6959 |
| US | 2.58\% | -0.22\% | 0.29\% | -0.19\% | 0.48\% | 0.21\% | -0.09\% | 0.30\% | 0.18\% |
|  | 5.8286 | -5.4747 | 1.8937 | -1.5014 | 2.5519 | 1.5447 | -0.4918 | 1.3247 | 0.6702 |

### 6.3. Basic characteristics of time-series and cross-sectional portfolios

To further investigate why the time-series momentum strategy outperforms the crosssectional momentum strategy, Table 6.2 presents information on the size, book-to-market and momentum characteristics of the two momentum strategies, which are best evaluated by comparing them with the average values over the sample period reported in Table 3.3 in Chapter 3. It should be emphasised that the results of these three characteristics from winner and loser portfolios reported in Table 6.2 are likely to be biased towards larger stocks or low volatility stocks, when the optimal portfolio weighting scheme uses market weight or inversed volatility weight.

With respect to size (in local currency), the stocks included in momentum portfolios are much smaller than the average stocks in the sample, with the loser portfolios consisting of stocks in even much smaller companies than is the case with the winner portfolios in 17 markets. Although the remaining seven countries, Austria, Belgium, Denmark, Finland, Germany, Greece and Sweden, present a similar pattern in which the loser portfolio contains smaller stocks, the winner portfolio stocks are larger than the average stocks in the sample. Finally, the most interesting findings are that in about 20 markets, the time-series momentum portfolios (both winner and loser) consist of stocks in smaller companies than those contained in cross-sectional momentum portfolios.

The three largest spreads of book-to-market ratio between time-series winner and loser portfolio are in Belgium with a spread of 2.21 , in Germany with a spread of 2.30 and in Israel with a spread of 0.90 . The three largest spreads of the ratios between cross-sectional winners and losers are shown in the same three markets, with spreads of $1.425,1.83$ and 1.89 , respectively. The winners are higher than the losers in 22 of 24 markets for time-series
momentum strategy and all markets for cross-sectional momentum strategy. Hence the loser stocks are more like value stocks than is the case with the winners for the two momentum strategies. In addition, the book-to-market spread between the winner and the loser in the time-series momentum strategy is wider than the one in the cross-sectional momentum strategy in 16 markets.

Finally, as would be expected the loser portfolios for both momentum strategies consist of stocks that have been performing extremely poorly over the previous six months, and winner portfolios consist of stocks that have performed extremely well. However, the spread in this performance is slightly larger for the time-series momentum portfolios.

In summary, the loser portfolios consist of small cap and more value stocks that have been performing poorly in recent months. The winner portfolios consist of slightly larger (but still small) and more growth stocks whose recent performance has been very good and so it is not surprising that both time-series and cross-sectional momentum strategies perform so well. The major distinction between the portfolio characteristics of the two types of momentum strategies are that the typical time-series momentum portfolios consist of slightly smaller and growth stocks with greater spreads in past performance than the cross-sectional portfolios. Both of these features suggest that the time-series momentum strategy will outperform the cross-sectional momentum strategy.

Table 6.2. Basic Characteristics of Optimal Time-Series and Cross-Sectional Momentum
This table displays the average monthly market value (MV), book-to-market (B/M) ratio and ex ante returns (returns over the last six months) of stocks being selected in loser and winner portfolios of time-series (TSM) and cross-sectional (CSM) momentum strategies based on "optimal" implementation approaches from Table 5.11 for each market.

|  | TSM |  |  |  |  |  | CSM |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | MV |  | B/M ratio |  | Return over last 6 months |  | MV |  | B/M ratio |  | Return over last 6 months |  |
|  | Loser | Winner | Loser | Winner | Loser | Winner | Loser | Winner | Loser | Winner | Loser | Winner |
| AUSTRALIA | 72.66 | 268.74 | 0.48 | 0.53 | -6.56\% | 9.79\% | 263.40 | 476.18 | 0.79 | 0.51 | -6.04\% | 9.46\% |
| AUSTRIA | 322.45 | 1269.17 | 1.10 | 0.91 | -3.90\% | 4.34\% | 353.20 | 946.41 | 1.43 | 1.09 | -3.53\% | 4.18\% |
| BELGIUM | 492.18 | 2706.10 | 2.93 | 0.74 | -3.29\% | 4.01\% | 617.22 | 2419.96 | 2.16 | 0.72 | -3.03\% | 3.91\% |
| CANADA | 202.29 | 578.39 | 1.06 | 0.64 | -5.95\% | 10.13\% | 303.40 | 661.08 | 1.21 | 0.61 | -5.80\% | 10.12\% |
| DENMARK | 1777.93 | 6341.44 | 0.99 | 0.68 | -4.55\% | 5.61\% | 1853.03 | 6094.82 | 0.99 | 0.70 | -4.18\% | 5.24\% |
| FINLAND | 633.56 | 2554.76 | 0.90 | 0.48 | -3.99\% | 5.58\% | 729.38 | 2225.25 | 0.85 | 0.51 | -3.14\% | 5.10\% |
| FRANCE | 548.94 | 1226.26 | 0.88 | 0.65 | -4.88\% | 6.23\% | 582.84 | 1248.64 | 0.90 | 0.65 | -4.59\% | 6.16\% |
| GERMANY | 243.35 | 1627.88 | 3.44 | 1.14 | -5.70\% | 5.63\% | 280.77 | 1484.50 | 2.97 | 1.14 | -5.05\% | 5.44\% |
| GREECE | 240.11 | 2808.42 | 1.28 | 0.91 | -11.48\% | 14.82\% | 786.85 | 5071.72 | 1.11 | 0.92 | -8.69\% | 12.92\% |
| HONGKONG | 1613.29 | 4487.89 | 1.50 | 0.94 | -6.38\% | 10.51\% | 2784.85 | 6685.21 | 1.57 | 1.01 | -5.54\% | 9.41\% |
| IRELAND | 359.96 | 694.42 | 1.67 | 0.71 | -4.04\% | 7.65\% | 426.61 | 689.72 | 1.74 | 0.63 | -3.92\% | 8.03\% |
| ISRAEL | 175.41 | 385.33 | 0.91 | 1.81 | -5.58\% | 7.12\% | 374.23 | 618.26 | 3.35 | 1.46 | -4.79\% | 6.65\% |
| ITALY | 15001.24 | 158131.14 | 1.54 | 0.72 | -4.02\% | 4.52\% | 15999.25 | 164496.67 | 1.09 | 0.73 | -3.45\% | 4.07\% |
| JAPAN | 120627.24 | 148494.96 | 0.91 | 0.82 | -4.25\% | 6.03\% | 157861.38 | 161095.19 | 0.96 | 0.86 | -3.87\% | 5.02\% |
| NETHERLANDS | 706.49 | 2216.26 | 1.09 | 0.58 | -4.74\% | 5.46\% | 953.15 | 2672.05 | 1.11 | 0.78 | -4.22\% | 5.21\% |
| NEWZEALAND | 156.62 | 343.64 | 1.05 | 0.69 | -4.03\% | 5.84\% | 165.89 | 352.01 | 1.03 | 0.67 | -3.69\% | 5.61\% |
| NORWAY | 1082.09 | 4214.57 | 1.05 | 0.61 | -5.36\% | 7.41\% | 1277.06 | 3999.24 | 1.19 | 0.65 | -4.82\% | 7.03\% |
| PORTUGAL | 709.60 | 1422.73 | 1.37 | 1.34 | -5.79\% | 8.28\% | 679.12 | 1446.84 | 1.66 | 1.16 | -5.43\% | 7.62\% |
| SINGAPORE | 379.17 | 878.03 | 1.17 | 0.72 | -4.60\% | 7.40\% | 761.87 | 1290.33 | 1.24 | 0.77 | -3.69\% | 6.28\% |
| SPAIN | 1800.53 | 3260.22 | 0.81 | 0.61 | -3.97\% | 4.42\% | 2885.15 | 3706.77 | 0.88 | 0.67 | -3.07\% | 4.30\% |
| SWEDEN | 1028.02 | 6458.43 | 1.25 | 0.53 | -6.15\% | 6.53\% | 1667.15 | 7580.89 | 1.21 | 0.61 | -4.80\% | 6.36\% |
| SWITZERLAND | 1369.29 | 3182.26 | 1.17 | 0.91 | -3.09\% | 4.47\% | 2044.45 | 3283.52 | 1.43 | 0.93 | -2.72\% | 4.26\% |
| UK | 146.32 | 567.62 | 0.80 | 0.53 | -5.62\% | 6.20\% | 189.10 | 648.34 | 0.92 | 0.54 | -5.37\% | 6.08\% |
| US | 1135.56 | 1919.62 | 0.74 | 0.45 | -4.53\% | 7.74\% | 1389.24 | 2035.15 | 0.75 | 0.46 | -4.27\% | 7.53\% |

### 6.4. Time-series and cross-sectional momentum strategies in "up" and "down" markets

### 6.4.1. Market conditions based on ex-ante market returns

Cooper et al. (2004) find that momentum profitability depends critically on the state of the market, with the momentum strategies in periods following positive markets ("up" markets) yielding better performance than momentum strategies in periods following negative markets ("down" market). In order to see whether this finding applies to our sample for both the timeseries and cross-sectional momentum strategies, the study evaluates the performances of the optimal implementations in both up and down markets. Following the method employed by Cooper et al. (2004), an up month is defined as one in which the market index has risen over
the previous 12 months and a down market is defined as one in which the market index has fallen. ${ }^{29}$

Table 6.3 reports the optimal time-series and cross-sectional momentum returns following "up" and "down" states of the markets over the sample period. Consistent with Cooper et al. (2004), we find that the investment outcomes using the two momentum strategies in the periods when market gains (i.e. up markets) outperform the outcomes when market losses (i.e. down markets). The performance for the time-series momentum strategy in up markets is much stronger than it is in down markets in 17 of 24 markets, while for the cross-sectional momentum strategy the performance in up markets is stronger in 19 markets. The weak performance of the two momentum strategies in up markets is evident in Germany, Israel, Japan and Spain. In Norway and Switzerland, it is only with time-series momentum strategies that the performance is better in down markets than in up markets. Sweden is the only case where it is only the cross-sectional momentum strategy that performs better in down markets than in up markets.

When comparing the returns of the two momentum strategies under up and down markets, it is found that the time-series momentum strategy outperforms the cross-sectional momentum strategy in either up or down periods in 20 of the 24 markets. In Denmark and Italy, timeseries momentum strategy only outperforms in up markets whereas in Greece and Norway it only outperforms in down periods. In addition, the outperformance of times-series momentum strategy in up markets is small than the outperformance in down markets and so the superior performance of time-series momentum strategy is largely explained by the relatively poor performance of cross-sectional momentum strategy in down markets. The

[^22]average outperformance of the time-series momentum strategy across the 24 markets in up market is around $0.57 \%$ per month whereas the average outperformance is around $1.16 \%$ per month in down market.

In order to provide an insight into why there are differences between the performances of time-series and cross-sectional momentum strategies (especially in down markets), the study provides details in Table 6.4 of the average number of stocks included in the portfolios formed by applying the two types of momentum under both up and down markets. The results show that under the time-series momentum strategy there are many more winners than losers in up markets and a lot more losers than winners in down markets (with, of course, the same number of winners and losers for cross-sectional momentum under both markets). This should come as no surprise as the time-series momentum strategy with fixed cut-offs will designate fewer stocks as losers when markets are doing well and fewer stocks as winners when markets are performing poorly. The consequence is that cross-sectional momentum will (i) go further down the rankings when choosing losing stocks in strong markets, and may even include stocks as losers that are actually doing quite well in absolute terms (and which will therefore be excluded from the loser portfolio for time-series-momentum), and (ii) go further down the rankings when choosing winning stocks in weak markets, and may even include stocks as winners that are actually doing quite poorly in absolute terms (and which will therefore be excluded from the winner portfolio for time series momentum). If momentum is picking up on trends, then it is not surprising that the time series momentum strategy should do better as its stock selection is based on stronger signals than the crosssectional momentum strategy.

Table 6.3. Comparison between optimal time-series and cross-sectional momentum following "up" and "down" market states

The second column in this table shows the aggregate numbers of months when the market is up (or down) for each market. The next three columns show the optimal implementation for each market from Table 5.11. Based on the optimal implementation for each market, this table reports the time-series (TSM) and cross-sectional (CSM) winner, loser and momentum returns following "up" and "down" states of market during the 252 months from 1992 to 2012 in the three right-hand columns. Following the method employed in Cooper et al. (2004), we defined an "up" month as one in which the market index has risen over the previous 12 months and a "down" market as one in which the market index has fallen over the previous 12 months. Newey-West adjusted tstatistics are reported below the returns in the table.

| "UP" MARKETS | $\begin{gathered} \text { NO. OF } \\ \text { MONTHS } \end{gathered}$ | OPTIMAL <br> IMPLEMENTATION |  |  | TSM |  |  | CSM |  |  | DIFFERENCE |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | JxH | Weight | Construction | L | W | W - L | L | W | W-L | TSM - CSM |
| AUSTRALIA | 202 | 9x3 | MW | BHAR(0) | -0.47\% | 2.60\% | $3.07 \%$ | -0.40\% | 2.27\% | 2.67\% | 0.40\% |
|  |  |  |  |  | -0.7604 | 4.8700 | 6.4333 | -0.6305 | 4.3420 | 4.9709 | 1.0678 |
| AUSTRIA | 184 | $12 \times 3$ | IVOL | CAR(0) | -0.02\% | 1.51\% | 1.53\% | 0.06\% | 1.51\% | 1.45\% | 0.08\% |
|  |  |  |  |  | -0.0422 | 3.9101 | 2.9598 | 0.1583 | 3.8472 | 3.4970 | 0.2469 |
| BELGIUM | 191 | $12 \times 3$ | IVOL | CAR(1) | -0.36\% | 1.72\% | 2.08\% | -0.03\% | 1.93\% | 1.96\% | 0.12\% |
|  |  |  |  |  | -0.9785 | 5.3574 | 5.0030 | -0.1200 | 6.7744 | 8.1823 | 0.3956 |
| CANADA | 230 | $9 \times 3$ | MW | BHAR(0) | -0.31\% | $3.17 \%$ | 3.48\% | -0.27\% | 2.57\% | 2.84\% | 0.64\% |
|  |  |  |  |  | -0.5073 | 5.2437 | 5.2124 | -0.4422 | 4.2380 | 4.3211 | 1.7385 |
| DENMARK | 197 | $9 \times 3$ | IVOL | BHAR(1) | -0.54\% | 1.75\% | 2.26\% | -0.32\% | 1.58\% | 1.90\% | 0.36\% |
|  |  |  |  |  | -1.0321 | 4.8732 | 6.1292 | -0.7600 | 4.5878 | 7.1315 | 1.3023 |
| FINLAND | 181 | $12 \times 6$ | MW | BHAR(0) | 0.29\% | $3.70 \%$ | $3.47 \%$ | 0.62\% | 2.81\% | 2.19\% | 1.28\% |
|  |  |  |  |  | 0.3038 | 4.9236 | 3.4862 | 0.9969 | 3.7160 | 2.6237 | 1.7429 |
| FRANCE | 194 | $9 \times 3$ | IVOL | CAR(1) | 0.24\% | 1.80\% | 1.56\% | 0.52\% | 1.70\% | 1.18\% | 0.38\% |
|  |  |  |  |  | 0.7238 | 5.1134 | 7.4634 | 1.8114 | 4.5515 | 4.7943 | 2.8028 |
| GERMANY | 190 | 12x3 | IVOL | CAR(0) | -0.45\% | 1.36\% | 1.80\% | -0.16\% | 1.37\% | 1.53\% | 0.27\% |
|  |  |  |  |  | -0.9553 | 4.2095 | 5.9907 | -0.4549 | 3.9127 | 6.6833 | 1.1772 |
| GREECE | 154 | $3 \times 12$ | MW | BHAR(1) | -0.42\% | 2.25\% | 2.58\% | 0.35\% | 3.44\% | 3.09\% | -0.52\% |
|  |  |  |  |  | -0.4141 | 1.8143 | 2.3847 | 0.3612 | 2.4358 | 2.7924 | -0.4900 |
| HONGKONG | 204 | 6x3 | MW | BHAR(0) | -0.09\% | 2.43\% | 2.53\% | 0.14\% | 1.89\% | 1.75\% | 0.78\% |
|  |  |  |  |  | -0.1345 | 2.7495 | 4.1211 | 0.2000 | 2.5137 | 3.4368 | 1.3357 |
| IRELAND | 212 | 6x12 | MW | BHAR(0) | -1.22\% | 2.64\% | $3.79 \%$ | -0.49\% | 2.39\% | 2.87\% | 0.91\% |
|  |  |  |  |  | -1.2183 | 3.5537 | 3.3520 | -0.5803 | 3.2137 | 2.6813 | 1.3987 |
| ISRAEL | 199 | $9 \times 12$ | MW | BHAR(0) | -0.11\% | 1.63\% | 1.74\% | 0.16\% | 1.50\% | 1.33\% | 0.41\% |
|  |  |  |  |  | -0.1536 | 2.4760 | 2.3992 | 0.2738 | 2.3262 | 2.5466 | 0.8187 |
| ITALY | 172 | $12 \times 6$ | MW | BHAR(0) | -1.08\% | 1.96\% | 3.05\% | 0.61\% | 2.06\% | 1.45\% | 1.60\% |
|  |  |  |  |  | -1.8368 | 3.0914 | 4.2734 | 0.9632 | 3.3445 | 2.1238 | 2.6689 |
| JAPAN | 146 | $3 \times 12$ | MW | BHAR(0) | -0.88\% | 0.18\% | 1.07\% | 0.15\% | 0.12\% | -0.04\% | 1.10\% |
|  |  |  |  |  | -1.9605 | 0.2984 | 2.1012 | 0.3978 | 0.1941 | -0.0804 | 3.6659 |
| NETHERLANDS | 202 | $9 \times 3$ | EW | BHAR(1) | -0.92\% | 1.76\% | 2.68\% | -0.16\% | 1.67\% | 1.83\% | 0.85\% |
|  |  |  |  |  | -1.6072 | 3.8504 | 6.4472 | -0.3753 | 3.6731 | 5.4213 | 2.5862 |
| NEWZEALAND | 232 | 12x3 | IVOL | BHAR(0) | -0.12\% | 2.74\% | $2.87 \%$ | 0.05\% | 1.90\% | 1.85\% | 1.02\% |
|  |  |  |  |  | -0.3318 | 4.2154 | 4.0406 | 0.1498 | 5.9377 | 5.0997 | 1.7247 |
| NORWAY | 196 | $9 \times 3$ | IVOL | BHAR(0) | 0.37\% | 2.25\% | 1.89\% | 0.43\% | 2.50\% | $2.07 \%$ | -0.17\% |
|  |  |  |  |  | 0.4221 | 3.3185 | 2.8940 | 0.8311 | 4.0495 | 4.5140 | -0.2460 |
| PORTUGAL | 177 | 6x6 | MW | BHAR(1) | -0.49\% | $2.46 \%$ | 2.94\% | -0.32\% | 1.31\% | 1.64\% | 1.30\% |
|  |  |  |  |  | -0.6621 | 3.5187 | 3.3570 | -0.4944 | 2.0489 | 2.1792 | 1.6491 |
| SINGAPORE | 189 | $9 \times 3$ | IVOL | BHAR(0) | -0.42\% | 1.83\% | $2.22 \%$ | 0.10\% | 1.70\% | 1.60\% | 0.62\% |
|  |  |  |  |  | -0.6465 | 2.9917 | 4.6349 | 0.1746 | 2.9659 | 4.2956 | 1.8618 |
| SPAIN | 167 | 12x6 | EW | BHAR(0) | 0.90\% | 1.81\% | 1.00\% | 0.75\% | 1.73\% | 0.98\% | 0.02\% |
|  |  |  |  |  | 1.0334 | 3.3517 | 1.6912 | 1.4012 | 3.3352 | 2.7183 | 0.0344 |
| SWEDEN | 196 | 12x3 | IVOL | BHAR(1) | -0.48\% | 2.58\% | 3.04\% | 0.92\% | 2.15\% | 1.23\% | 1.81\% |
|  |  |  |  |  | -0.6108 | 4.6975 | 5.5355 | 1.6292 | 3.8602 | 2.8035 | 4.1503 |
| SWITZERLAND | 195 | $12 \times 3$ | EW | CAR(0) | 0.29\% | $1.91 \%$ | 1.62\% | 0.49\% | 1.92\% | 1.44\% | 0.19\% |
|  |  |  |  |  | 0.6489 | 4.5773 | 5.1271 | 1.4877 | 4.4909 | 5.1796 | 0.7371 |
| UK | 214 | 12x3 | IVOL | CAR(0) | -0.43\% | 1.77\% | $2.20 \%$ | -0.27\% | 1.73\% | $2.01 \%$ | 0.20\% |
|  |  |  |  |  | -1.1063 | 5.3822 | 9.3196 | $\underline{-0.7443}$ | 4.8108 | 7.1054 | 1.4112 |
| US | 226 | $9 \times 3$ | MW | CAR(1) | 0.89\% | $2.02 \%$ | 1.13\% | 0.90\% | 1.94\% | 1.04\% | 0.09\% |
|  |  |  |  |  | 2.6179 | 4.9104 | 2.9995 | 2.6730 | 4.8127 | 2.6821 | 0.5041 |


| "DOWN" MARKETS | NO. OF MONTHS | OPTIMAL <br> IMPLEMENTATION |  |  | TSM |  |  | CSM |  |  | DIFFERENCE |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | JxH | Weight | Construction | L | W | W - L | L | W | W - L | TSM - CSM |
| AUSTRALIA | 50 | 9x3 | MW | BHAR(0) | 1.83\% | 3.37\% | 1.54\% | 2.52\% | 1.13\% | -1.39\% | 2.93\% |
|  |  |  |  |  | 1.3417 | 2.1038 | 1.6020 | 1.1641 | 0.9516 | -0.7472 | 1.4870 |
| AUSTRIA | 68 | 12x3 | IVOL | CAR(0) | -1.28\% | 0.41\% | 1.69\% | -1.10\% | 0.15\% | 1.25\% | 0.44\% |
|  |  |  |  |  | -1.3214 | 0.7349 | 1.5545 | -0.9212 | 0.6340 | 1.1463 | 0.9831 |
| BELGIUM | 61 | 12x3 | IVOL | CAR(1) | -1.36\% | -0.47\% | 0.89\% | -0.99\% | -0.39\% | 0.60\% | 0.29\% |
|  |  |  |  |  | -1.5253 | -0.8311 | 1.1782 | -0.9178 | -0.8283 | 0.7613 | 0.7627 |
| CANADA | 22 | 9x3 | MW | BHAR(0) | 2.23\% | 1.73\% | -0.50\% | 6.45\% | 0.35\% | -6.09\% | 5.59\% |
|  |  |  |  |  | 0.9056 | 1.0813 | -0.2975 | 1.5159 | 0.1837 | -1.5577 | 1.6206 |
| DENMARK | 55 | 9x3 | IVOL | BHAR(1) | -1.49\% | -0.45\% | 1.08\% | -1.28\% | -0.11\% | 1.16\% | -0.09\% |
|  |  |  |  |  | -1.2973 | -0.3735 | 1.1403 | -0.9272 | -0.1412 | 1.3413 | -0.1288 |
| FINLAND | 71 | 12x6 | MW | BHAR(0) | -0.56\% | 0.85\% | 1.26\% | -0.75\% | -0.24\% | 0.51\% | 0.76\% |
|  |  |  |  |  | -0.3683 | 0.8662 | 0.8416 | -0.4827 | -0.1631 | 0.3094 | 0.5628 |
| FRANCE | 58 | 9x3 | IVOL | CAR(1) | -1.20\% | -0.20\% | 1.00\% | -1.06\% | -0.20\% | 0.86\% | 0.14\% |
|  |  |  |  |  | -1.0667 | -0.4385 | 1.2428 | -0.7437 | -0.4049 | 0.7582 | 0.3360 |
| GERMANY | 62 | 12x3 | IVOL | CAR(0) | -1.87\% | 0.11\% | 1.98\% | -1.66\% | 0.23\% | 1.89\% | 0.09\% |
|  |  |  |  |  | -1.5355 | 0.1797 | 2.1631 | -1.1627 | 0.4952 | 1.6673 | 0.1964 |
| GREECE | 98 | 3x12 | MW | BHAR(1) | -0.54\% | -0.17\% | 0.36\% | 0.27\% | -1.05\% | -1.31\% | 1.67\% |
|  |  |  |  |  | -0.3334 | -0.1696 | 0.3555 | 0.1577 | -1.4588 | -0.9801 | 1.7655 |
| HONGKONG | 48 | 6x3 | MW | BHAR(0) | 1.26\% | 2.12\% | 0.86\% | 1.87\% | 1.48\% | -0.39\% | 1.25\% |
|  |  |  |  |  | 0.6398 | 1.1339 | 0.4275 | 0.8966 | 1.0903 | -0.2838 | 0.8701 |
| IRELAND | 40 | 6x12 | MW | BHAR(0) | -1.82\% | 0.28\% | 2.10\% | 0.77\% | 0.41\% | -0.36\% | 2.46\% |
|  |  |  |  |  | -0.6004 | 0.0917 | 0.7560 | 0.3254 | 0.1488 | -0.1326 | 1.9394 |
| ISRAEL | 53 | 9x12 | MW | BHAR(0) | 0.49\% | 3.54\% | 3.05\% | -0.40\% | 2.48\% | 2.88\% | 0.17\% |
|  |  |  |  |  | 0.3001 | 2.0298 | 2.3402 | -0.1955 | 2.4863 | 1.7675 | 0.1236 |
| ITALY | 80 | 12x6 | MW | BHAR(0) | -1.12\% | -0.56\% | 0.57\% | -1.44\% | -0.21\% | 1.23\% | -0.66\% |
|  |  |  |  |  | -0.9944 | -0.4829 | 0.4924 | -1.1665 | -0.2668 | 1.5521 | -0.6341 |
| JAPAN | 106 | $3 \times 12$ | MW | BHAR(0) | -0.46\% | 0.65\% | 1.12\% | -0.07\% | 0.57\% | 0.63\% | 0.49\% |
|  |  |  |  |  | -0.5957 | 0.8890 | 1.7334 | -0.0756 | 0.7770 | 1.1039 | 1.7824 |
| NETHERLANDS | 50 | 9 x 3 | EW | BHAR(1) | -1.29\% | -0.04\% | 1.25\% | -0.97\% | -0.40\% | 0.57\% | 0.69\% |
|  |  |  |  |  | -0.8663 | -0.0217 | 1.0528 | -0.5435 | -0.3844 | 0.5292 | 0.5786 |
| NEWZEALAND | 20 | 12x3 | IVOL | BHAR(0) | -0.82\% | 1.76\% | 2.31\% | -0.74\% | -0.36\% | 0.37\% | 1.94\% |
|  |  |  |  |  | -0.6179 | 0.7256 | 1.3834 | -0.4684 | -0.3787 | 0.2600 | 1.2907 |
| NORWAY | 56 | 9x3 | IVOL | BHAR(0) | -0.28\% | 2.42\% | 2.70\% | 0.31\% | 0.14\% | -0.17\% | 2.87\% |
|  |  |  |  |  | -0.1985 | 1.6117 | 1.7558 | 0.1816 | 0.1607 | -0.1448 | 2.1536 |
| PORTUGAL | 75 | 6x6 | MW | BHAR(1) | -0.84\% | -0.78\% | 0.06\% | -0.88\% | -1.75\% | $-0.87 \%$ | 0.93\% |
|  |  |  |  |  | -0.6756 | -0.6517 | 0.0388 | -0.6096 | -1.8807 | -0.5963 | 0.7529 |
| SINGAPORE | 63 | $9 \times 3$ | IVOL | BHAR(0) | 0.46\% | 0.36\% | -0.11\% | 1.58\% | 0.25\% | -1.33\% | 1.22\% |
|  |  |  |  |  | 0.2678 | 0.3102 | -0.0695 | 0.7336 | 0.2891 | -0.8559 | 1.7549 |
| SPAIN | 85 | 12x6 | EW | BHAR(0) | -1.32\% | 0.69\% | 1.87\% | -1.15\% | -0.12\% | 1.03\% | 0.84\% |
|  |  |  |  |  | -1.4047 | 1.0406 | 2.4364 | -1.1893 | -0.2248 | 1.5447 | 2.1693 |
| SWEDEN | 56 | 12x3 | IVOL | BHAR(1) | -1.93\% | 0.06\% | 1.99\% | -2.02\% | -0.17\% | 1.85\% | 0.14\% |
|  |  |  |  |  | -1.2162 | 0.0433 | 1.6900 | -1.0575 | -0.1628 | 1.4101 | 0.1778 |
| SWITZERLAND | 57 | 12x3 | EW | CAR(0) | -1.27\% | 0.92\% | 2.19\% | -1.06\% | -0.16\% | 0.90\% | 1.29\% |
|  |  |  |  |  | -1.1036 | 0.7597 | 2.3199 | -0.7521 | -0.2941 | 0.8586 | 1.2561 |
| UK | 38 | 12x3 | IVOL | CAR(0) | -1.12\% | 0.70\% | 1.83\% | -0.65\% | 0.33\% | 0.98\% | 0.85\% |
|  |  |  |  |  | -0.6695 | 0.5040 | 2.0885 | -0.3194 | 0.3056 | 0.7864 | 1.1998 |
| US | 26 | 9x3 | MW | CAR(1) | 0.89\% | -0.44\% | -1.33\% | 2.61\% | -0.20\% | -2.81\% | 1.49\% |
|  |  |  |  |  | 0.4578 | -0.2351 | -1.1037 | 0.9526 | -0.1312 | -1.5157 | 1.3635 |

## Table 6.4. Distribution of number of stocks in optimal time-series and cross-sectional strategies

The second column in this table shows the optimal implementation for each market from Table 5.11. Based on the optimal implementation for each market, this table reports the average monthly number of stocks in timeseries (TSM) and cross-sectional (CSM) winner and loser portfolios in the testing period from 1992 to 2012 and in the period when the market is following "up" and "down". Following the method employed in Cooper et al. (2004), we defined an "up" month as one in which the market index has risen over the previous 12 months and a "down" market as one in which the market index has fallen over the previous 12 months.

| No. of stocks |  |  |  | Time-series momentum |  |  |  |  |  | Cross-sectional momentum |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Country | Optimal implementation |  |  | 1992-2012 |  | "Up" market |  | "Down" market |  | 1992-2012 |  | "Up" market |  | "Down" market |  |
|  | JxH | Weight | Construction | Loser | Winner | Loser | Winner | Loser | Winner | Loser | Winner | Loser | Winner | Loser | Winner |
| AUSTRA | 9x3 | MW | BHAR(0) | 178 | 176 | 140 | 198 | 330 | 88 | 178 | 178 | 177 | 177 | 184 | 184 |
| AUSTRIP | $12 \times 3$ | IVOL | CAR(0) | 16 | 16 | 10 | 20 | 29 | 5 | 15 | 15 | 15 | 15 | 14 | 14 |
| BELGIUN | 12x3 | IVOL | CAR(1) | 22 | 24 | 16 | 28 | 41 | 12 | 24 | 24 | 24 | 24 | 26 | 26 |
| CANADA | $9 \times 3$ | MW | BHAR(0) | 185 | 190 | 160 | 202 | 439 | 67 | 188 | 188 | 188 | 188 | 191 | 191 |
| DENMAF | $9 \times 3$ | IVOL | BHAR(1) | 32 | 33 | 21 | 40 | 67 | 10 | 31 | 31 | 31 | 31 | 31 | 31 |
| FINLANI | 12x6 | MW | BHAR(0) | 20 | 19 | 13 | 23 | 35 | 7 | 17 | 17 | 17 | 17 | 17 | 17 |
| FRANCE | $9 \times 3$ | IVOL | CAR(1) | 127 | 134 | 83 | 156 | 277 | 59 | 131 | 131 | 128 | 128 | 139 | 139 |
| GERMAN | $12 \times 3$ | IVOL | CAR(0) | 105 | 106 | 61 | 127 | 239 | 40 | 104 | 104 | 100 | 100 | 117 | 117 |
| GREECE | $3 \times 12$ | MW | BHAR(1) | 46 | 33 | 33 | 44 | 62 | 17 | 37 | 37 | 37 | 37 | 38 | 38 |
| HONGKC | 6x3 | MW | BHAR(0) | 120 | 115 | 82 | 130 | 282 | 50 | 118 | 118 | 116 | 116 | 126 | 126 |
| IRELANI | $6 \times 12$ | MW | BHAR(0) | 6 | 13 | 5 | 14 | 10 | 10 | 9 | 9 | 9 | 9 | 9 | 9 |
| ISRAEL | $9 \times 12$ | MW | BHAR(0) | 72 | 84 | 49 | 99 | 155 | 30 | 76 | 76 | 74 | 74 | 84 | 84 |
| ITALY | 12x6 | MW | BHAR(0) | 37 | 35 | 19 | 46 | 75 | 12 | 37 | 37 | 36 | 36 | 39 | 39 |
| JAPAN | $3 \times 12$ | MW | BHAR(0) | 290 | 410 | 175 | 515 | 448 | 266 | 350 | 350 | 350 | 350 | 349 | 349 |
| NETHERI | $9 \times 3$ | EW | BHAR(1) | 25 | 28 | 17 | 33 | 54 | 6 | 25 | 25 | 26 | 26 | 23 | 23 |
| NEWZEA | $12 \times 3$ | IVOL | BHAR(0) | 17 | 18 | 15 | 19 | 46 | 6 | 17 | 17 | 17 | 17 | 20 | 20 |
| NORWA! | $9 \times 3$ | IVOL | BHAR(0) | 27 | 26 | 16 | 32 | 64 | 6 | 25 | 25 | 25 | 25 | 27 | 27 |
| PORTUG | 6x6 | MW | BHAR(1) | 16 | 16 | 13 | 19 | 22 | 7 | 14 | 14 | 15 | 15 | 13 | 13 |
| SINGAPC | $9 \times 3$ | IVOL | BHAR(0) | 63 | 59 | 39 | 74 | 132 | 13 | 59 | 59 | 59 | 59 | 57 | 57 |
| SPAIN | 12x6 | EW | BHAR(0) | 25 | 27 | 18 | 34 | 38 | 11 | 23 | 23 | 22 | 22 | 23 | 23 |
| SWEDEN | 12x3 | IVOL | BHAR(1) | 47 | 48 | 28 | 57 | 111 | 16 | 46 | 46 | 43 | 43 | 53 | 53 |
| SWITZER | 12x3 | EW | CAR(0) | 34 | 39 | 18 | 48 | 88 | 7 | 37 | 37 | 36 | 36 | 39 | 39 |
| UK | 12x3 | IVOL | CAR(0) | 243 | 242 | 185 | 270 | 570 | 83 | 242 | 242 | 240 | 240 | 250 | 250 |
| US | $9 \times 3$ | MW | CAR(1) | 666 | 673 | 576 | 708 | 1446 | 363 | 669 | 669 | 668 | 668 | 674 | 674 |

### 6.4.2. Market conditions based on contemporaneous market index

In order to examine how the optimal implementation of the two momentum strategies perform under different financial conditions, Chart 6.1 plots the annualised returns of timeseries (TSM) and cross-sectional (CSM) momentum strategies from 1992 to $2012 .{ }^{30}$ The light-grey shade indicates that the years when the annualised market index is non-positive.

During the subprime crisis (i.e. 2007-2009), the two momentum strategies performed poorly and yielded negative returns in most of the developed markets during 2009 with the exception being Ireland and Sweden. The cross-sectional momentum strategy produces losses in excess

[^23]of $50 \%$ in ten out of the 24 markets during 2009, with these losses being greatest in Australia, Canada and Singapore. Time-series momentum strategy produces comparatively better outcomes in most markets during 2009 with the exception being Singapore. It is also noteworthy that in the year after the Asian financial crisis (i.e. 1997 - 1998), that both momentum strategies perform poorly in the Asian markets (Hong Kong, Singapore and Japan). Daniel and Moskowitz (2013) find that poor momentum patterns are predictable with momentum strategies typically realising poor performance at market "turning points" following large market declines. This study finds evidence to support this proposition as there are many instances under both momentum strategies where extreme losses are suffered during periods when markets turn up after market corrections.

## Chart 6.1. Annual returns of time-series and cross-sectional momentum strategies

Based on the optimal implementation for each market in Table 5.11, this chart shows the annualised time-series (TSM) and cross-sectional (CSM) momentum returns from 1992 to 2012. The light-grey shade in chart indicates the contemporaneous annualized market index is non-positive.






### 6.5. Conclusion

The superiority of the time-series momentum strategy over the cross-sectional momentum strategy is evident in all markets and this superiority is statistically significant in 13 of the 24 markets. The focus of this chapter is on investigating the reasons for why time-series momentum strategy has proven to be the superior strategy.

The major difference between the two approaches is in the way that they choose stocks to be included in the winner and loser portfolios. Time-series momentum strategy choses more winning stocks when markets are strong and less losing stocks when markets are weak. It results in the time-series momentum strategy choosing stocks that are smaller and which enjoy a wider spread in their past returns than is the case for the cross-sectional momentum strategy. Moreover, it leads to the time-series momentum stocks outperforming the crosssectional momentum stocks.

The findings suggest that this outperformance is largely restricted to periods when markets are performing poorly which are periods when the cross-sectional momentum strategy is likely to select stocks to be included in the winner portfolios which have performed quite poorly during the formation periods. Consistent with Daniel and Moskowitz (2013), we find that both momentum strategies perform poorly in periods when markets turn up after experiencing a large decline.

## Chapter 7 - Time-series and cross-sectional momentum strategies after transaction costs

### 7.1. Introduction

Chapters 5 and 6 compare returns of the time-series and cross-sectional momentum strategies under numerous implementation approaches across 24 markets without accounting for the transaction costs. Based on investing $32 \%$ stocks in the market, our findings suggest that the time-series momentum strategy under $94 \%$ implementations and the cross-sectional momentum strategy under $88 \%$ implementations produce positive outcomes. The time-series momentum strategy outperforms the cross-sectional momentum strategy under optimal implementations across the 24 markets with the outperformance being significant in 13 markets. In order to examine whether the apparent profitability of these strategies is both indicative of market inefficiency and is exploitable by investors, in this chapter we will repeat some of the previous analysis but on an after-transaction costs basis.

The remainder of this chapter is organised as follows. Section 7.2 discusses prior literature on the impact of transaction costs on the performance of the momentum strategies. Section 7.3 considers alternative means for measuring transaction costs. Sections 7.4 and 7.5 present the after-transaction costs returns for the time-series and cross-sectional momentum strategies under the same implementation approaches which were first discussed in Chapter 4. Section 7.6 compares the performances of the two momentum strategies under optimal implementation approaches. In Section 7.7 we examine the performance the two momentum strategies under different market conditions. Section 7.8 compares the two strategies after considering short-sale constrains. Conclusions are drawn in Section 7.9.

### 7.2. The viability of momentum strategies

Although the momentum anomaly has been discussed and investigated over the last two decades, the literature still has not reached consensus on whether the momentum strategies are profitable. A study by Jegadeesh and Titman (1993) based on work undertaken by Berkowitz et al. (1988) assume a cost of $0.5 \%$ per trade when calculating the after-transaction costs returns in their examination of cross-sectional momentum strategy. They conclude that their momentum trading strategy still yields around $9 \%$ per annum in the US market after accounting for transaction costs.

Lesmond et al. (2004), however, argue that the after transaction costs returns reported in the literature fail to consider several issues relating to the calculation of transaction costs. First, Lesmond et al. (2004) argue that it is inappropriate to assume a single transaction cost for all stocks because these costs exhibit substantial cross-sectional variation (Keim \& Madhavan, 1997). Second, they argue that the cost estimated over one period is unable to capture the time-series variations in trading costs over another period (Lesmond et al., 1999). Third, they point out that most measurements of transaction costs from the extant literature, such as the use of bid-ask spread plus commissions, fail to account for other costs faced by investors, such as price impact costs, taxes, short-sale costs and immediacy costs.

In order to overcome these deficiencies, Lesmond et al. (1999) propose a model (LOT) which indirectly calculates investors' transaction costs, and claim that these estimates have an accuracy of more than $85 \%$ when measuring the overall costs from the buyer's side. ${ }^{31}$ They find that the profitability of the cross-sectional momentum strategy disappears once the

[^24]transaction costs are included. Thus Lesmond et al. (2004) argue that there is no reason to resort to risks or other explanations in order to explain the momentum anomaly.

Starting with Jegadeesh and Titman (1993), the momentum profit has been calculated as the aggregate of a long portfolio of winners and a short portfolio of losers. However, market regulations restrict the investors from shorting some or all of the losing stocks in the short portfolio. Alexander (2000) and Lesmond et al. (2004) argue that momentum studies are biased toward rejecting the EMH as much of the strategy might not be implementable. The importance of this becomes apparent when one realises that the majority of the profits are attributed to the poor performance of the loser portfolios (Ali \& Trombley, 2006). This suggests that the profitability of the momentum strategy highlighted in numerous studies may well be illusory and so momentum may not provide the challenge to the EMH that many would have us believe.

In contrast, Li et al. (2009) argue that the solo use of a six-month holding period in the study of Lesmond et al. (2004) may not provide a full picture of the profitability of the crosssectional momentum strategy. They show that the transaction costs are reduced by extending the holding period, for example when using a 12-month holding period instead of a six-month period, and that the momentum strategy remains profitable after using a longer holding period. Moreover, Li et al. (2008) point out that the profitability of momentum strategies is sensitive to alternative implementation approaches used, such as buy-and-hold vs. monthlyrebalancing. In addition, the short-sale restriction does not necessarily prevent a continuation of momentum profits. Griffin et al. (2005) show that momentum traders can still be profitable when they only take long positions of the winner portfolios across 40 countries when ignoring transaction costs. Fong et al. (2005) investigate the momentum strategy in 24
countries and point out that only buying stocks in the winner portfolio generates significant abnormal returns after accounting for transaction costs.

To date, the debate about the viability of momentum strategies in the literature has focused on two questions: (i) whether the momentum strategies remain profitable after applying appropriate transaction cost measurement and implementation approaches, and (ii) whether the momentum strategies remain profitable when only buying stocks in the winner portfolio if short-selling is either not allowed or severely restricted in the market. Therefore, this chapter re-examines the time-series and cross-sectional momentum strategies using numerous implementations and compares the performances of the two momentum strategies when the transaction costs and short-sale constraints are taken into account.

### 7.3. Stock transaction costs measurement

### 7.3.1. Assumptions of LOT model

Since the LOT Y-split model is the amended version of Lesmond et al. (1999) (LOT) model, this section starts with discussing the LOT model. According to Lesmond et al. (1999, 2004), the LOT model indirectly infers the transaction costs based on investors' behaviour. This model assumes that investors rationally assess the (potential) transaction costs which they will face from their investments, such as the bid-ask spread, applicable commissions, price impact costs, taxes, short-sale costs and immediacy costs, before making trading decisions. Investors rationally start trading if the value of investment after transaction costs is profitable. The LOT model infers monthly transaction costs for each stock through the incidence of zero daily returns over a given period, such as over the last one calendar year used in their study. The basic hypothesis of the LOT model is that a zero return, on average, is observed if the transaction costs threshold is not exceeded. In other words, zero-return is observed if
investors do not trade because the trading is not profitable after accounting for the transaction costs.

This implies that zero returns result from the effects of costs on marginal traders, who may be informed or uninformed. For informed traders, if the value of the public-plus-private information is insufficient to exceed the costs of trading, then these marginal investors will either reduce their desired trades or even refrain from trading. Under these circumstances, there will be no price movement from the previous day. For most liquidity traders, if the need for liquidity is sufficiently low and the transaction costs sufficiently high, again they will not trade, which again leads to a zero return. However, some liquidity traders may trade regardless of transaction costs and the resulting returns may be non-zero. The LOT model assumes that the value of their trades is idiosyncratic and over time the average returns resulting from their trades will be zero.

### 7.3.2. Calculations of the LOT model

This measurement is based on the limited dependent variable (LDV) model to estimate the frequency of zero returns in order to infer the transaction costs of buying $\alpha_{2}$ and selling $\alpha_{1}$. In the presence of transaction costs, the marginal informed traders will trade only if the value of information exceeds trading costs.

Lesmond et al. (1999) estimate true return $R_{j t}^{*}$ on the basis of the standard market model. ${ }^{32}$ Let $R_{j t}^{*}$ be the true returns such that,

$$
\begin{equation*}
R_{j t}^{*}=\beta_{j} R_{m t}+\varepsilon_{j t} \tag{1}
\end{equation*}
$$

[^25]where $\beta_{j}$ is the sensitivity of stock j to the market return $R_{m t}$ on day t , and the error term $\varepsilon_{j t}$ indicates a public information shock on day t . This model assumes that $\varepsilon_{j t}$ is normally distributed with a mean zero and variance $\sigma_{j}^{2}$.

Let $R_{j t}$ be measured returns from daily prices on stocks, where j denotes the stock j and t is the trading day. The measured daily return will be non-zero only if the true stock returns from market model exceed the transaction costs.

The relationship between the measured return $R_{j t}$ and true return $R_{j t}^{*}$ can be shown as

$$
\begin{align*}
& R_{j t}=R_{j t}^{*}-\alpha_{1 j} \text { if } R_{j t}^{*}<\alpha_{1 j}  \tag{1}\\
& R_{j t}=0 \text { if } \alpha_{1 j}<R_{j t}^{*}<\alpha_{2 j}  \tag{0}\\
& R_{j t}=R_{j t}^{*}-\alpha_{2 j} \text { if } R_{j t}^{*}>\alpha_{2 j} \tag{2}
\end{align*}
$$

where $\alpha_{1 j}$ is the threshold level below which the marginal investors will want to sell if given negative information about stock j . Similarly, $\alpha_{2 j}$ is the threshold above which the marginal investors will want to buy given positive information about stock j . If the true return is not low enough or high enough to exceed two thresholds levels, the investors will decide not to trade, which causes a zero return. The two threshold levels measure the percentage transaction costs of selling stock j and buying stock j , respectively. Therefore, the proportional round-trip transaction cost of stock j at time t for a competitive marginal investor is the difference between the percentage buying and selling costs,

$$
\begin{equation*}
\operatorname{cosT}_{j}=\alpha_{2 j}-\alpha_{1 j} \tag{2}
\end{equation*}
$$

To determine two threshold levels, $\alpha_{1 j}$ and $\alpha_{2 j}$, Lesmond et al. (1999) develop the following maximum likelihood function to estimate the four parameters $\alpha_{1 j}, \alpha_{2 j}, \beta_{j}, \sigma_{j}$ of the LOT model:

$$
\begin{aligned}
\mathrm{L}\left(\alpha_{1 j}, \alpha_{2 j}, \beta_{j},\right. & \left.\sigma_{j} \mid R_{j t}, R_{m t}\right) \\
& =\prod_{1} \frac{1}{\sigma_{j}} n\left[\frac{R_{j t}+\alpha_{1 j}-\beta_{j} R_{m t}}{\sigma_{j}}\right] \\
& \times \prod_{0}\left[N\left(\frac{\alpha_{2 j}-\beta_{j} R_{m t}}{\sigma_{j}}\right)-N\left(\frac{\alpha_{1 j}-\beta_{j} R_{m t}}{\sigma_{j}}\right)\right] \\
& \times \prod_{2} \frac{1}{\sigma_{j}} n\left[\frac{R_{j t}+\alpha_{2 j}-\beta_{j} R_{m t}}{\sigma_{j}}\right]
\end{aligned}
$$

## S.T. $\alpha_{1 j} \leq 0, \alpha_{2 j} \geq 0, \beta_{j} \geq 0, \sigma_{j} \geq 0$

where $\mathrm{N}($.$) is the cumulative normal distribution and \mathrm{n}($.$) is the normal distribution.$

By giving the relationship between measured return $R_{j t}$ and true return $R_{j t}^{*}$, the LOT model is using an optimisation method to find the maximum measured return $R_{j t}$ (return after transaction costs) by estimating four parameters $\alpha_{1 j}, \alpha_{2 j}, \beta_{j}, \sigma_{j}$. The critical parameters that we are interested in are $\alpha_{1 j}$ and $\alpha_{2 j}$, which are potential transaction costs for selling and buying, respectively. ${ }^{33}$

[^26]
### 7.3.3. LOT - Y split model

Goyenko et al. (2009) point out that the definitions of the three regions in the LOT model influence the quality of the estimates. By matching the information of effective and realised spread, and price impact, they show that assigning daily returns into three regions based on stock return itself $\left(R_{j t}\right)$ rather than combining with market return $\left(R_{m t}\right)$ will be more accurate for measuring the transaction costs. That is, the returns on the day will be in the region of zero when $R_{j t}=0$, returns on the day will be in the region of one when $R_{j t}>0$, and returns on the day will be in the region of 2 when $R_{j t}<0$, and therefore, the model is named as the LOT Y-split model.

This study estimates the transaction costs of individual stock following the method employed in Goyenko et al. (2009) and seeks to find whether the two momentum strategies are still profitable across 24 developed markets over last two decades. To my best knowledge, this is the first study to test the two momentum profits after including the transaction costs by using the LOT Y-split measurement model.

### 7.4. The profitability of time-series momentum strategies

Table 7.1 in Appendix 3 reports the average monthly time-series momentum returns after accounting for the transaction costs for each of the implementations as set out in Table 4.1. The specific time-series momentum strategy is to form a long portfolio consisting of the identified winning stocks and a short portfolio consisting of the identified losing stocks with the monthly returns reported being the difference between the monthly before-transaction costs returns for the winner and loser portfolios. The results all relate to an implementation in which the cut-offs for selecting the stocks to be included in the cross-sectional momentum portfolios were set at $16 \%$.

The after-transaction cost returns for the time-series momentum strategy is then calculated by subtracting the aggregate transaction costs of the winner and loser portfolios from the momentum before-cost (raw) returns reported in Table 5.1. We estimate the transaction costs based on actual turnover, which assumes that investors only close out the positions if stocks no longer remain in the same winner (or loser) portfolio in the subsequent period. ${ }^{34}$

Panels A, B and C of Table 7.1 present the monthly after-transaction cost (net) return of timeseries momentum strategies when the portfolio weights are based on EW, MW and IVOL, respectively.

### 7.4.1. Profitability of time-series momentum strategies

Table 7.2 provides a summary of the number of time-series momentum strategies from the 192 implementations that yield positive and negative (net) returns after the transaction costs. Based on the pooled sample for the 24 markets, we find that with the introduction of transaction costs that the number of profitable implementations falls from $94 \%$ to $66 \%$ with those being significant falling to $27 \%$ from $61 \%$. The time-series momentum strategy produces a good investment outcome in some markets with there being no instance of an implementation that yields a significant negative net return in Austria, Belgium, Finland, Italy, Netherlands and New Zealand. More than half of the implementations still yield significant positive net returns in Belgium, Denmark, Italy, the Netherlands, New Zealand, Switzerland and the UK, whereas a smaller number of implementations show significant profitability in the remaining markets.

Chart 7.1 shows the average monthly before-cost (raw) returns and net returns of the timeseries momentum strategies across the 192 implementations analysed for each market. After

[^27]accounting for the transaction costs, the average monthly net returns across the 24 markets drop $74 \%$ to $0.24 \%$ per month from $0.91 \%$. The pooled average monthly transaction cost is around $0.68 \%$ per month with it being highest in Canada ( $1.18 \%$ per month), Australia ( $1.14 \%$ per month) and Hong Kong (1.10\% per month). The time-series momentum strategy produces more than $0.5 \%$ per month in after-cost returns in nine markets, with the highest being $0.85 \%$ per month in Italy. We see that the time-series momentum strategy is generally not profitable in nine markets, Australia, France, Greece, Hong Kong, Israel, Japan, Portugal, Spain and the US after taking the transaction costs into account.

## Table 7.2. Numbers of implementations yield positive/negative time-series momentum returns after transaction costs

This table reports the numbers of implementations that yield positive and negative average monthly returns after the transaction cost time-series momentum returns for each market. The SIGNIFICANT column indicates the aggregate numbers of implementations that generate average monthly returns at the $1 \%, 5 \%$, or $10 \%$ significant levels, whereas the NON-SIGNIFICANT column indicates the numbers of strategies that produce average monthly returns over $10 \%$ significance level.

|  |  | POSITIVE |  |  |  | NEGATIVE |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | IMPLEMENTATION APPROACHES | SIGNIFICANT | PERCENTAGE | NON SIGNIFICANT | PERCENTAGE | SIGNIFICANT | PERCENTAGE | NON SIGNIFICANT | PERCENTAGE |
| AUSTRALIA | 192 | 23 | 12\% | 44 | 23\% | 73 | 38\% | 52 | 27\% |
| AUSTRIA | 192 | 53 | 28\% | 120 | 63\% | 0 | 0\% | 19 | 10\% |
| BELGIUM | 192 | 111 | 58\% | 71 | 37\% | 0 | 0\% | 10 | 5\% |
| CANADA | 192 | 36 | 19\% | 81 | 42\% | 16 | 8\% | 59 | 31\% |
| DENMARK | 192 | 127 | 66\% | 53 | 28\% | 1 | 1\% | 11 | 6\% |
| FINLAND | 192 | 39 | 20\% | 126 | 66\% | 0 | 0\% | 27 | 14\% |
| FRANCE | 192 | 32 | 17\% | 74 | 39\% | 24 | 13\% | 62 | 32\% |
| GERMANY | 192 | 45 | 23\% | 117 | 61\% | 6 | 3\% | 24 | 13\% |
| GREECE | 192 | 4 | 2\% | 43 | 22\% | 4 | 2\% | 141 | 73\% |
| HONGKONG | 192 | 0 | 0\% | 45 | 23\% | 51 | 27\% | 96 | 50\% |
| IRELAND | 192 | 6 | 3\% | 121 | 63\% | 17 | 9\% | 48 | 25\% |
| ISRAEL | 192 | 5 | 3\% | 53 | 28\% | 80 | 42\% | 54 | 28\% |
| ITALY | 192 | 139 | 72\% | 45 | 23\% | 0 | 0\% | 8 | 4\% |
| JAPAN | 192 | 2 | 1\% | 47 | 24\% | 30 | 16\% | 113 | 59\% |
| NETHERLANDS | 192 | 121 | 63\% | 62 | 32\% | 0 | 0\% | 9 | 5\% |
| NEWZEALAND | 192 | 127 | 66\% | 54 | 28\% | 0 | 0\% | 11 | 6\% |
| NORWAY | 192 | 4 | 2\% | 116 | 60\% | 9 | 5\% | 63 | 33\% |
| PORTUGAL | 192 | 4 | 2\% | 74 | 39\% | 12 | 6\% | 102 | 53\% |
| SINGAPORE | 192 | 9 | 5\% | 125 | 65\% | 1 | 1\% | 57 | 30\% |
| SPAIN | 192 | 5 | $3 \%$ | 90 | 47\% | 30 | 16\% | 67 | 35\% |
| SWEDEN | 192 | 73 | 38\% | 101 | 53\% | 3 | 2\% | 15 | 8\% |
| SWITZERLAND | 192 | 122 | 64\% | 55 | 29\% | 2 | 1\% | 13 | 7\% |
| UK | 192 | 146 | 76\% | 38 | 20\% | 2 | 1\% | 6 | $3 \%$ |
| US | 192 | 0 | 0\% | 44 | 23\% | 33 | 17\% | 115 | 60\% |
| POOLED SAMPLE | 192 | 51 | 27\% | 75 | 39\% | 16 | 9\% | 49 | 26\% |

Chart 7.1.Average time-series momentum returns across implementations for each market
This chart reports the pooled average monthly before/after transaction cost returns for 192 time-series momentum strategies for each market. The dashed line shows the average monthly returns across the 24 developed markets.


### 7.4.2. The weighting method

Within each market, Table 7.3 reports the average monthly raw and net returns of the timeseries momentum strategies across the 24 markets using equal weights (EW), market weights (MW) and inverse volatility weights (IVOL), respectively. The pooled average net gain of the time-series momentum strategies across the 24 markets are reduced by the transaction costs, to $0.13 \%$ per month from $0.71 \%$ using EW, to $0.32 \%$ per month from $0.64 \%$ using MW and to $0.26 \%$ per month from $0.68 \%$ using IVOL. The costs of the three weighting schemes in the majority of markets are below $1 \%$ per month, with the exceptions in Australia at 1.15\% per month, Canada at $1.2 \%$ per month and Hong Kong at $1.1 \%$ per month. The time-series
momentum strategy incurs a loss in ten, three and eight of the 24 markets when using EW, MW and IVOL, respectively.

Compared with investment outcomes based on raw returns, investment outcomes on the basis of highest average monthly net returns remain largely unchanged across each of the three weighting schemes with exceptions being in Austria and Netherland. Time-series momentum strategies with MW sill produce the best investment results after accounting for the transaction costs. It is MW that yields the highest profits in Australia, Canada, Hong Kong, Ireland, Israel, Japan, Portugal and the US. Although some weighting schemes yield positive profits in Hong Kong, Japan, Norway, Portugal, Singapore and the US, those gains are all relatively small, below $0.1 \%$ per month. Finally, all three methods produce negative average profits in Greece.

## Table 7.3. Time-series momentum profit based on three weights

This table reports the pooled average monthly after transaction cost time-series momentum returns using equal weight (EW), market weight (MW) and inversed volatility weight (IVOL) for each market. T-statistics are reported in italic. The raw return column reports the time-series momentum before transaction costs from Table 5.3. The net return column reports the time-series momentum before transaction costs. The highest return is highlighted in green and the lowest return is marked in red.

|  | Raw returns |  |  |  |  |  | Net returns |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | EW |  | MW |  | IVOL |  | EW |  | MW |  | IVOL |  |
| AUSTRALIA | 0.27\% | 6.9961 | 1.53\% | 22.1688 | 0.78\% | 16.5708 | -0.90\% | -18.0191 | 0.41\% | 7.1437 | -0.36\% | -6.2765 |
| AUSTRIA | 1.05\% | 27.6351 | 0.74\% | 14.3792 | 1.05\% | 31.2568 | 0.58\% | 17.9456 | 0.30\% | 5.8163 | 0.59\% | 17.3029 |
| BELGIUM | 1.13\% | 34.6241 | 0.95\% | 20.9260 | 1.10\% | 26.2520 | 0.71\% | 21.7033 | 0.57\% | 11.9328 | 0.70\% | 15.5559 |
| CANADA | 0.95\% | 22.3287 | 1.88\% | 27.8333 | 1.29\% | 24.3764 | -0.35\% | -5.6476 | 0.83\% | 11.8354 | 0.10\% | 1.8149 |
| DENMARK | 1.44\% | 42.2548 | 1.28\% | 29.7733 | 1.38\% | 37.7092 | 0.77\% | 17.6884 | 0.70\% | 15.1891 | 0.74\% | 15.4999 |
| FINLAND | 0.94\% | 19.6530 | 1.55\% | 23.7333 | 1.01\% | 21.7778 | 0.32\% | 6.4403 | 1.00\% | 12.5262 | 0.42\% | 8.5733 |
| FRANCE | 0.76\% | 22.3039 | 0.23\% | 7.3412 | 0.81\% | 20.2468 | 0.10\% | 1.9028 | -0.38\% | -6.3077 | 0.17\% | 3.1044 |
| GERMANY | 1.09\% | 33.8434 | 1.31\% | 29.6823 | 1.26\% | 35.7024 | 0.19\% | 4.6121 | 0.48\% | 9.1781 | 0.42\% | 8.6304 |
| GREECE | 0.36\% | 4.7452 | 0.37\% | 5.2758 | 0.46\% | 5.8896 | -0.36\% | -5.1516 | -0.32\% | -3.8910 | -0.23\% | -3.2715 |
| HONGKONG | 0.33\% | 7.1432 | 1.07\% | 18.9594 | 0.54\% | 10.6977 | -0.84\% | -13.7584 | 0.06\% | 1.0690 | -0.58\% | -10.2857 |
| IRELAND | 0.56\% | 7.3645 | 1.07\% | 10.4331 | 0.64\% | 8.3217 | -0.09\% | -1.0184 | 0.45\% | 4.2387 | 0.00\% | 0.0265 |
| ISRAEL | 0.08\% | 1.8824 | 1.06\% | 13.6355 | 0.17\% | 3.3812 | -0.76\% | -10.6143 | 0.26\% | 2.8421 | -0.65\% | -9.6330 |
| ITALY | 1.35\% | 27.2860 | 1.27\% | 20.3594 | 1.25\% | 27.2933 | 0.94\% | 19.1266 | 0.89\% | 13.4450 | 0.87\% | 19.0354 |
| JAPAN | 0.23\% | 12.7582 | 0.48\% | 21.0948 | 0.26\% | 15.8305 | -0.32\% | -8.7427 | 0.03\% | 0.8400 | -0.26\% | -8.1519 |
| NETHERLANDS | 1.63\% | 42.3633 | 0.97\% | 19.2116 | 1.58\% | 34.3010 | 1.02\% | 28.0566 | 0.43\% | 8.2804 | 1.03\% | 22.6014 |
| NEWZEALAND | 1.28\% | 22.2580 | 1.30\% | 16.1999 | 1.54\% | 23.4382 | 0.73\% | 13.3591 | 0.75\% | 10.9314 | 0.99\% | 18.0265 |
| NORWAY | 0.83\% | 16.4406 | 0.79\% | 17.8877 | 0.89\% | 18.3339 | 0.00\% | 0.0580 | 0.08\% | 1.2178 | 0.11\% | 2.2544 |
| PORTUGAL | 0.24\% | 4.2879 | 0.63\% | 8.6450 | 0.48\% | 7.9924 | -0.33\% | -4.4417 | 0.10\% | 1.2145 | -0.08\% | -1.1561 |
| SINGAPORE | 0.83\% | 20.5356 | 0.86\% | 17.0309 | 1.09\% | 27.2685 | 0.00\% | -0.0331 | 0.12\% | 1.9532 | 0.29\% | 5.6727 |
| SPAIN | 0.48\% | 12.5638 | -0.03\% | -0.4602 | 0.38\% | 9.3087 | 0.02\% | 0.4295 | -0.46\% | -6.2491 | -0.05\% | -0.8456 |
| SWEDEN | 1.53\% | 25.2874 | 1.30\% | 23.1607 | 1.67\% | 26.8186 | 0.56\% | 9.2177 | 0.55\% | 8.8760 | 0.79\% | 11.9081 |
| SWITZERLAND | 1.24\% | 28.2021 | 0.79\% | 18.2514 | 1.10\% | 27.4184 | 0.75\% | 18.7330 | 0.35\% | 7.4548 | 0.63\% | 15.3612 |
| UK | 1.38\% | 37.5991 | 1.07\% | 26.3088 | 1.51\% | 39.1080 | 0.77\% | 26.2999 | 0.48\% | 8.0770 | 0.93\% | 27.5502 |
| US | 0.29\% | 9.8281 | 0.51\% | 20.5771 | 0.33\% | 14.9429 | -0.38\% | -11.7275 | 0.01\% | 0.1407 | -0.27\% | -7.6495 |
| POOLED SAMPLE | 0.84\% | 8.7100 | 0.96\% | 10.4588 | 0.94\% | 10.1932 | 0.13\% | 1.1064 | 0.32\% | 4.0254 | 0.26\% | 2.5218 |

### 7.4.3. The formation (J) and holding period (H)

Li et al. (2009) point out that the cost of the momentum strategy could be reduced when using alternative implementation approaches, such as an extended holding period. Table 7.4 reports the pooled average monthly net returns across 16 time-series momentum strategies when the formation period $\mathrm{J}(\mathrm{J}=$ three, six, nine and 12 months $)$ and the holding period $\mathrm{H}(\mathrm{H}=$ three, six, nine and 12 months) are calculated for each market.

Before accounting for the transaction costs, this study finds that the time-series momentum strategy that tends to yield the highest returns infers a momentum investment cycle (i.e. sum of formation and holding periods) of between 12 and 15 months. After considering the trading costs, the findings would appear to confirm that in most markets the high returns from implementations using a short holding period are heavily diluted by high transaction costs. Therefore, it appears that except in Sweden, the highest net return for each market increase to an aggregate of between 15 and 18 months for the combination of the formation and holding periods. Compared with the before-transaction costs performance of the time-series momentum strategy, the formation period remains unchanged in 13 markets, whereas the best holding period of the time-series momentum portfolios extend by three months in half of our sample.

## Table 7.4. Time-series momentum profitability based on formation (J) and holding (H) period

This table reports the pooled average monthly after-transaction cost time-series momentum returns based on the formation J ( $\mathrm{J}=$ three, six, nine and 12 months) and the holding $\mathrm{H}(\mathrm{H}=$ three, six, nine and 12 months) for each market. T -statistics is reported in italics. The highest return is highlighted in green and the lowest return is highlighted in red.


| ITALY | H = 3 | H = 6 | H = 9 | $\mathrm{H}=12$ | JAPAN | $\mathrm{H}=3$ | H = 6 | $\mathrm{H}=9$ | $\mathrm{H}=12$ | NETHERLANDS | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{J}=3$ | 0.20\% | 0.25\% | 0.76\% | 0.62\% | $\mathrm{J}=3$ | -0.78\% | -0.33\% | -0.11\% | 0.16\% | $\mathrm{J}=3$ | 0.44\% | 0.63\% | 0.51\% | 1.06\% |
|  | 2.6325 | 1.9137 | 11.2385 | 7.7001 |  | -11.6133 | -7.1695 | -2.5064 | 1.6538 |  | 10.1233 | 6.8155 | 4.3182 | 13.2773 |
| $\mathrm{J}=6$ | 0.70\% | 0.90\% | 0.94\% | 0.55\% | $\mathrm{J}=6$ | -0.60\% | -0.21\% | -0.01\% | 0.14\% | $\mathrm{J}=6$ | 0.39\% | 0.74\% | 0.87\% | 1.20\% |
|  | 12.8644 | 12.4577 | 13.9034 | 5.0403 |  | -8.4494 | -2.7362 | -0.2582 | 1.9302 |  | 2.9300 | 6.7626 | 8.8355 | 7.6141 |
| $\mathrm{J}=9$ | 1.02\% | 1.22\% | 1.24\% | 0.99\% | $\mathrm{J}=9$ | -0.47\% | -0.03\% | -0.03\% | -0.04\% | $\mathrm{J}=9$ | 0.95\% | 1.22\% | 0.94\% | 1.04\% |
|  | 18.4005 | 14.8222 | 27.7202 | 17.0267 |  | -10.1853 | -0.6312 | -1.0378 | -0.7632 |  | 7.3076 | 9.0729 | 8.0153 | 11.0450 |
| $\mathrm{J}=12$ | 1.23\% | 1.45\% | 1.18\% | 1.14\% | $\mathrm{J}=12$ | -0.30\% | -0.10\% | -0.12\% | -0.14\% | $\mathrm{J}=12$ | 0.71\% | 1.11\% | 0.83\% | 0.63\% |
|  | 27.0716 | 18.5373 | 21.1748 | 11.8280 |  | -7.8669 | $-1.7486$ | -2.3297 | $-2.4175$ |  | 6.5994 | 10.3563 | 7.9222 | 4.3626 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NEWZEALAND | H=3 | H = 6 | $\mathrm{H}=9$ | $\mathrm{H}=12$ | NORWAY | H = 3 | H = 6 | H = 9 | $\mathrm{H}=12$ | PORTUGAL | H=3 | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | 0.28\% | 0.46\% | 0.46\% | 0.13\% | $\mathrm{J}=3$ | -0.98\% | 0.17\% | 0.12\% | 0.17\% | $\mathrm{J}=3$ | -1.04\% | 0.19\% | 0.41\% | 0.40\% |
|  | 2.3582 | 4.7224 | 6.4481 | 1.0815 |  | -19.0720 | 2.1690 | 1.0159 | 1.8396 |  | -6.9376 | 1.7571 | 3.0897 | 3.2354 |
| $\mathrm{J}=6$ | 1.03\% | 0.81\% | 0.68\% | 0.65\% | $\mathrm{J}=6$ | -0.39\% | 0.16\% | 0.15\% | 0.38\% | $\mathrm{J}=6$ | -0.25\% | 0.29\% | 0.56\% | 0.44\% |
|  | 10.0621 | 7.4170 | 6.1921 | 7.3920 |  | -4.7347 | 2.5038 | 1.5449 | 4.8833 |  | -1.5365 | 1.8868 | 3.8117 | 2.9464 |
| $\mathrm{J}=9$ | 1.03\% | 0.91\% | 1.10\% | 0.81\% | $\mathrm{J}=9$ | 0.05\% | 0.23\% | 0.18\% | 0.04\% | $\mathrm{J}=9$ | -0.86\% | -0.08\% | 0.07\% | 0.06\% |
|  | 12.4162 | 6.5803 | 26.1739 | 8.1427 |  | 0.3649 | 4.2369 | 4.8261 | 0.5215 |  | -7.3875 | -0.9828 | 0.6672 | 0.9613 |
| $\mathrm{J}=12$ | 1.52\% | 1.36\% | 1.08\% | 0.86\% | $\mathrm{J}=12$ | 0.05\% | 0.37\% | 0.16\% | 0.16\% | $\mathrm{J}=12$ | -0.73\% | -0.54\% | -0.22\% | -0.38\% |
|  | 16.5453 | 10.5506 | 13.2894 | 22.9332 |  | 0.5175 | 3.3480 | 2.1479 | 1.3816 |  | -6.8175 | -6.2534 | -3.4863 | -4.5529 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SINGAPORE | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | SPAIN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | SWEDEN | H = 3 | $\mathrm{H}=6$ | H =9 | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.74\% | 0.12\% | 0.48\% | -0.01\% | $\mathrm{J}=3$ | -0.96\% | -0.67\% | -0.04\% | 0.19\% | $\mathrm{J}=3$ | -0.76\% | 0.31\% | 0.37\% | 0.41\% |
|  | -11.5409 | 0.8924 | 11.6136 | -0.0916 |  | -17.3127 | -4.2119 | -0.6409 | 3.7103 |  | -11.4066 | 5.9584 | 6.7977 | 5.0969 |
| $\mathrm{J}=6$ | -0.27\% | 0.17\% | 0.47\% | 0.30\% | $\mathrm{J}=6$ | -0.97\% | -0.42\% | 0.12\% | -0.14\% | $\mathrm{J}=6$ | 0.38\% | 0.76\% | 0.70\% | 0.71\% |
|  | -3.9946 | 2.6242 | 6.2512 | 7.2862 |  | -9.9055 | -3.0033 | 1.1554 | -1.2166 |  | 6.3737 | 16.5188 | 8.3757 | 11.0686 |
| $\mathrm{J}=9$ | -0.13\% | 0.21\% | 0.30\% | 0.00\% | $\mathrm{J}=9$ | -0.60\% | -0.10\% | 0.31\% | 0.00\% | $\mathrm{J}=9$ | 0.81\% | 1.01\% | 0.91\% | 0.50\% |
|  | -1.3432 | 2.4933 | 3.6679 | -0.0231 |  | -3.3472 | -1.0183 | 3.9882 | 0.0191 |  | 11.1468 | 12.6877 | 16.9510 | 5.4547 |
| $\mathrm{J}=12$ | -0.02\% | 0.45\% | 0.52\% | 0.31\% | $\mathrm{J}=12$ | -0.06\% | 0.39\% | 0.17\% | 0.19\% | $\mathrm{J}=12$ | 0.93\% | 1.00\% | 1.04\% | 1.14\% |
|  | -0.4091 | 6.6782 | 6.2240 | 3.6366 |  | -0.5903 | 4.0581 | 2.3935 | 7.1071 |  | 7.6261 | 12.3651 | 14.4620 | 8.5938 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SWITZERLAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H =9 | $\mathrm{H}=12$ | UK | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | US | H = 3 | H = 6 | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.25\% | 0.46\% | 0.33\% | 0.78\% | $\mathrm{J}=3$ | -0.12\% | 0.59\% | 0.65\% | 0.77\% | $\mathrm{J}=3$ | -1.05\% | -0.16\% | -0.18\% | -0.04\% |
|  | -2.8121 | 8.9121 | 4.9206 | 8.9224 |  | -0.9514 | 8.7402 | 7.3254 | 20.2146 |  | -15.8985 | -2.3560 | -4.0567 | -0.9213 |
| $\mathrm{J}=6$ | 0.44\% | 0.86\% | 0.53\% | 0.75\% | $\mathrm{J}=6$ | 0.49\% | 0.75\% | 0.79\% | 0.87\% | $\mathrm{J}=6$ | -0.52\% | -0.17\% | -0.05\% | -0.05\% |
|  | 4.6352 | 11.7588 | 4.3487 | 9.4370 |  | 3.6942 | 8.3831 | 16.5416 | 22.4663 |  | -8.9181 | -2.9969 | -0.7224 | -0.8716 |
| $\mathrm{J}=9$ | 0.65\% | 0.93\% | 0.68\% | 0.52\% | $\mathrm{J}=9$ | 0.71\% | 1.07\% | 1.01\% | 0.81\% | $\mathrm{J}=9$ | -0.23\% | 0.03\% | -0.02\% | -0.12\% |
|  | 6.0603 | 11.1716 | 6.1589 | 11.5744 |  | 5.8151 | 17.8370 | 23.5126 | 18.0795 |  | -5.4627 | 0.6564 | -0.4034 | -1.8383 |
| $\mathrm{J}=12$ | 0.81\% | 0.73\% | 0.44\% | 0.53\% | $\mathrm{J}=12$ | 0.86\% | 0.94\% | 0.83\% | 0.59\% | $\mathrm{J}=12$ | -0.32\% | -0.17\% | -0.14\% | -0.24\% |
|  | 18.5009 | 19.1607 | 7.7742 | 9.7260 |  | 6.0939 | 10.5293 | 16.7760 | 9.0565 |  | -7.1853 | -2.7157 | -1.8194 | -2.7551 |

### 7.4.4. The rebalancing methods

Table 7.5 reports the pooled raw and net returns of the time-series momentum strategy under different implementation approaches according to four rebalancing methods: CAR (0), BHAR (0), CAR (1), and BHAR (1). The investment outcomes of highest average monthly net returns are unchanged across each of the four rebalancing methods. The average net return on the basis of pooled samples across the 24 markets reduces to $0.27 \%$ per month from $0.93 \%$ per month for CAR ( 0 ) and to $0.25 \%$ per month from $0.92 \%$ per month for CAR (1), and declines to $0.23 \%$ per month from $0.92 \%$ per month and to $0.20 \%$ per month from $0.89 \%$ per month for BHAR (0) and BHAR (1), respectively. The study finds only a few basis points difference between after-transaction costs returns across all four methods, however the implementation involving CAR (0) still produces the highest net return in the time-series momentum strategy.

## Table 7.5. Time-series momentum profit based on portfolio constructions

This table reports the pooled average monthly after transaction cost time-series momentum returns based on four rebalancing methods: monthly-rebalancing with zero gap (CAR (0)), monthly-rebalancing with 1-month gap (CAR (1)), buy-and-hold with zero gap (BHAR (0)), and buy-and-hold with 1-month gap (BHAR (1)). Tstatistics are reported in italics. The highest return is highlighted in green and the lowest return is marked in red.

|  | Raw return |  |  |  |  |  |  |  | Net return |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | CAR (0) |  | CAR (1) |  | BHAR (0) |  | BHAR (1) |  | CAR (0) |  | CAR (1) |  | BHAR (0) |  | BHAR (1) |  |
| AUSTRALIA | 0.96\% | 9.8928 | 0.92\% | 9.9801 | 0.83\% | 8.3174 | 0.73\% | 7.5825 | -0.15\% | -1.4153 | -0.20\% | -2.1353 | -0.29\% | -2.8326 | -0.48\% | -5.2320 |
| AUSTRIA | 0.98\% | 23.6070 | 0.96\% | 20.9950 | 0.96\% | 16.3530 | 0.90\% | 14.4926 | 0.53\% | 11.1067 | 0.52\% | 12.6301 | 0.49\% | 8.3018 | 0.43\% | 8.2307 |
| BELGIUM | 1.13\% | 32.5487 | 1.13\% | 29.1885 | 0.99\% | 16.7125 | 1.00\% | 19.3390 | 0.73\% | 18.5876 | 0.74\% | 21.8512 | 0.58\% | 9.1704 | 0.59\% | 11.1638 |
| CANADA | 1.42\% | 19.0625 | 1.36\% | 18.0069 | 1.40\% | 14.2535 | 1.32\% | 14.7031 | 0.27\% | 2.7559 | 0.20\% | 2.2382 | 0.19\% | 1.6255 | 0.11\% | 1.0919 |
| DENMARK | 1.44\% | 49.3548 | 1.41\% | 43.2048 | 1.25\% | 22.5371 | 1.36\% | 26.3513 | 0.81\% | 17.6499 | 0.79\% | 19.0611 | 0.62\% | 9.6968 | 0.73\% | 13.4082 |
| FINLAND | 1.21\% | 20.1596 | 1.20\% | 19.5272 | 1.13\% | 12.9204 | 1.13\% | 13.7626 | 0.64\% | 9.0653 | 0.62\% | 9.2143 | 0.53\% | 5.3445 | 0.54\% | 5.9104 |
| FRANCE | 0.54\% | 10.0216 | 0.72\% | 16.0317 | 0.48\% | 7.9730 | 0.65\% | 11.7681 | -0.08\% | -1.0238 | 0.10\% | 1.7332 | -0.16\% | -1.9129 | 0.01\% | 0.0872 |
| GERMANY | 1.26\% | 32.1995 | 1.23\% | 28.6094 | 1.22\% | 24.5469 | 1.17\% | 23.7623 | 0.43\% | 7.4465 | 0.40\% | 8.2491 | 0.34\% | 4.9802 | 0.28\% | 5.2851 |
| GREECE | 0.15\% | 3.5603 | 0.12\% | 2.6475 | 0.57\% | 6.0343 | 0.75\% | 7.0552 | -0.55\% | -14.0178 | -0.58\% | -14.7273 | -0.14\% | -1.4546 | 0.07\% | 0.7213 |
| HONGKONG | 0.78\% | 11.4652 | 0.65\% | 8.8019 | 0.72\% | 9.5388 | 0.43\% | 6.1402 | -0.28\% | -3.8473 | -0.42\% | -5.5437 | -0.40\% | -4.5363 | -0.70\% | -7.8241 |
| IRELAND | 0.84\% | 14.0122 | 0.83\% | 15.5630 | 0.73\% | 5.0734 | 0.63\% | 4.9339 | 0.21\% | 2.7708 | 0.20\% | 2.8851 | 0.10\% | 0.6596 | -0.03\% | -0.1914 |
| ISRAEL | 0.33\% | 4.3098 | 0.39\% | 5.3157 | 0.50\% | 4.6901 | 0.54\% | 4.8229 | -0.49\% | -5.0297 | -0.43\% | -4.9528 | -0.31\% | -2.5127 | -0.30\% | -2.2979 |
| ITALY | 1.45\% | 30.0403 | 1.41\% | 32.9050 | 1.17\% | 15.6672 | 1.14\% | 18.1901 | 1.07\% | 20.2051 | 1.03\% | 23.4831 | 0.76\% | 10.6797 | 0.73\% | 11.4414 |
| JAPAN | 0.26\% | 13.9653 | 0.28\% | 12.0013 | 0.42\% | 14.8662 | 0.33\% | 10.5679 | -0.23\% | -5.8836 | -0.22\% | -5.5569 | -0.10\% | -1.9267 | -0.18\% | -3.7156 |
| NETHERLANDS | 1.42\% | 26.6903 | 1.29\% | 24.8728 | 1.49\% | 19.7965 | 1.36\% | 16.5201 | 0.88\% | 18.3519 | 0.74\% | 16.1750 | 0.92\% | 11.8137 | 0.78\% | 9.4840 |
| NEWZEALAND | 1.54\% | 24.2346 | 1.38\% | 25.0574 | 1.40\% | 14.3759 | 1.18\% | 12.8381 | 0.99\% | 18.9440 | 0.83\% | 20.7324 | 0.84\% | 9.4608 | 0.63\% | 7.6779 |
| NORWAY | 0.80\% | 21.8733 | 0.74\% | 15.4617 | 0.92\% | 12.8146 | 0.90\% | 15.7309 | 0.03\% | 0.6153 | -0.03\% | -0.4805 | 0.14\% | 1.6607 | 0.11\% | 2.0521 |
| PORTUGAL | 0.21\% | 4.7798 | 0.44\% | 12.0386 | 0.47\% | 5.2444 | 0.69\% | 6.7606 | -0.33\% | -4.7830 | -0.11\% | -2.2702 | -0.10\% | -0.9586 | 0.13\% | 1.2150 |
| SINGAPORE | 1.05\% | 33.8020 | 0.98\% | 27.4378 | 0.92\% | 14.8131 | 0.76\% | 11.4605 | 0.27\% | 5.4899 | 0.20\% | 4.7360 | 0.11\% | 1.7253 | -0.05\% | -0.6055 |
| SPAIN | 0.35\% | 6.9314 | 0.38\% | 10.2233 | 0.19\% | 2.1557 | 0.20\% | 3.5377 | -0.08\% | -1.1273 | -0.05\% | -0.7959 | -0.27\% | -2.7307 | -0.25\% | -3.4595 |
| SWEDEN | 1.54\% | 26.0457 | 1.52\% | 24.2078 | 1.40\% | 18.0049 | 1.53\% | 17.9888 | 0.69\% | 9.9658 | 0.68\% | 12.5329 | 0.53\% | 6.0340 | 0.65\% | 7.8548 |
| SWITZERLAND | 1.04\% | 20.0429 | 0.99\% | 20.8679 | 1.09\% | 17.5848 | 1.06\% | 17.0588 | 0.58\% | 11.3903 | 0.53\% | 14.8430 | 0.61\% | 8.8404 | 0.58\% | 9.8957 |
| UK | 1.32\% | 24.4876 | 1.29\% | 31.3181 | 1.37\% | 23.3649 | 1.31\% | 24.1997 | 0.74\% | 11.5749 | 0.70\% | 15.3958 | 0.77\% | 11.6282 | 0.70\% | 14.7812 |
| US | 0.37\% | 13.1790 | 0.40\% | 11.1489 | 0.40\% | 13.1828 | 0.33\% | 9.4651 | -0.21\% | -4.2073 | -0.18\% | -3.9484 | -0.20\% | -3.8912 | -0.27\% | -6.7462 |
| POOLED SAMPLE | 0.93\% | 9.8703 | 0.92\% | 10.7287 | 0.92\% | 11.6773 | 0.89\% | 11.7039 | 0.27\% | 2.6646 | 0.25\% | 2.6658 | 0.23\% | 2.6932 | 0.20\% | 2.2669 |

### 7.5. The profitability of cross-sectional momentum strategies

Table 7.6 in Appendix 3 reports the average monthly cross-sectional momentum net returns for each of the implementations as set out in Table 4.1. The reported profits all relate to an implementation where the cut-offs are set at $16 \%$. In each rebalancing period the top $16 \%$ are identified as winning stocks and the bottom $16 \%$ as losing stocks. The specific strategy used it to form a long portfolio consisting of the identified winning stocks and a short portfolio consisting of the identified losing stocks with the average monthly returns being the difference between the monthly returns of the two portfolios. The cross-sectional momentum net returns, then, are estimated the returns from buying winners and selling losers subtract trading costs of both portfolios in each month. As for the time-series momentum strategy, we assume that momentum investors close out the positions of stocks in the winner or loser portfolio when they no longer remain in the same portfolio in the subsequent period.

The data in Panels A, B and C of Table 7.6 show the average monthly cross-sectional momentum returns after the transaction costs when the portfolio weights are based on EW, MW and IVOL, respectively.

### 7.5.1. Profitability of cross-sectional momentum strategies

Table 7.7 summarises the number of implementations that produce positive and negative net returns for the cross-sectional momentum strategy across the 24 markets. When pooling all of the 24 markets, the number of implementations yield positive net returns declines by $29 \%$, to $59 \%$ from $88 \%$, of which $23 \%$ of the total implementations prove to be significantly profitable compared with $53 \%$ that are significant before accounting for the transaction costs. Based on the average monthly net returns across the 192 implementations, in excess of $50 \%$ of the implementations examined yield significant positive net returns in Belgium, Denmark,

Italy, Netherlands, New Zealand and the UK. None of the implementations in the crosssectional momentum strategies yields significant negative profitability in Belgium, Denmark, Italy, New Zealand and Sweden in contrast to none of the implementations being significant positive profitability in Australia, Greece, Hong Kong, Japan, Portugal, Singapore and the US markets.

Chart 7.2 shows the average net returns of the cross-sectional momentum strategy across all of the implementations for each of the markets. With the introduction of transaction costs, these average monthly returns drop by $75 \%$, to $0.17 \%$ per month from $0.7 \%$. The average transaction costs of implementing 192 cross-sectional momentum strategies are higher than $1 \%$ per month in six markets, Hong Kong (1.49\%), Japan (1.22\%), Israel (1.09\%), the US (1.09\%), Australia (1.02\%) and Singapore (1\%).

This average for the cross-sectional momentum strategy realises a loss in ten markets, with the highest loss of $-0.8 \%$ per month occurring in the Hong Kong market. In contrast, the cross-sectional momentum strategies in Belgium, Denmark, Italy and New Zealand produce the highest average after-transaction costs returns of around $0.6 \%$ per month. Comparing the after-transaction costs performance of the time-series and cross-sectional momentum strategies, overall the time-series momentum strategy still outperforms by $0.07 \%$ per month, $0.24 \%$ per month as compared to $0.17 \%$ per month for the cross-sectional momentum strategy.

Table 7.7. Numbers of implementations yield positive/negative cross-sectional momentum returns after transaction costs

This table reports the numbers of implementations that yield positive and negative average monthly aftertransaction cost cross-sectional momentum returns for each market. The SIGNIFICANT column indicates the aggregate numbers of implementations that generate average monthly returns at the $1 \%, 5 \%$, or $10 \%$ significance level, whereas the NON-SIGNIFICANT column indicates the numbers of strategies that produce average monthly returns over $10 \%$ significance level.

|  |  | POSITIVE |  |  |  | NEGATIVE |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | IMPLEMENTATION APPROACHES | SIGNIFICANT | PERCENTAGE | NON SIGNIFICANT | PERCENTAGE | SIGNIFICANT | PERCENTAGE | NON SIGNIFICANT | PERCENTAGE |
| AUSTRALIA | 192 | 0 | 0\% | 48 | 25\% | 66 | 34\% | 78 | 41\% |
| AUSTRIA | 192 | 67 | 35\% | 87 | 45\% | 3 | 2\% | 35 | 18\% |
| BELGIUM | 192 | 122 | 64\% | 59 | 31\% | 0 | 0\% | 11 | 6\% |
| CANADA | 192 | 10 | 5\% | 87 | 45\% | 21 | 11\% | 74 | 39\% |
| DENMARK | 192 | 145 | 76\% | 35 | 18\% | 0 | 0\% | 12 | 6\% |
| FINLAND | 192 | 52 | 27\% | 124 | 65\% | 2 | 1\% | 14 | 7\% |
| FRANCE | 192 | 4 | $2 \%$ | 102 | 53\% | 25 | 13\% | 61 | 32\% |
| GERMANY | 192 | 28 | 15\% | 131 | 68\% | 13 | 7\% | 20 | 10\% |
| GREECE | 192 | 0 | 0\% | 47 | 24\% | 11 | 6\% | 134 | 70\% |
| HONGKONG | 192 | 0 | 0\% | 6 | 3\% | 120 | 63\% | 66 | 34\% |
| IRELAND | 192 | 6 | 3\% | 87 | 45\% | 9 | 5\% | 90 | 47\% |
| ISRAEL | 192 | 2 | 1\% | 42 | 22\% | 98 | 51\% | 50 | 26\% |
| ITALY | 192 | 134 | 70\% | 50 | 26\% | 0 | 0\% | 8 | 4\% |
| JAPAN | 192 | 0 | 0\% | 5 | $3 \%$ | 95 | 49\% | 92 | 48\% |
| NETHERLANDS | 192 | 97 | 51\% | 36 | 19\% | 3 | 2\% | 56 | 29\% |
| NEWZEALAND | 192 | 126 | 66\% | 60 | 31\% | 0 | 0\% | 6 | 3\% |
| NORWAY | 192 | 12 | 6\% | 136 | 71\% | 11 | 6\% | 33 | 17\% |
| PORTUGAL | 192 | 0 | 0\% | 123 | 64\% | 10 | 5\% | 59 | 31\% |
| SINGAPORE | 192 | 0 | 0\% | 21 | 11\% | 15 | 8\% | 156 | 81\% |
| SPAIN | 192 | 53 | 28\% | 92 | 48\% | 10 | 5\% | 37 | 19\% |
| SWEDEN | 192 | 9 | 5\% | 135 | 70\% | 0 | 0\% | 48 | 25\% |
| SWITZERLAND | 192 | 78 | 41\% | 94 | 49\% | 2 | 1\% | 18 | 9\% |
| UK | 192 | 103 | 54\% | 57 | 30\% | 4 | 2\% | 28 | 15\% |
| US | 192 | 0 | 0\% | 17 | 9\% | 56 | 29\% | 119 | 62\% |
| POOLED SAMPLE | 192 | 44 | 23\% | 70 | 36\% | 24 | 12\% | 54 | 28\% |

Chart 7.2. Average cross-sectional momentum returns across implementations for each market

This chart reports the pooled average monthly after-transaction costs returns for 192 cross-sectional momentum strategies for each market. The dashed line shows the average monthly returns across the 24 developed markets.


### 7.5.2. The weighting method

Table 7.8 outlines the average monthly raw and net returns of the cross-sectional momentum strategies using the three different portfolio weights: equal weights (EW), market weights (MW) and inverse volatility weights (IVOL), respectively.

In Table 5.8 we observe that the cross-sectional momentum strategies using MW produce the highest returns in ten markets, the strategies using IVOL and EW generate greatest returns in eight and six markets, respectively. The findings with respect to the best investment outcomes reported for each of the weighting methods for the cross-sectional momentum strategy remain the same as those previously identified on the basis of raw returns in all the markets.

In terms of the pooled returns across the 24 markets, the average monthly net return of implementing cross-sectional momentum strategies falls by $0.58 \%$ to $0.08 \%$ per month using EW, reduces by $0.55 \%$ to $0.10 \%$ per month using MW and decreases by $0.59 \%$ to $0.15 \%$ per month using IVOL. The investment outcome with IVOL consistently proves to be the best for implementing the cross-sectional momentum strategy.

Based on the average monthly net returns under different weighting schemes as reported in Tables 7.3 and 7.8, the pooled performances of time-series and cross-sectional momentum becomes poorly when implementing both momentum strategies use EW as compared to the outcomes using the other two weighting schemes. Both momentum strategies consistently yield superior investment outcomes for Belgium, Denmark, Italy, and Switzerland when using EW, for Australia, Canada, Finland, Germany and Israel when using MW, and for Austria, New Zealand, Sweden and the UK when using IVOL. However, neither of the two momentum strategies produces positive returns in Hong Kong, Japan, Singapore and the US.

Compared to the costs of the three weighting schemes in the time-series momentum strategies, the costs of the cross-sectional momentum strategies are lower by around $0.1 \%$ per month on average. Australia, Canada and Hong Kong still remain the markets with the highest monthly transaction costs of around $1 \%$ per month.

## Table 7.8. Cross-sectional momentum profit based on three weights

This table reports the pooled average monthly after transaction cost cross-sectional momentum returns using equal weight (EW), market weight (MW) and inversed volatility weight (IVOL) for each market. T-statistics are reported in italics. The raw return column reports the time-series momentum before the transaction costs from Table 5.8. The transaction cost column reports the pooled average monthly costs of winner and loser portfolios using EW, MW and IVOL. The highest return is highlighted in green and the lowest return is marked in red.

|  | Raw return |  |  |  |  |  | Net return |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | EW |  | MW |  | IVOL |  | EW |  | MW |  | IVOL |  |
| AUSTRALIA | 0.25\% | 7.0778 | 1.15\% | 19.6631 | 0.71\% | 15.3687 | -0.72\% | -18.1059 | 0.13\% | 3.0705 | -0.42\% | -7.4048 |
| AUSTRIA | 0.90\% | 27.0270 | 0.42\% | 10.4853 | 0.96\% | 27.8379 | 0.51\% | 14.5196 | 0.01\% | 0.3256 | 0.55\% | 13.8478 |
| BELGIUM | 1.17\% | 31.7460 | 0.85\% | 16.2799 | 1.12\% | 26.6987 | 0.84\% | 21.2993 | 0.52\% | 9.5454 | 0.77\% | 17.0556 |
| CANADA | 0.66\% | 17.9078 | 1.40\% | 26.2589 | 0.93\% | 21.3127 | -0.43\% | -7.6464 | 0.45\% | 8.3609 | -0.10\% | -1.9166 |
| DENMARK | 1.30\% | 35.2329 | 1.16\% | 30.6922 | 1.30\% | 34.3466 | 0.76\% | 18.1742 | 0.68\% | 15.8893 | 0.74\% | 17.5555 |
| FINLAND | 0.82\% | 24.3617 | 1.45\% | 31.8624 | 0.87\% | 25.3838 | 0.29\% | 7.8866 | 0.94\% | 14.9787 | 0.33\% | 8.7524 |
| FRANCE | 0.65\% | 18.6061 | 0.21\% | 6.3814 | 0.58\% | 12.7077 | 0.09\% | 1.8550 | -0.35\% | -5.6513 | 0.00\% | -0.0369 |
| GERMANY | 0.92\% | 28.7380 | 1.09\% | 28.9323 | 1.06\% | 24.9748 | 0.18\% | 4.2470 | 0.34\% | 6.2309 | 0.30\% | 6.1754 |
| GREECE | 0.11\% | 2.4722 | 0.56\% | 10.0614 | 0.23\% | 4.7895 | -0.44\% | -10.1949 | 0.04\% | 0.7107 | -0.31\% | -7.0286 |
| HONGKONG | -0.13\% | -3.4014 | 0.48\% | 9.9660 | -0.02\% | -0.3273 | -1.08\% | -23.0430 | -0.37\% | -9.1958 | -0.97\% | -22.6728 |
| IRELAND | 0.51\% | 11.7774 | 0.30\% | 3.4392 | 0.65\% | 13.4941 | -0.06\% | -1.2306 | -0.28\% | -3.2619 | 0.06\% | 1.1534 |
| ISRAEL | -0.04\% | -1.9781 | 0.74\% | 14.8199 | 0.04\% | 1.3800 | -0.69\% | -17.3884 | 0.09\% | 1.6754 | -0.63\% | -17.1042 |
| ITALY | 1.04\% | 38.5665 | 0.94\% | 23.2819 | 0.96\% | 37.8547 | 0.73\% | 22.9515 | 0.62\% | 12.2829 | 0.64\% | 21.4501 |
| JAPAN | -0.16\% | -7.9805 | -0.08\% | -3.6968 | -0.15\% | -8.0806 | -0.59\% | -17.0941 | -0.46\% | -13.2897 | -0.58\% | -17.5707 |
| NETHERLANDS | 1.18\% | 40.9944 | 0.16\% | 6.3412 | 1.07\% | 36.1738 | 0.72\% | 21.8314 | -0.30\% | -7.6831 | 0.62\% | 16.8709 |
| NEWZEALAND | 1.20\% | 27.4084 | 1.03\% | 23.2423 | 1.34\% | 28.9816 | 0.73\% | 19.1390 | 0.53\% | 13.9619 | 0.87\% | 30.5211 |
| NORWAY | 0.83\% | 23.8389 | 0.89\% | 17.7318 | 0.87\% | 22.9060 | 0.15\% | 3.3707 | 0.28\% | 3.8127 | 0.20\% | 4.3897 |
| PORTUGAL | 0.29\% | 8.4966 | 0.61\% | 15.9200 | 0.66\% | 20.2409 | -0.17\% | -3.0853 | 0.16\% | 4.1813 | 0.17\% | 3.8583 |
| SINGAPORE | 0.39\% | 11.7226 | 0.20\% | 6.9797 | 0.46\% | 13.8557 | -0.29\% | -8.2747 | -0.44\% | -10.4999 | -0.23\% | -6.3547 |
| SPAIN | 0.72\% | 26.9760 | 0.37\% | 6.6461 | 0.78\% | 23.8108 | 0.35\% | 9.1545 | -0.02\% | -0.2811 | 0.40\% | 9.3562 |
| SWEDEN | 1.04\% | 25.9284 | 0.41\% | 6.5307 | 1.08\% | 26.1557 | 0.35\% | 11.6870 | -0.16\% | -3.3267 | 0.43\% | 13.0321 |
| SWITZERLAND | 0.94\% | 35.7678 | 0.57\% | 18.8627 | 0.88\% | 32.1360 | 0.56\% | 22.6442 | 0.19\% | 4.8755 | 0.49\% | 15.7140 |
| UK | 1.15\% | 31.5340 | 0.51\% | 15.6855 | 1.24\% | 32.9874 | 0.63\% | 19.5295 | -0.03\% | -0.5196 | 0.71\% | 20.8590 |
| US | 0.04\% | 1.5237 | 0.23\% | 7.5748 | 0.04\% | 1.6700 | -0.51\% | -15.9522 | -0.22\% | -4.6915 | -0.49\% | -12.4061 |
| POOLED SAMPLE | 0.66\% | 6.9674 | 0.65\% | 7.6915 | 0.74\% | 8.3433 | 0.08\% | 0.6869 | 0.10\% | 1.2439 | 0.15\% | 1.4135 |

### 7.5.3. The formation (J) and holding period (H)

In Table 7.9, we report the average after-transaction cost returns for cross-sectional momentum strategy for all of the combinations of formation (J) and holding (H) periods. The returns realised by the various implementations reduce dramatically for the shorter holding periods once account is taken of the transaction costs but the momentum strategy still remains profitable in most markets over longer holding periods.

The findings as reported in Table 7.4 suggest that in most markets the optimum momentum strategy to apply once the impact of transaction costs are recognised is a shorter formation period of either six or nine months in combination with a holding period of either nine or 12 months. This represents a significant change from the situation before transaction costs are taken into account (see Table 5.9) where the typical optimum formation period in 14 markets is nine or 12 months while the optimum holding period is three months. In other words the combination of the holding and formation periods has remained unchanged at between 15 and 18 months with the impact of the transaction costs resulting in a move to a shorter formation period and a longer holding period, with the exceptions being the New Zealand and Sweden markets. This indicates that the best way of exploiting the momentum phenomenon, when one recognizes the transaction costs, is to extend the holding period (thereby reducing the transaction costs) and reduce the formation period in order to leave the aggregate of the two largely unchanged.

## Table 7.9. Cross-sectional momentum profitability based on formation (J) and holding (H) period

This table reports the pooled average monthly after-transaction cost cross-sectional momentum returns based on the formation J ( $\mathrm{J}=$ three, six, nine and 12 months) and the holding $\mathrm{H}(\mathrm{H}=$ three, six, nine and 12 months) for each market. T-statistics are reported in italics. The highest return is highlighted in green and the lowest return is marked in red.


| ITALY | H = 3 | H = 6 | H = 9 | $\mathrm{H}=12$ | JAPAN | H = 3 | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | NETHERLANDS | H = 3 | $\mathrm{H}=6$ | H = 9 | H = 12 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{J}=3$ | -0.08\% | 0.35\% | 0.72\% | 0.62\% | $\mathrm{J}=3$ | -1.07\% | -0.56\% | -0.41\% | -0.13\% | $\mathrm{J}=3$ | -0.27\% | 0.04\% | 0.26\% | 0.22\% |
|  | -1.4114 | 8.8178 | 11.5055 | 27.5779 |  | -30.5649 | -15.2014 | -9.3071 | -4.1314 |  | -2.9993 | 0.2771 | 2.0155 | 2.5565 |
| $\mathrm{J}=6$ | 0.41\% | 0.64\% | 0.71\% | 0.71\% | $\mathrm{J}=6$ | -0.95\% | -0.72\% | -0.37\% | -0.18\% | $\mathrm{J}=6$ | 0.10\% | 0.38\% | 0.48\% | 0.67\% |
|  | 8.8494 | 10.3351 | 13.3261 | 22.9776 |  | -23.9325 | -13.0452 | -13.3093 | -3.5635 |  | 0.5422 | 2.1876 | 3.8597 | 6.3023 |
| $\mathrm{J}=9$ | 0.80\% | 0.83\% | 0.84\% | 0.55\% | $\mathrm{J}=9$ | -0.76\% | -0.43\% | -0.33\% | -0.37\% | $\mathrm{J}=9$ | 0.33\% | 0.43\% | 0.62\% | 0.50\% |
|  | 13.5304 | 12.9545 | 23.8094 | 6.1674 |  | -21.0876 | -15.9735 | -9.7703 | -9.1868 |  | 1.6445 | 2.5472 | 4.7520 | 3.8443 |
| $\mathrm{J}=12$ | 0.88\% | 0.93\% | 0.93\% | 0.75\% | $\mathrm{J}=12$ | -0.63\% | -0.59\% | -0.62\% | -0.57\% | $\mathrm{J}=12$ | 0.41\% | 0.46\% | 0.47\% | 0.42\% |
|  | 25.3592 | 24.6776 | 14.8892 | 10.7129 |  | -36.9767 | -16.8772 | -14.6113 | $-16.5067$ |  | 2.0740 | 2.8062 | 3.2988 | 3.3901 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NEWZEALAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | NORWAY | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | PORTUGAL | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | 0.34\% | 0.72\% | 0.47\% | 0.39\% | $\mathrm{J}=3$ | -1.01\% | -0.15\% | 0.20\% | 0.29\% | $\mathrm{J}=3$ | -0.71\% | 0.12\% | 0.13\% | 0.29\% |
|  | 3.0487 | 10.8274 | 4.9498 | 4.2645 |  | -18.8326 | -3.1101 | 6.8428 | 6.6981 |  | -3.2492 | 1.1944 | 1.6449 | 4.5120 |
| $\mathrm{J}=6$ | 0.81\% | 0.80\% | 0.81\% | 0.53\% | $\mathrm{J}=6$ | -0.26\% | 0.33\% | 0.52\% | 0.65\% | $\mathrm{J}=6$ | -0.40\% | 0.09\% | 0.25\% | 0.27\% |
|  | 7.7166 | 9.2542 | 25.2758 | 5.1582 |  | -4.4468 | 8.2773 | 6.6269 | 6.3461 |  | -4.0261 | 1.1755 | 4.4868 | 4.8651 |
| $\mathrm{J}=9$ | 0.95\% | 0.92\% | 0.85\% | 0.67\% | $\mathrm{J}=9$ | 0.38\% | 0.61\% | 0.39\% | 0.52\% | $\mathrm{J}=9$ | -0.05\% | 0.23\% | 0.31\% | 0.32\% |
|  | 12.3256 | 20.9853 | 16.1689 | 9.3345 |  | 9.3190 | 12.8448 | 9.0076 | 4.3447 |  | -0.6800 | 3.5488 | 3.4464 | 4.7888 |
| $\mathrm{J}=12$ | 0.90\% | 0.89\% | 0.64\% | 0.65\% | $\mathrm{J}=12$ | 0.27\% | 0.28\% | 0.31\% | 0.04\% | $\mathrm{J}=12$ | -0.09\% | 0.04\% | 0.02\% | 0.04\% |
|  | 12.6942 | 20.9852 | 19.4179 | 13.2145 |  | 6.0464 | 5.7118 | 5.8793 | 0.4697 |  | -0.9987 | 0.7292 | 0.3704 | 0.8278 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SINGAPORE | H = 3 | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | SPAIN | H = 3 | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | SWEDEN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -1.15\% | -0.44\% | 0.03\% | -0.12\% | $\mathrm{J}=3$ | -0.60\% | -0.32\% | 0.17\% | 0.18\% | $\mathrm{J}=3$ | -0.18\% | 0.11\% | 0.39\% | 0.11\% |
|  | -20.3501 | -5.0344 | 0.5801 | -4.3927 |  | -6.8350 | -2.7329 | 2.4496 | 1.9208 |  | -2.6267 | 1.2822 | 8.5841 | 0.9423 |
| $\mathrm{J}=6$ | -0.38\% | -0.19\% | -0.20\% | -0.05\% | $\mathrm{J}=6$ | -0.27\% | 0.20\% | 0.38\% | 0.37\% | $\mathrm{J}=6$ | 0.28\% | 0.50\% | 0.49\% | 0.29\% |
|  | -7.1749 | -2.5821 | -5.0004 | -0.9705 |  | -2.1111 | 2.0850 | 5.4500 | 16.0499 |  | 4.3170 | 9.0446 | 8.3422 | 4.5938 |
| $\mathrm{J}=9$ | -0.42\% | -0.30\% | -0.15\% | -0.44\% | $\mathrm{J}=9$ | 0.19\% | 0.43\% | 0.49\% | 0.35\% | $\mathrm{J}=9$ | 0.34\% | 0.35\% | 0.26\% | 0.03\% |
|  | -5.7644 | -6.2452 | -2.7954 | -8.7109 |  | 1.4108 | 3.8701 | 5.5803 | 4.5993 |  | 2.9434 | 2.9263 | 2.4389 | 0.2738 |
| $\mathrm{J}=12$ | -0.41\% | -0.24\% | -0.36\% | -0.30\% | $\mathrm{J}=12$ | 0.44\% | 0.63\% | 0.70\% | 0.52\% | $\mathrm{J}=12$ | 0.17\% | 0.20\% | -0.07\% | 0.05\% |
|  | -12.2072 | -4.9341 | -8.3596 | -5.7021 |  | 6.7767 | 20.2385 | 19.6714 | 10.3425 |  | 0.9202 | 1.3116 | -0.5173 | 0.5504 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SWITZERLAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | UK | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | US | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.18\% | 0.18\% | 0.26\% | 0.37\% | $\mathrm{J}=3$ | -0.36\% | 0.18\% | 0.39\% | 0.37\% | $\mathrm{J}=3$ | -1.32\% | -0.56\% | -0.36\% | -0.22\% |
|  | -2.0304 | 2.2641 | 4.0853 | 6.5996 |  | -2.1290 | 1.4109 | 3.6183 | 4.3003 |  | -27.5779 | -14.7859 | -6.6006 | -5.7284 |
| $\mathrm{J}=6$ | 0.25\% | 0.49\% | 0.44\% | 0.65\% | $\mathrm{J}=6$ | 0.28\% | 0.48\% | 0.58\% | 0.72\% | $\mathrm{J}=6$ | -0.72\% | -0.26\% | -0.35\% | -0.06\% |
|  | 2.6889 | 10.3828 | 7.3859 | 9.7664 |  | 1.5614 | 4.0892 | 7.3106 | 10.5452 |  | -17.2939 | -7.0899 | -4.0956 | -0.8438 |
| $\mathrm{J}=9$ | 0.44\% | 0.51\% | 0.56\% | 0.37\% | $\mathrm{J}=9$ | 0.52\% | 0.70\% | 0.67\% | 0.47\% | $\mathrm{J}=9$ | -0.36\% | -0.23\% | -0.18\% | -0.32\% |
|  | 5.6538 | 8.6470 | 11.7123 | 6.9346 |  | 3.3691 | 8.4448 | 9.7071 | 7.2838 |  | -7.3988 | -3.5437 | -2.5384 | $-4.7355$ |
| $\mathrm{J}=12$ | 0.62\% | 0.75\% | 0.53\% | 0.39\% | $\mathrm{J}=12$ | 0.60\% | 0.66\% | 0.50\% | 0.26\% | $\mathrm{J}=12$ | -0.47\% | -0.28\% | -0.37\% | -0.44\% |
|  | 7.2860 | 13.0258 | 13.5454 | 12.8919 |  | 3.4695 | 6.2172 | 6.1693 | 3.6811 |  | -10.3108 | -4.5884 | -5.6937 | -5.4010 |

### 7.5.4. The rebalancing methods

Table 7.10 summarises the average cross-sectional momentum net returns under each of the four approaches to portfolio constructions considered in this study. Based on the pooled net returns across the 24 markets, the returns of cross-sectional momentum strategies decline from their raw returns in Table 5.10 to $0.16 \%$ per month for CAR (0), $0.13 \%$ per month for CAR (1), $0.11 \%$ per month for BHAR (0) and $0.04 \%$ per month for BHAR (1).

For the time-series momentum strategies, we find that the investment outcomes remained largely unchanged across the four portfolio rebalancing strategies both before and after transaction costs, and we now observe this to be equally true for the cross-sectional momentum strategies. The overall performances of time-series and cross-sectional momentum strategies using CAR (0) continuous to be the best and the performances of the strategies using BHAR (1) appear to be the worst. The strategies using CAR (0) gain the highest net returns in 14 markets, while the strategies involving BHAR (1) yield the greatest net returns in Israel and Portugal. However, the differences of investment outcomes are quite small when the methods employed for portfolio construction under the two momentum strategies in majority of the markets.

Table 7.10. Cross-sectional momentum profit based on portfolio constructions
This table reports the pooled average monthly after-transaction cost cross-sectional momentum returns based on four rebalancing methods: monthly-rebalancing with zero gap (CAR (0)), monthly-rebalancing with 1-month gap (CAR (1)), buy-and-hold with zero gap (BHAR (0)), and buy-and-hold with 1-month gap (BHAR (1)). Tstatistics are reported in italics. The highest return is highlighted in green and the lowest return is marked in red.

|  | Raw return |  |  |  |  |  |  |  | Net return |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | CAR (0) |  | CAR (1) |  | BHAR (0) |  | BHAR (1) |  | CAR (0) |  | CAR (1) |  | BHAR (0) |  | BHAR (1) |  |
| AUSTRALIA | 0.76\% | 10.3534 | 0.72\% | 9.9358 | 0.70\% | 8.7297 | 0.63\% | 7.9395 | -0.25\% | -3.1418 | -0.28\% | -4.3209 | -0.28\% | -3.5978 | -0.53\% | -7.5711 |
| AUSTRIA | 0.82\% | 17.6583 | 0.76\% | 14.5969 | 0.76\% | 13.1667 | 0.70\% | 11.5878 | 0.42\% | 8.3559 | 0.36\% | 6.7593 | 0.35\% | 5.5416 | 0.29\% | 4.6465 |
| BELGIUM | 1.06\% | 23.5119 | 1.06\% | 22.3689 | 1.05\% | 15.9384 | 1.02\% | 17.1942 | 0.73\% | 14.4440 | 0.73\% | 15.3904 | 0.71\% | 10.1646 | 0.67\% | 11.1780 |
| CANADA | 1.09\% | 16.1903 | 1.02\% | 14.3255 | 0.98\% | 14.5523 | 0.90\% | 13.5202 | 0.10\% | 1.1407 | 0.02\% | 0.3037 | -0.08\% | -0.9434 | -0.16\% | -2.2644 |
| DENMARK | 1.35\% | 36.3750 | 1.28\% | 33.1283 | 1.19\% | 24.8015 | 1.18\% | 24.8415 | 0.84\% | 18.2364 | 0.77\% | 18.2197 | 0.65\% | 12.1447 | 0.64\% | 13.5008 |
| FINLAND | 1.08\% | 20.6948 | 1.07\% | 18.4582 | 1.02\% | 14.5816 | 1.01\% | 16.4649 | 0.57\% | 8.9990 | 0.55\% | 8.8574 | 0.49\% | 5.5848 | 0.48\% | 7.4986 |
| FRANCE | 0.46\% | 9.7012 | 0.60\% | 14.5988 | 0.38\% | 6.3942 | 0.47\% | 8.7864 | -0.09\% | -1.2140 | 0.05\% | 0.8403 | -0.19\% | -2.3525 | -0.10\% | -1.4387 |
| GERMANY | 1.06\% | 28.1905 | 1.03\% | 27.1077 | 1.05\% | 18.9098 | 0.95\% | 21.5367 | 0.34\% | 5.9906 | 0.30\% | 6.7059 | 0.28\% | 3.9065 | 0.17\% | 3.4390 |
| GREECE | 0.30\% | 6.7751 | 0.27\% | 6.0312 | 0.34\% | 4.2846 | 0.31\% | 3.8392 | -0.23\% | -5.3884 | -0.26\% | -6.7052 | -0.21\% | -2.7571 | -0.24\% | -3.3044 |
| HONGKONG | 0.21\% | 3.3986 | 0.13\% | 1.9467 | 0.15\% | 2.3046 | -0.05\% | -0.8449 | -0.68\% | -10.4597 | -0.76\% | -11.5884 | -0.79\% | -11.7437 | -1.00\% | -15.5865 |
| IRELAND | 0.60\% | 17.9627 | 0.53\% | 12.5493 | 0.51\% | 4.8921 | 0.30\% | 3.4005 | 0.04\% | 1.0534 | -0.04\% | -1.0523 | -0.07\% | -0.6233 | -0.31\% | -3.1373 |
| ISRAEL | 0.24\% | 4.0226 | 0.23\% | 3.9726 | 0.23\% | 3.2832 | 0.28\% | 3.8627 | -0.41\% | -6.0904 | -0.42\% | -7.1127 | -0.42\% | -4.9527 | -0.39\% | -5.0559 |
| ITALY | 1.00\% | 28.4487 | 1.02\% | 34.3066 | 0.96\% | 24.1993 | 0.94\% | 22.4729 | 0.69\% | 15.1872 | 0.71\% | 20.2205 | 0.63\% | 13.2254 | 0.61\% | 12.6745 |
| JAPAN | -0.17\% | -11.8703 | -0.10\% | -5.9294 | -0.08\% | -2.9609 | -0.18\% | -5.4467 | -0.58\% | -16.0390 | -0.50\% | -16.0953 | -0.50\% | -10.9641 | -0.60\% | -13.2083 |
| NETHERLANDS | 0.86\% | 12.4616 | 0.82\% | 11.8242 | 0.83\% | 10.7581 | 0.71\% | 8.8704 | 0.41\% | 5.5038 | 0.37\% | 5.0418 | 0.36\% | 4.4047 | 0.24\% | 2.9055 |
| NEWZEALAND | 1.25\% | 30.4919 | 1.15\% | 26.6534 | 1.25\% | 20.7591 | 1.11\% | 16.2939 | 0.78\% | 26.4697 | 0.67\% | 21.6670 | 0.76\% | 14.7384 | 0.62\% | 10.6824 |
| NORWAY | 0.83\% | 20.0567 | 0.77\% | 18.0157 | 0.94\% | 17.7793 | 0.90\% | 17.8584 | 0.19\% | 3.2517 | 0.13\% | 2.4227 | 0.28\% | 3.7983 | 0.24\% | 3.4051 |
| PORTUGAL | 0.46\% | 9.6943 | 0.54\% | 17.2247 | 0.50\% | 9.5121 | 0.58\% | 11.0675 | 0.01\% | 0.1792 | 0.09\% | 2.1393 | 0.02\% | 0.2691 | 0.10\% | 1.6710 |
| SINGAPORE | 0.35\% | 10.0186 | 0.30\% | 7.5608 | 0.41\% | 10.7302 | 0.35\% | 7.6080 | -0.31\% | -8.2507 | -0.36\% | -9.1547 | -0.27\% | -5.5806 | -0.33\% | -6.2378 |
| SPAIN | 0.66\% | 16.3123 | 0.68\% | 18.3078 | 0.59\% | 8.1034 | 0.57\% | 10.2238 | 0.29\% | 5.2750 | 0.31\% | 6.1542 | 0.19\% | 2.2623 | 0.17\% | 2.6088 |
| SWEDEN | 0.89\% | 14.6839 | 0.82\% | 12.3780 | 0.87\% | 11.0390 | 0.80\% | 9.8037 | 0.27\% | 5.3851 | 0.20\% | 4.0370 | 0.21\% | 3.3369 | 0.14\% | 2.2324 |
| SWITZERLAND | 0.83\% | 24.1481 | 0.78\% | 24.5525 | 0.85\% | 17.5328 | 0.72\% | 17.2430 | 0.46\% | 12.1396 | 0.41\% | 13.0755 | 0.46\% | 8.3389 | 0.34\% | 7.1847 |
| UK | 1.05\% | 16.6634 | 0.97\% | 17.9141 | 0.97\% | 14.5151 | 0.86\% | 13.7392 | 0.53\% | 7.6945 | 0.46\% | 7.9972 | 0.44\% | 5.9152 | 0.32\% | 5.0095 |
| US | 0.11\% | 3.9741 | 0.14\% | 4.2658 | 0.12\% | 3.3049 | 0.04\% | 1.1454 | -0.39\% | -7.9776 | -0.35\% | -7.7386 | -0.40\% | -6.9689 | -0.48\% | -10.7629 |
| POOLED SAMPLE | 0.71\% | 8.8670 | 0.69\% | 9.1702 | 0.69\% | 9.2340 | 0.63\% | 8.3009 | 0.16\% | 1.7150 | 0.13\% | 1.5017 | 0.11\% | 1.2376 | 0.04\% | 0.4121 |

### 7.6. Time-series and cross-sectional momentum strategies after accounting for the transaction costs

The conclusion that can be drawn from the general analysis of the time-series and the crosssectional momentum returns after accounting for the transaction cost is that over the last two decades both momentum strategies have realised positive gains across all of our markets other than Australia, Greece, Hong Kong, Israel, Japan, Singapore and the US. The findings suggest that in most markets implementing either form of momentum strategy with combined formation and holding periods of between 15 and 18 months has a high probability of success. Based on the returns before the transaction costs reported in Chapters 5, the optimal timeseries momentum strategy outperforms the optimal cross-sectional momentum strategy. We now turn our attention to whether this finding still holds when the transaction costs and shortsale constraints are introduced into our analysis.

### 7.6.1. Comparing performances of optimal time-series and cross-sectional momentum strategies

In Table 7.7 we report the average monthly returns after the trading costs for both time-series (TSM) and cross-sectional (CSM) momentum implementations in each of the 24 markets. The optimum implementation in each market is determined by aggregating the returns for each momentum strategy for each implementation and then choosing the one which yields the highest combined returns.

The second column of results for each momentum strategy is the average before-transaction costs (raw) return for the optimum implementation with the next two columns reporting the transaction costs for the long and short portfolios with the final column reporting the average monthly after-transaction costs (net) returns. Before the trading costs are taken into account, the findings in Chapter 5 suggest that the optimal implementation period (i.e. sum of formation and holding periods) tends to be between 12 and 15 months, including a formation period between 9 and 12 months, and a 3-month holding period for the most developed markets. After taking the transaction costs into account, the combination of formation and holding periods is now between 15 and 18 months in 20 out of the 24 markets. The optimal combination of formation and holding periods remain basically unchanged in Finland, Greece, Ireland, Israel, Italy, Japan, Spain and the UK, with the introduction of the transaction costs. For six other markets, the optimal combination involves combining the same formation period with a longer holding period, while in the remaining ten countries; the optimal combination involves a shorter formation period but a longer holding period.

Before considering the transaction costs, the optimal portfolio weighting scheme involves using MW in 11 markets, using IVOL in ten markets and using EW in three markets. Now, the optimal portfolio weighting scheme involves MW in 16 markets, and is split equally
between using EW and IVOL in the other eight markets. Our findings suggest that a buy-andhold approach provides the best investment outcomes for portfolio rebalancing under both of the momentum strategies but in fact there is very little difference across all rebalancing schemes.

A comparison of the transaction costs between the winners and losers of the two momentum strategies under optimal implementations is presented in Table 7.11. The transaction cost estimates associated with the losers are higher than those of the winners in all markets, with the exceptions being in Australia, Greece, Israel, Portugal and Singapore for the time-series momentum strategy, and the sole exception of Australia for the cross-sectional momentum strategy. A number of studies report that the price impacts of buyer- and seller-initiated transactions costs are asymmetric (Chan \& Lakonishok, 1993, 1995; Li et al., 2009), and our findings from the two momentum strategies also strongly suggest that the asymmetric costs between the winners and losers are dominated by selling costs.

Comparing the aggregate costs of the winners and losers for the time-series and crosssectional momentum strategies, it is perhaps not surprising that transaction costs from the time-series momentum strategy are slightly higher than the costs from the cross-sectional momentum strategy. We highlight in Chapter 6 that the time-series momentum strategy with fixed cut-offs designate fewer stocks as losers when markets are performing well, and fewer stocks as winners when markets are performing poorly. This suggests that the time-series momentum strategy will generate a higher turnover over a market cycle which will contribute to higher transaction costs. We have also shown that the typical time-series momentum stock is smaller than the typical cross-sectional momentum stock which will likewise contribute to larger transaction costs.

The net returns for the optimum time-series momentum implementation strategies are positive in all markets and significant in 19 of these markets. The returns range between $3.17 \%$ per month in Ireland to $0.14 \%$ per month in the US. For the cross-sectional momentum strategies, the net returns are positive in 23 markets but not in the Hong Kong market, and are significant in 15 of these markets. The maximum net monthly return is the $2.20 \%$ per month realised in Ireland whereas the net return in the Hong Kong market is $-0.12 \%$ per month.

The last column in Table 7.7 (TSM - CSM) reports the difference between the aftertransaction cost return of the time-series and cross-sectional momentum strategies under the optimal implementation. Before accounting for the transaction costs, in Table 5.11 we find that the time-series momentum strategy outperforms the cross-sectional momentum strategy in all the 24 markets and is significant in 13 markets. After we introduce the transaction costs into the study, the costs erode the advantage of the time-series momentum strategy over the cross-sectional momentum strategy. The time-series momentum strategy now outperforms cross-sectional momentum strategy in 21 markets with this superior outperformance being significant in seven markets, Canada, Ireland, Japan, the Netherlands and Sweden at the 5\% level and Finland and New Zealand at the $10 \%$ level. The three markets in which the crosssectional momentum strategy outperforms the time-series momentum strategy are Germany, Norway and the US with only the US being significant. The market in which the superior performance by time-series momentum strategies is greatest is New Zealand at $1.26 \%$ per month while for cross-sectional momentum strategies the superior performance is greatest at $0.39 \%$ per month in Norway.

Table 7.11. Monthly profits of time-series and cross-sectional momentum strategies
This table reports "optimal" implementations, average monthly before-transaction costs (raw) returns and aftertransaction cost (net) returns, transaction costs of loser and winner portfolios in time-series (TSM) and crosssectional (CSM) momentum strategies, and the difference of net return between TSM and CSM for each market from 1992 to 2012.

| Country | OPTIMAL <br> IMPLEMENTATION |  |  | TSM |  |  |  |  |  | CSM |  |  |  |  |  | DIFFERENCE |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | JxH | Weight | Construction | Momentum <br> Raw return | Cost - <br> Loser | Cost - <br> Winner | Loser | Winner | Momentum <br> Net return | Momentum <br> Raw return | Cost - <br> Loser | Cost - <br> Winner | Loser | Winner | Momentum <br> Net return | NET RETURN TSM - CSM |
| AUSTRALIA | 9 x 6 | MW | BHAR(0) | 2.38\% | 0.58\% | 0.47\% | 0.55\% | 1.88\% | 1.33\% | 1.54\% | 0.53\% | 0.45\% | 0.68\% | 1.25\% | 0.57\% | 0.76\% |
|  |  |  |  | 5.0943 | 12.3667 | 11.2053 | 1.0345 | 3.2676 | 2.8036 | 2.8656 | 10.8816 | 11.1959 | 1.3300 | 2.6855 | 1.0395 | 1.3122 |
| AUSTRIA | $9 \times 12$ | EW | BHAR(0) | 1.33\% | 0.15\% | 0.13\% | -0.39\% | 0.66\% | 1.05\% | 1.17\% | 0.12\% | 0.12\% | -0.27\% | 0.66\% | 0.93\% | 0.12\% |
|  |  |  |  | 2.5334 | 5.5640 | 5.3852 | -0.7819 | 1.9256 | 2.0199 | 3.2215 | 5.7272 | 5.6728 | -0.8177 | 1.6867 | 2.5529 | 0.3616 |
| BELGIUM | 3x6 | MW | BHAR(1) | 0.86\% | 0.23\% | 0.18\% | 0.13\% | 0.59\% | 0.46\% | 0.57\% | 0.18\% | 0.17\% | 0.51\% | 0.72\% | 0.22\% | 0.24\% |
|  |  |  |  | 1.5368 | 8.3630 | 9.3981 | 0.2659 | 1.2179 | 0.8080 | 1.2342 | 8.9586 | 9.5912 | 0.9841 | 2.1147 | 0.4660 | 0.4759 |
| CANADA | 6 x 9 | MW | BHAR(0) | 3.06\% | 0.42\% | 0.36\% | 0.13\% | 2.41\% | 2.28\% | 1.86\% | 0.38\% | 0.35\% | 0.47\% | 1.60\% | 1.13\% | 1.14\% |
|  |  |  |  | 4.7563 | 7.0787 | 7.0248 | 0.2179 | 3.8265 | 3.4751 | 3.1269 | 7.2038 | 7.1919 | 0.8596 | 3.0699 | 1.8569 | 2.9539 |
| DENMARK | 6x12 | IVOL | BHAR(0) | 1.64\% | 0.18\% | 0.15\% | -0.23\% | 1.07\% | 1.30\% | 1.50\% | 0.17\% | 0.16\% | -0.03\% | 1.15\% | 1.18\% | 0.12\% |
|  |  |  |  | 5.8275 | 5.7452 | 5.5935 | -0.6530 | 3.0110 | 4.5031 | 5.6947 | 5.5705 | 5.6586 | -0.0932 | 3.0767 | 4.3053 | 0.5623 |
| FINLAND | 12x6 | MW | BHAR(0) | 2.85\% | 0.24\% | 0.22\% | 0.25\% | 2.64\% | 2.38\% | 1.72\% | 0.24\% | 0.22\% | 0.47\% | 1.73\% | 1.25\% | 1.13\% |
|  |  |  |  | 3.4246 | 8.6730 | 7.7744 | 0.3660 | 4.0425 | 2.8739 | 2.2456 | 10.0101 | 9.2034 | 0.7232 | 2.3028 | 1.6279 | 1.7901 |
| FRANCE | 9x9 | IVOL | BHAR(0) | 1.12\% | 0.24\% | 0.21\% | 0.48\% | 1.16\% | 0.67\% | 0.99\% | 0.21\% | 0.20\% | 0.53\% | 1.10\% | 0.58\% | 0.09\% |
|  |  |  |  | 4.3878 | 7.4840 | 7.4086 | 1.3973 | 3.6475 | 2.5031 | 3.4665 | 7.1953 | 7.2468 | 1.4395 | 3.3849 | 1.9295 | 0.6249 |
| GERMANY | 6x12 | MW | BHAR(0) | 1.43\% | 0.23\% | 0.20\% | 0.08\% | 1.07\% | 1.00\% | 1.47\% | 0.20\% | 0.19\% | -0.09\% | 0.99\% | 1.07\% | -0.08\% |
|  |  |  |  | 2.7486 | 5.4618 | 5.1760 | 0.1375 | 2.2255 | 1.9197 | 3.2587 | 5.2354 | 5.3071 | -0.1697 | 1.9676 | 2.3552 | -0.2026 |
| GREECE | 3x12 | MW | BHAR(1) | 1.71\% | 0.15\% | 0.16\% | -0.25\% | 1.15\% | 1.40\% | 1.38\% | 0.14\% | 0.12\% | 0.46\% | 1.58\% | 1.12\% | 0.28\% |
|  |  |  |  | 2.1623 | 5.0379 | 5.2156 | -0.3361 | 1.3408 | 1.7747 | 1.5022 | 5.2883 | 5.3960 | 0.5372 | 1.6178 | 1.2187 | 0.3663 |
| HONGKONG | 9 x 9 | MW | BHAR(0) | 1.35\% | 0.37\% | 0.33\% | 1.20\% | 1.86\% | 0.65\% | 0.51\% | 0.34\% | 0.28\% | 1.07\% | 0.95\% | -0.12\% | 0.77\% |
|  |  |  |  | 2.1003 | 7.3601 | 7.3283 | 1.7623 | 2.7195 | 0.9993 | 0.9215 | 7.3346 | 7.2141 | 1.7083 | 1.4378 | -0.2093 | 1.3233 |
| IRELAND | 6x12 | MW | BHAR(0) | 3.52\% | 0.18\% | 0.17\% | -1.08\% | 2.09\% | 3.17\% | 2.36\% | 0.18\% | 0.16\% | -0.11\% | 1.92\% | 2.02\% | 1.15\% |
|  |  |  |  | 3.3624 | 4.7604 | 4.7532 | -1.1691 | 2.5604 | 3.0214 | 2.3081 | 4.7160 | 4.5299 | -0.1404 | 2.4541 | 1.9873 | 1.9602 |
| ISRAEL | 9x12 | MW | BHAR(0) | 2.02\% | 0.20\% | 0.23\% | 0.22\% | 1.81\% | 1.59\% | 1.66\% | 0.19\% | 0.16\% | 0.23\% | 1.54\% | 1.31\% | 0.28\% |
|  |  |  |  | 3.0968 | 5.4669 | 5.0817 | 0.3764 | 2.6930 | 2.4179 | 3.0009 | 5.6391 | 5.5262 | 0.3932 | 2.7378 | 2.3692 | 0.5479 |
| ITALY | 12x6 | MW | BHAR(0) | 2.26\% | 0.21\% | 0.15\% | -0.89\% | 1.01\% | 1.90\% | 1.38\% | 0.15\% | 0.12\% | 0.11\% | 1.22\% | 1.12\% | 0.78\% |
|  |  |  |  | 3.6685 | 10.2911 | 8.8661 | -1.5524 | 1.6811 | 3.0967 | 2.7298 | 10.7226 | 9.1670 | 0.1951 | 2.3315 | 2.2079 | 1.4517 |
| JAPAN | 3x12 | MW | BHAR(0) | 1.09\% | 0.12\% | 0.11\% | -0.59\% | 0.27\% | 0.85\% | 0.24\% | 0.10\% | 0.11\% | 0.16\% | 0.20\% | 0.04\% | 0.81\% |
|  |  |  |  | 2.9597 | 5.6485 | 5.5457 | -1.3030 | 0.5503 | 2.2666 | 0.7032 | 5.6448 | 5.6464 | 0.3816 | 0.4221 | 0.1062 | 3.6487 |
| NETHERLANDS | 6x12 | IVOL | BHAR(0) | 2.17\% | 0.19\% | 0.12\% | -0.84\% | 1.02\% | 1.86\% | 1.42\% | 0.14\% | 0.12\% | 0.10\% | 1.26\% | 1.16\% | 0.70\% |
|  |  |  |  | 6.1297 | 5.1762 | 5.3031 | -1.7883 | 2.1978 | 5.1031 | 5.0848 | 5.3401 | 5.4380 | 0.2622 | 2.7484 | 4.1280 | 2.2860 |
| NEWZEALAND | 12x6 | MW | BHAR(0) | 2.84\% | 0.28\% | 0.24\% | -0.44\% | 1.87\% | 2.31\% | 1.51\% | 0.25\% | 0.21\% | 0.14\% | 1.19\% | 1.05\% | 1.26\% |
|  |  |  |  | 3.6648 | 10.8400 | 11.1266 | -0.8986 | 2.9847 | 2.9731 | 3.0464 | 11.0246 | 11.5907 | 0.3142 | 3.8278 | 2.0919 | 1.8665 |
| NORWAY | $6 \times 12$ | MW | BHAR(0) | 1.30\% | 0.22\% | 0.16\% | 0.71\% | 1.63\% | 0.92\% | 1.65\% | 0.18\% | 0.16\% | 0.45\% | 1.77\% | 1.32\% | -0.39\% |
|  |  |  |  | 2.1253 | 5.3819 | 5.6283 | 0.9477 | 2.6035 | 1.4796 | 3.6658 | 5.4751 | 5.6053 | 0.7740 | 2.7588 | 2.8482 | -0.7861 |
| PORTUGAL | $6 \times 12$ | MW | BHAR(0) | 1.73\% | 0.14\% | 0.19\% | -0.07\% | 1.32\% | 1.40\% | 0.95\% | 0.13\% | 0.12\% | 0.09\% | 0.79\% | 0.70\% | 0.70\% |
|  |  |  |  | 2.1303 | 4.8743 | 3.6227 | -0.1016 | 2.1453 | 1.6989 | 1.5842 | 5.0981 | 5.3660 | 0.1440 | 1.2840 | 1.1472 | 1.0124 |
| SINGAPORE | 3 x 9 | MW | BHAR(0) | 1.26\% | 0.26\% | 0.27\% | 0.51\% | 1.24\% | 0.73\% | 0.70\% | 0.24\% | 0.23\% | 0.70\% | 0.92\% | 0.22\% | 0.50\% |
|  |  |  |  | 2.7756 | 7.3562 | 7.1360 | 0.8746 | 1.9406 | 1.5616 | 1.7045 | 7.3407 | 7.2608 | 1.2346 | 1.7961 | 0.5383 | 0.9587 |
| SPAIN | 12x6 | EW | BHAR(0) | 1.29\% | 0.20\% | 0.18\% | 0.25\% | 1.16\% | 0.91\% | 1.00\% | 0.17\% | 0.15\% | 0.27\% | 0.96\% | 0.68\% | 0.23\% |
|  |  |  |  | 2.7071 | 10.9276 | 9.3148 | 0.4856 | 2.8819 | 1.9188 | 2.9540 | 12.3874 | 12.1255 | 0.6515 | 2.2665 | 1.9958 | 0.6050 |
| SWEDEN | 9x6 | IVOL | CAR(0) | 2.18\% | 0.44\% | 0.38\% | 0.14\% | 1.50\% | 1.36\% | 1.39\% | 0.32\% | 0.27\% | 0.62\% | 1.42\% | 0.79\% | 0.56\% |
|  |  |  |  | 4.7164 | 19.0483 | 12.0311 | 0.2537 | 2.8704 | 2.9015 | 3.2792 | 26.5265 | 31.0804 | 1.1656 | 2.8037 | 1.8729 | 1.9690 |
| SWITZERLAND | 6x12 | EW | BHAR(0) | 1.42\% | 0.15\% | 0.12\% | 0.21\% | 1.36\% | 1.15\% | 1.20\% | 0.12\% | 0.11\% | 0.33\% | 1.30\% | 0.98\% | 0.18\% |
|  |  |  |  | 3.7521 | 5.6532 | 5.4296 | 0.4481 | 3.5662 | 3.0304 | 4.3403 | 5.5229 | 5.5894 | 1.0157 | 3.2222 | 3.5000 | 0.6187 |
| UK | 12x3 | IVOL | CAR(0) | 2.15\% | 0.40\% | 0.39\% | -0.13\% | 1.22\% | 1.36\% | 1.85\% | 0.34\% | 0.31\% | 0.01\% | 1.22\% | 1.20\% | 0.16\% |
|  |  |  |  | 8.8272 | 21.0705 | 19.4509 | -0.3906 | 3.2608 | 5.3578 | 5.8716 | 17.1522 | 17.3715 | 0.0401 | 3.2591 | 3.7155 | 0.9354 |
| US | $6 \times 12$ | MW | BHAR(0) | 0.42\% | 0.15\% | 0.13\% | 1.04\% | 1.18\% | 0.14\% | 0.70\% | 0.13\% | 0.13\% | 0.89\% | 1.34\% | 0.45\% | -0.31\% |
|  |  |  |  | 1.3837 | 5.3964 | 5.5375 | 2.3668 | 2.3582 | 0.4644 | 2.2296 | 5.5225 | 5.5189 | 2.1221 | 2.7211 | 1.4154 | -2.0179 |

### 7.6.2. Comparing performances of time-series and cross-sectional momentum strategies based on the winners

Momentum strategies are implemented by taking a long position for stocks in the winner portfolio and a short position for stocks in the loser portfolio. However, the literature suggests that regulations may outlaw or significantly restrict the ability to build short portfolios in
many of our 24 markets (Chang, Cheng, \& Yu, 2007; Demir, Muthuswamy, \& Walter, 2004; Griffin et al., 2005).

Griffin et al. (2005) point out that in a situation where shorting the losers is restricted, momentum strategies could still make a profit depending on the performance of the long portfolio consisting of the winner stocks. Following their suggestion, this section examines returns for time-series and cross-sectional momentum strategies after the transaction costs of buying stocks in the winner portfolio under the optimal implementation (that is the implementation with the highest aggregate of the after-costs returns) across the time-series and cross-sectional winner portfolios.

In Table 7.12 we report the performance of the time-series (TSM) and cross-sectional (CSM) momentum winner portfolios after the transaction costs for the optimum implementations of the long-only portfolios. We find that only considering the long positions in the winner stocks has only a small impact on the optimal implementations in most markets. The optimal implementation cycle is slightly expanded from a range of between 15 and 18 months to a range of between 12 and 18 months when buying stocks in the winners. The dominant schemes for portfolio weighting scheme and portfolio construction still involve MW (16 markets) and a buy-and-hold strategy (20 markets).

The reported raw returns are before the transaction costs while the net returns are after the transaction costs. We find that a strategy of building a portfolio of winning stocks performs fairly well in their own right. The results suggest that the winner portfolios yield aftertransaction costs returns that are positive for both momentum strategies across all 24 markets. Further the performance is significant in all but two markets (Greece and Japan) for the timeseries momentum strategy, and two markets (Hong Kong and Singapore) for the crosssectional momentum strategy.

Over the testing period, the range of profits from the winner portfolios are between $2.38 \%$ per month in Finland and $0.27 \%$ per month in Japan for the time-series momentum strategy. For the cross-sectional momentum strategy the corresponding profits are $2.37 \%$ in Finland and $0.2 \%$ in Japan. Based on the difference between time-series and cross-sectional momentum strategies (TSM - CSM) in the last column in the table, it can be consistently seen that the time-series momentum strategy outperforms the cross-sectional momentum strategy in 18 out of the 24 markets, but compared to the findings before considering the transaction costs, however, the superior performance of the time-series momentum strategy again is eroded as the difference is only significant in two markets (Australia and Hong Kong).

Table 7.12. Monthly profits from buying stocks in time-series and cross-sectional winners
This table reports optimal implementations, average monthly before-transaction costs (raw) returns and aftertransaction cost (net) returns, transaction costs of the winner portfolios in the time-series (TSM) and crosssectional (CSM) momentum strategies, and the difference of net return between TSM and CSM for each market from 1992 to 2012. The optimum implementation for each market is chosen by aggregating the returns of the winners for time-series and cross-sectional momentum under each implementation and then choosing the one for which this aggregate return was greatest. The Newey-West adjusted t-statistics are reported below the returns.

| Country | OPTIMAL <br> IMPLEMENTATION |  |  | TSM |  |  | CSM |  |  | DIFFERENCE |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | JxH | Weight | Construction | Winner Raw return | Cost - <br> Winner | Winner Net return | Winner Raw return | Cost - <br> Winner | Winner Net return | NET RETURN TSM - CSM |
| AUSTRALIA | 9x3 | MW | BHAR(0) | $\begin{gathered} 2.75 \% \\ 5.2183 \end{gathered}$ | $\begin{gathered} \hline 0.76 \% \\ 14.1990 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.99 \% \\ 3.8201 \end{gathered}$ | $\begin{gathered} 2.04 \% \\ 4.0943 \end{gathered}$ | $\begin{gathered} \hline 0.69 \% \\ 12.9189 \end{gathered}$ | $\begin{gathered} \hline 1.35 \% \\ 2.6627 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.65 \% \\ 2.5417 \\ \hline \end{gathered}$ |
| AUSTRIA | 12x3 | IVOL | CAR(0) | $\begin{gathered} 1.21 \% \\ 3.6148 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.27 \% \\ 17.0585 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.94 \% \\ 2.7880 \\ \hline \end{gathered}$ | $\begin{gathered} 1.14 \% \\ 3.6849 \\ \hline \end{gathered}$ | $\begin{gathered} 0.25 \% \\ 20.6265 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.89 \% \\ 2.8706 \\ \hline \end{gathered}$ | $\begin{gathered} 0.05 \% \\ 0.3493 \\ \hline \end{gathered}$ |
| BELGIUM | 6x12 | IVOL | BHAR(0) | $\begin{gathered} \hline 1.19 \% \\ 3.9297 \end{gathered}$ | $\begin{gathered} \hline 0.10 \% \\ 4.8927 \end{gathered}$ | $\begin{gathered} 1.09 \% \\ 3.5590 \end{gathered}$ | $\begin{gathered} 1.25 \% \\ 4.0071 \end{gathered}$ | $\begin{gathered} \hline 0.09 \% \\ 4.8980 \end{gathered}$ | $\begin{gathered} \hline 1.15 \% \\ 3.6691 \\ \hline \end{gathered}$ | $\begin{aligned} & \hline-0.06 \% \\ & -0.4905 \end{aligned}$ |
| CANADA | 9x3 | MW | CAR(0) | $\begin{gathered} \hline 2.97 \% \\ 5.1047 \\ \hline \end{gathered}$ | $\begin{gathered} 0.67 \% \\ 23.3241 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 2.30 \% \\ 3.9706 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 2.55 \% \\ 4.1742 \\ \hline \end{gathered}$ | $\begin{gathered} 0.59 \% \\ 25.7160 \\ \hline \end{gathered}$ | $\begin{gathered} 1.95 \% \\ 3.1941 \\ \hline \end{gathered}$ | $\begin{aligned} & \hline 0.35 \% \\ & 1.4624 \\ & \hline \end{aligned}$ |
| DENMARK | $9 \times 3$ | MW | CAR(1) | $\begin{gathered} \hline 1.85 \% \\ 3.9573 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.38 \% \\ 13.0640 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.47 \% \\ 3.1223 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.74 \% \\ 4.6799 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.29 \% \\ 18.5237 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.45 \% \\ 3.9227 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.02 \% \\ 0.0859 \\ \hline \end{gathered}$ |
| FINLAND | 6x12 | MW | BHAR(0) | $\begin{gathered} 2.51 \% \\ 3.4578 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.14 \% \\ 5.1492 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 2.38 \% \\ 3.2602 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 2.49 \% \\ 3.4101 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.12 \% \\ 5.1049 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 2.37 \% \\ 3.2440 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.01 \% \\ 0.0158 \\ \hline \end{gathered}$ |
| FRANCE | 9x9 | IVOL | BHAR(0) | $\begin{array}{r} 1.37 \% \\ 4.3388 \\ \hline \end{array}$ | $\begin{gathered} \hline 0.21 \% \\ 7.4086 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.16 \% \\ 3.6475 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.30 \% \\ 3.9973 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.20 \% \\ 7.2468 \end{gathered}$ | $\begin{gathered} \hline 1.10 \% \\ 3.3849 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.05 \% \\ 0.6801 \\ \hline \end{gathered}$ |
| GERMANY | 6x12 | MW | BHAR(0) | $\begin{gathered} \hline 1.27 \% \\ 2.6542 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.20 \% \\ 5.1760 \\ \hline \end{gathered}$ | $\begin{array}{r} \hline 1.07 \% \\ 2.2255 \\ \hline \end{array}$ | $\begin{array}{r} 1.18 \% \\ 2.3595 \\ \hline \end{array}$ | $\begin{gathered} \hline 0.19 \% \\ 5.3071 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.99 \% \\ 1.9676 \end{gathered}$ | $\begin{gathered} \hline 0.08 \% \\ 0.4461 \\ \hline \end{gathered}$ |
| GREECE | 3x12 | MW | BHAR(1) | $\begin{gathered} \hline 1.31 \% \\ 1.5279 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.16 \% \\ 5.2156 \\ \hline \end{gathered}$ | $\begin{gathered} 1.15 \% \\ 1.3408 \\ \hline \end{gathered}$ | $\begin{aligned} & \hline 1.70 \% \\ & 1.7414 \\ & \hline \end{aligned}$ | $\begin{gathered} \hline 0.12 \% \\ 5.3960 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.58 \% \\ 1.6178 \\ \hline \end{gathered}$ | $\begin{gathered} \hline-0.43 \% \\ -0.6507 \\ \hline \end{gathered}$ |
| HONGKONG | 9x9 | MW | BHAR(0) | $\begin{gathered} \hline 2.18 \% \\ 3.1928 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.33 \% \\ 7.3283 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.86 \% \\ 2.7195 \\ \hline \end{gathered}$ | $\begin{gathered} 1.23 \% \\ 1.8665 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.28 \% \\ 7.2141 \\ \hline \end{gathered}$ | $\begin{aligned} & \hline 0.95 \% \\ & 1.4378 \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 0.91 \% \\ & 2.1035 \\ & \hline \end{aligned}$ |
| IRELAND | 6x12 | MW | BHAR(0) | $\begin{array}{r} \hline 2.26 \% \\ 2.7749 \\ \hline \end{array}$ | $\begin{gathered} \hline 0.17 \% \\ 4.7532 \end{gathered}$ | $\begin{gathered} \hline 2.09 \% \\ 2.5604 \\ \hline \end{gathered}$ | $\begin{array}{r} \hline 2.07 \% \\ 2.6551 \\ \hline \end{array}$ | $\begin{aligned} & \hline 0.16 \% \\ & 4.5299 \\ & \hline \end{aligned}$ | $\begin{gathered} \hline 1.92 \% \\ 2.4541 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.18 \% \\ 0.6778 \\ \hline \end{gathered}$ |
| ISRAEL | 9x3 | MW | BHAR(1) | $\begin{aligned} & \hline 2.56 \% \\ & 3.6043 \\ & \hline \end{aligned}$ | $\begin{gathered} \hline 0.61 \% \\ 10.2145 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.95 \% \\ 2.7769 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 2.19 \% \\ 3.9725 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.44 \% \\ 14.8743 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.74 \% \\ 3.1985 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.20 \% \\ 0.4390 \\ \hline \end{gathered}$ |
| ITALY | 12x9 | MW | BHAR(0) | $\begin{array}{r} \hline 1.10 \% \\ 2.1161 \\ \hline \end{array}$ | $\begin{gathered} \hline 0.11 \% \\ 6.1416 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.99 \% \\ 1.9028 \end{gathered}$ | $\begin{gathered} \hline 1.51 \% \\ 2.7897 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.09 \% \\ 6.3831 \end{gathered}$ | $\begin{gathered} 1.42 \% \\ 2.6312 \\ \hline \end{gathered}$ | $\begin{gathered} \hline-0.43 \% \\ -1.2857 \end{gathered}$ |
| JAPAN | 3x12 | MW | BHAR(0) | $\begin{gathered} \hline 0.38 \% \\ 0.7806 \end{gathered}$ | $\begin{gathered} \hline 0.11 \% \\ 5.5457 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.27 \% \\ 0.5503 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.31 \% \\ 0.6389 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.11 \% \\ 5.6464 \end{gathered}$ | $\begin{gathered} \hline 0.20 \% \\ 0.4221 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.07 \% \\ 0.5840 \\ \hline \end{gathered}$ |
| NETHERLANDS | 9x6 | IVOL | BHAR(0) | $\begin{gathered} 1.76 \% \\ 3.2384 \\ \hline \end{gathered}$ | $\begin{aligned} & \hline 0.26 \% \\ & 9.4464 \\ & \hline \end{aligned}$ | $\begin{gathered} \hline 1.50 \% \\ 2.7779 \end{gathered}$ | $\begin{gathered} 1.21 \% \\ 2.9708 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.21 \% \\ 11.2132 \end{gathered}$ | $\begin{gathered} 1.00 \% \\ 2.4411 \\ \hline \end{gathered}$ | $\begin{aligned} & \hline 0.50 \% \\ & 1.4640 \\ & \hline \end{aligned}$ |
| NEWZEALAND | 6x3 | MW | CAR(0) | $\begin{gathered} \hline 2.73 \% \\ 3.7688 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.45 \% \\ 25.3003 \end{gathered}$ | $\begin{aligned} & \hline 2.28 \% \\ & 3.1584 \\ & \hline \end{aligned}$ | $\begin{gathered} \hline 2.11 \% \\ 5.9857 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.38 \% \\ 24.9827 \\ \hline \end{gathered}$ | $\begin{array}{r} \hline 1.73 \% \\ 4.8555 \\ \hline \end{array}$ | $\begin{aligned} & \hline 0.56 \% \\ & 1.0561 \\ & \hline \end{aligned}$ |
| NORWAY | 9x6 | MW | BHAR(1) | $\begin{gathered} 1.88 \% \\ 3.0923 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.33 \% \\ 10.4367 \end{gathered}$ | $\begin{gathered} 1.55 \% \\ 2.5621 \\ \hline \end{gathered}$ | $\begin{gathered} 2.31 \% \\ 3.7092 \end{gathered}$ | $\begin{gathered} 0.26 \% \\ 12.5570 \\ \hline \end{gathered}$ | $\begin{gathered} 2.05 \% \\ 3.2961 \\ \hline \end{gathered}$ | $\begin{gathered} \hline-0.50 \% \\ -1.6141 \end{gathered}$ |
| PORTUGAL | 6x9 | IVOL | BHAR(1) | $\begin{aligned} & \hline 1.90 \% \\ & 3.2291 \\ & \hline \end{aligned}$ | $\begin{gathered} \hline 0.21 \% \\ 6.8504 \end{gathered}$ | $\begin{gathered} \hline 1.69 \% \\ 2.8459 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.75 \% \\ 3.0858 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.19 \% \\ 6.5473 \end{gathered}$ | $\begin{gathered} \hline 1.56 \% \\ 2.7234 \end{gathered}$ | $\begin{gathered} \hline 0.13 \% \\ 0.3735 \\ \hline \end{gathered}$ |
| SINGAPORE | 12x6 | IVOL | BHAR(1) | $\begin{gathered} 1.74 \% \\ 2.4901 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.40 \% \\ 12.2762 \\ \hline \end{gathered}$ | $\begin{gathered} 1.34 \% \\ 1.9172 \\ \hline \end{gathered}$ | $\begin{gathered} 1.20 \% \\ 2.1019 \\ \hline \end{gathered}$ | $\begin{gathered} 0.30 \% \\ 12.4580 \\ \hline \end{gathered}$ | $\begin{aligned} & \hline 0.90 \% \\ & 1.5856 \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 0.44 \% \\ & 1.1469 \\ & \hline \end{aligned}$ |
| SPAIN | $12 \times 6$ | MW | BHAR(0) | $\begin{gathered} \hline 1.67 \% \\ 3.1907 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.18 \% \\ 9.2946 \end{gathered}$ | $\begin{gathered} \hline 1.33 \% \\ 2.7987 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.15 \% \\ 2.4309 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.16 \% \\ 10.2678 \end{gathered}$ | $\begin{gathered} \hline 1.00 \% \\ 2.0977 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.33 \% \\ 0.9033 \\ \hline \end{gathered}$ |
| SWEDEN | 3x9 | MW | BHAR(1) | $\begin{gathered} \hline 1.47 \% \\ 2.3562 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.22 \% \\ 6.6404 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.24 \% \\ 1.9817 \\ \hline \end{gathered}$ | $\begin{aligned} & \hline 2.24 \% \\ & 3.4544 \\ & \hline \end{aligned}$ | $\begin{gathered} \hline 0.19 \% \\ 6.9974 \\ \hline \end{gathered}$ | $\begin{aligned} & \hline 2.05 \% \\ & 3.1664 \end{aligned}$ | $\begin{gathered} \hline-0.80 \% \\ -2.7688 \\ \hline \end{gathered}$ |
| SWITZERLAND | 12x3 | MW | BHAR(0) | $\begin{gathered} 1.88 \% \\ 3.9250 \end{gathered}$ | $\begin{gathered} 0.32 \% \\ 10.9250 \end{gathered}$ | $\begin{gathered} \hline 1.54 \% \\ 3.2552 \end{gathered}$ | $\begin{gathered} \hline 1.45 \% \\ 3.6776 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.22 \% \\ 12.7915 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.23 \% \\ 3.0935 \end{gathered}$ | $\begin{aligned} & \hline 0.31 \% \\ & 1.1102 \\ & \hline \end{aligned}$ |
| UK | 12x6 | IVOL | BHAR(0) | $\begin{gathered} \hline 1.56 \% \\ 3.7523 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.25 \% \\ 11.3960 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.30 \% \\ 3.1360 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.39 \% \\ 3.6215 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.21 \% \\ 11.0682 \end{gathered}$ | $\begin{gathered} \hline 1.18 \% \\ 3.0609 \\ \hline \end{gathered}$ | $\begin{aligned} & \hline 0.12 \% \\ & 1.3472 \end{aligned}$ |
| US | 6x12 | EW | BHAR(0) | $\begin{gathered} \hline 1.70 \% \\ 3.6476 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 0.17 \% \\ 5.3149 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.53 \% \\ 3.2727 \\ \hline \end{gathered}$ | $\begin{aligned} & \hline 1.75 \% \\ & 3.7285 \\ & \hline \end{aligned}$ | $\begin{gathered} \hline 0.17 \% \\ 5.3418 \\ \hline \end{gathered}$ | $\begin{gathered} \hline 1.58 \% \\ 3.3662 \\ \hline \end{gathered}$ | $\begin{array}{r} \hline-0.05 \% \\ -1.1477 \\ \hline \end{array}$ |

### 7.7. Time-series and cross-sectional momentum in "up" and "down" markets after accounting for the transaction costs

When previously analysing raw returns, we find that both the time-series momentum strategy in 17 markets and the cross-sectional momentum strategy in 19 markets perform better in up markets (i.e. as measured by the market performance over the previous 12 months). In this section we repeat the analysis but this time taking account of transaction costs. We continue to define the state of the market based on the index performance over the previous 12 months.

### 7.7.1. Comparing performances of time-series and cross-sectional momentum strategies

Table 7.13 reports the average monthly (raw) returns before the transaction costs, the transaction costs for the winners and losers, and the net return after the transaction costs. The data is given for the time-series (TSM) and cross-sectional (CSM) momentum strategies following up and down market conditions based on the optimal implementations of the strategies (Table 7.11).

The previous finding that shorting losers is more costly than taking long positions in winners is largely maintained for the cross-sectional momentum strategies in both up and down markets. However, this finding is much weaker for the time-series momentum strategies during the periods of down markets. Comparing the aggregate costs of the winners and losers in the two momentum strategies in both up and down market conditions, the time-series momentum consistently produces higher costs than the cross-sectional momentum in both market conditions, with the exceptions of Finland in up markets, and Belgium and Canada in down markets.

In addition, transaction costs in the two momentum strategies are not only asymmetric between the winners and losers, but are also impacted by the ex-ante market conditions. Comparing the aggregate costs of the winners and losers in up and down markets, the costs of the two momentum strategies across 17 markets in the periods when markets have been performing strongly are much lower than those costs in the periods when markets have been performing poorly. One possible explanation for this finding is the different amounts of liquidity available on the buying and selling sides under different market conditions (Chiyachantana, Jain, Jiang, \& Wood, 2004).

The previous findings (Table 5.11) that the performances of the time-series and crosssectional momentum strategies in up markets are stronger than that they are in down markets in the majority of the 24 markets, is consistently true after accounting for the transaction costs. Time-series momentum strategies in 21 markets and cross-sectional momentum strategies in 20 markets yield higher after-transaction costs returns in up markets than the returns in down markets. The exceptions are in Israel, Spain and Switzerland for time-series momentum strategies and in Israel, Japan, Portugal and Spain for cross-sectional momentum strategies.

The last column in Table 7.13 provides a comparison of the after-costs performances of the two momentum strategies under up and down markets in each market. Before accounting for the transaction costs (Table 6.3), we find that the time-series momentum strategy outperforms the cross-sectional momentum in 20 markets ( 9 significant) during up and in 22 markets ( 6 significant) in down market state. Using net returns, we continue to find that the outperformance of the time-series momentum strategy is largely contributed by the superior performance realised during the down markets.

After considering transaction costs, the time-series momentum strategy outperforms the cross-sectional momentum strategy in 20 markets ( 7 significant) following up periods and 16
markets (4 significant) following down periods. However, the average after-costs outperformance of the time-series momentum strategy across the 24 markets drops by $0.1 \%$, to $0.47 \%$ per month from $0.57 \%$ per month in up markets, and it dramatically falls by $0.7 \%$, to $0.46 \%$ per month from $1.16 \%$ per month in down markets. In Section 7.6 , we highlight that outperformance of the time-series momentum strategy is weakened due it experiencing higher transaction costs to those experienced by the cross-sectional momentum strategy. The finding in Table 7.13 indicates that the dilution of the advantage of the time-series momentum strategy is due to the higher transaction costs of the strategy during the down periods.

## Table 7.13. Profitability of momentum strategies in Up and Down markets

The second column in this table shows the aggregate numbers of months when the market is following up (or down) markets for each market. The third column shows the optimal implementation for each market from Table 7.11. Based on the optimal implementation for each market, this table reports the (raw) return before transaction costs and (net) return after transaction costs, average monthly transaction costs of winner and loser portfolios for time-series (TSM) and cross-sectional (CSM) following "up" and "down" states of markets during the 252 months from 1992 to 2012. Following the method employed in Cooper et al. (2004), we defined an "up" ("down") month as one in which the market index has risen (fallen) over the previous 12 months. Newey-West adjusted t -statistics are reported below the returns in the table.

| "UP" MARKETS | $\begin{gathered} \text { NO. OF } \\ \text { MONTHS } \end{gathered}$ | OPTIMAL <br> IMPLEMENTATION |  |  | TSM |  |  |  | CSM |  |  |  | DIFFERENCE |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | JxH | Weight | Construction | Raw return (W-L) | Cost - L | Cost - W | Net return (W-L) | Raw return (W-L) | Cost - L | Cost - W | Net return (W-L) | TSM - CSM |
| AUSTRALIA | 202 | 9 x 6 | MW | BHAR(0) | 2.57\% | 0.59\% | 0.46\% | 1.53\% | 2.18\% | 0.52\% | 0.43\% | 1.23\% | 0.30\% |
|  |  |  |  |  | 5.0812 | 5.8475 | 5.6420 | 2.9327 | 4.7395 | 5.5770 | 5.5918 | 2.6678 | 0.7546 |
| AUSTRIA | 184 | 9x12 | EW | BHAR(0) | 1.39\% | 0.18\% | 0.14\% | 1.07\% | 1.28\% | 0.14\% | 0.14\% | 1.00\% | 0.07\% |
|  |  |  |  |  | 2.1990 | 4.2248 | 4.2304 | 1.6942 | 2.8779 | 4.3139 | 4.2853 | 2.2105 | 0.1661 |
| BELGIUM | 191 | $3 \times 6$ | MW | BHAR(1) | 0.99\% | 0.23\% | 0.17\% | 0.58\% | 0.67\% | 0.17\% | 0.16\% | 0.34\% | 0.25\% |
|  |  |  |  |  | 1.6506 | 4.9567 | 5.1508 | 0.9668 | 1.4932 | 4.9912 | 5.1679 | 0.7444 | 0.4286 |
| CANADA | 230 | 6 x 9 | MW | BHAR(0) | 3.39\% | 0.41\% | 0.35\% | 2.64\% | 2.34\% | 0.36\% | 0.34\% | 1.64\% | 1.00\% |
|  |  |  |  |  | 5.1266 | 4.9884 | 4.9691 | 3.9260 | 4.2739 | 5.0407 | 5.0338 | 2.9366 | 2.4934 |
| DENMARK | 197 | 6x12 | IVOL | BHAR(0) | 1.81\% | 0.17\% | 0.14\% | 1.51\% | 1.56\% | 0.15\% | 0.15\% | $1.26 \%$ | 0.24\% |
|  |  |  |  |  | 6.0099 | 4.0396 | 4.0059 | 5.0281 | 5.1504 | 3.9973 | 4.0283 | $4.1815$ | 1.0024 |
| FINLAND | 181 | 12x6 | MW | BHAR(0) | 3.47\% | 0.23\% | 0.17\% | 3.06\% | 2.19\% | 0.24\% | 0.19\% | 1.76\% | 1.31\% |
|  |  |  |  |  | 3.4862 | 5.1013 | 4.9576 | 3.0851 | 2.6237 | 5.2789 | 4.9232 | 2.0740 | 1.7914 |
| FRANCE | 194 | 9 x 9 | IVOL | BHAR(0) | 1.07\% | 0.22\% | 0.18\% | 0.67\% | 0.98\% | 0.18\% | 0.17\% | 0.63\% | 0.04\% |
|  |  |  |  |  | 4.4638 | 4.6246 | 4.6403 | 2.7283 | 4.5233 | 4.5532 | 4.5542 | 2.8609 | 0.2839 |
| GERMANY | 190 | 6x12 | MW | BHAR(0) | 1.76\% | 0.19\% | 0.14\% | 1.43\% | 1.42\% | 0.16\% | 0.15\% | 1.11\% | 0.32\% |
|  |  |  |  |  | 2.9815 | 3.6670 | 3.6757 | 2.4483 | 2.8572 | 3.6349 | 3.6131 | 2.2165 | 0.7741 |
| GREECE | 154 | $3 \times 12$ | MW | BHAR(1) | 2.58\% | 0.15\% | 0.16\% | 2.27\% | 3.09\% | 0.14\% | 0.13\% | 2.82\% | -0.55\% |
|  |  |  |  |  | 2.3847 | 3.3670 | 3.5025 | 2.1296 | 2.7924 | 3.5050 | 3.4915 | 2.5685 | -0.5216 |
| HONGKONG | 204 | 9x9 | MW | BHAR(0) | 1.42\% | 0.36\% | 0.30\% | 0.76\% | 0.71\% | 0.32\% | 0.26\% | 0.13\% | 0.63\% |
|  |  |  |  |  | 2.1439 | 4.7060 | 4.6646 | 1.1492 | 1.2781 | 4.6724 | 4.6508 | 0.2324 | 1.1147 |
| IRELAND | 212 | 6x12 | MW | BHAR(0) | 3.79\% | 0.18\% | 0.16\% | 3.45\% | 2.87\% | 0.18\% | 0.15\% | 2.54\% | 0.91\% |
|  |  |  |  |  | 3.3520 | 3.7033 | 3.7934 | 3.0459 | 2.6813 | 3.6756 | 3.6444 | 2.3870 | 1.3926 |
| ISRAEL | 199 | 9x12 | MW | BHAR(0) | 1.74\% | 0.22\% | 0.24\% | 1.28\% | 1.33\% | 0.20\% | 0.18\% | 0.95\% | 0.33\% |
|  |  |  |  |  | 2.3992 | 4.0593 | 3.8018 | 1.7315 | 2.5466 | 4.1409 | 4.1553 | 1.8141 | 0.6593 |
| ITALY | 172 | 12x6 | MW | BHAR(0) | 3.05\% | 0.23\% | 0.13\% | 2.69\% | 1.45\% | 0.14\% | 0.11\% | 1.19\% | 1.50\% |
|  |  |  |  |  | 4.2734 | 5.1971 | 4.5479 | 3.8127 | 2.1238 | 5.0698 | 4.7795 | 1.7505 | 2.4464 |
| JAPAN | 146 | $3 \times 12$ | MW | BHAR(0) | 1.07\% | 0.10\% | 0.08\% | 0.88\% | -0.04\% | 0.08\% | 0.08\% | -0.20\% | 1.08\% |
|  |  |  |  |  | 2.1012 | 3.2070 | 3.1205 | 1.6863 | -0.0804 | 3.1493 | 3.1551 | -0.4227 | 3.5877 |
| NETHERLANDS | 202 | 6x12 | IVOL | BHAR(0) | 2.42\% | 0.18\% | 0.11\% | 2.13\% | 1.41\% | 0.12\% | 0.11\% | 1.18\% | 0.95\% |
|  |  |  |  |  | 6.4012 | 3.8585 | 4.0530 | 5.5030 | 5.1849 | 4.1410 | 4.0942 | 4.3916 | 2.7734 |
| NEWZEALAND | 232 | 12x6 | MW | BHAR(0) | 3.08\% | 0.29\% | 0.24\% | 2.55\% | 1.59\% | 0.25\% | 0.22\% | 1.12\% | 1.42\% |
|  |  |  |  |  | 3.7275 | 6.2546 | 6.2826 | 3.0653 | 3.0331 | 6.2294 | 6.3153 | 2.1233 | 2.0216 |
| NORWAY | 196 | 6x12 | MW | BHAR(0) | 1.39\% | 0.22\% | 0.15\% | 1.02\% | 1.91\% | 0.18\% | 0.15\% | 1.58\% | -0.57\% |
|  |  |  |  |  | 2.0169 | 3.8921 | 4.0126 | 1.4536 | 4.0726 | 3.9901 | 4.0056 | 3.3198 | -0.9078 |
| PORTUGAL | 177 | 6x12 | MW | BHAR(0) | 1.74\% | 0.10\% | 0.11\% | 1.53\% | 0.72\% | 0.11\% | 0.11\% | 0.51\% | 1.02\% |
|  |  |  |  |  | 1.8199 | 3.3143 | 3.5265 | 1.5726 | 0.9399 | 3.4415 | 3.4338 | 0.6463 | 1.4357 |
| SINGAPORE | 189 | 3 x 9 | MW | BHAR(0) | 1.80\% | 0.29\% | 0.27\% | 1.25\% | 1.20\% | 0.26\% | 0.23\% | 0.71\% | 0.54\% |
|  |  |  |  |  | 3.6632 | 4.7805 | 4.7429 | 2.5208 | 3.5520 | 4.8472 | 4.7789 | 2.0487 | 1.1384 |
| SPAIN | 167 | 12x6 | EW | BHAR(0) | 1.00\% | 0.22\% | 0.20\% | 0.59\% | 0.98\% | 0.17\% | 0.15\% | 0.66\% | -0.07\% |
|  |  |  |  |  | 1.6912 | 5.3905 | 5.1700 | 0.9971 | 2.7183 | 5.7983 | 5.6908 | 1.8141 | -0.1266 |
| SWEDEN | 196 | 9x6 | IVOL | CAR(0) | 2.43\% | 0.43\% | 0.33\% | 1.67\% | 1.40\% | 0.31\% | 0.27\% | 0.82\% | 0.86\% |
|  |  |  |  |  | 5.3459 | 44.0169 | 40.3871 | 3.6637 | 3.8679 | 54.3451 | 56.4990 | 2.2264 | 2.7170 |
| SWITZERLAND | 195 | 6x12 | EW | BHAR(0) | 1.40\% | 0.15\% | 0.11\% | 1.14\% | 1.34\% | 0.11\% | 0.10\% | 1.12\% | 0.02\% |
|  |  |  |  |  | 3.1628 | 4.0479 | 4.0122 | 2.5832 | 4.6830 | 3.9881 | 4.0365 | 3.9437 | 0.0602 |
| UK | 214 | 12x3 | IVOL | CAR(0) | 2.20\% | 0.41\% | 0.37\% | 1.43\% | 2.01\% | 0.33\% | 0.29\% | 1.38\% | 0.05\% |
|  |  |  |  |  | 9.3196 | 38.7362 | 35.9982 | 5.7717 | 7.1054 | 32.2913 | 32.6316 | 4.8154 | 0.3264 |
| US | 226 | 6x12 | MW | BHAR(0) | 0.59\% | 0.15\% | 0.13\% | 0.31\% | 0.84\% | 0.13\% | 0.13\% | 0.59\% | -0.28\% |
|  |  |  |  |  | 1.9192 | 4.2321 | 4.2916 | 0.9954 | 2.5091 | 4.2995 | 4.2829 | 1.7418 | -1.7948 |


| "DOWN" <br> MARKETS | NO. OF <br> MONTHS | OPTIMAL <br> IMPLEMENTATION |  |  | TSM |  |  |  | CSM |  |  |  | DIFFERENCE |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | JxH | Weight | Construction | Raw return (W-L) | Cost - L | Cost - W | Net return (W-L) | Raw return (W-L) | Cost - L | Cost - W | Net return (W-L) | TSM - CSM |
| AUSTRALIA | 50 | $9 \times 6$ | MW | BHAR(0) | 1.61\% | 0.56\% | 0.54\% | 0.51\% | -1.04\% | 0.55\% | 0.52\% | -2.11\% | 2.62\% |
|  |  |  |  |  | 1.3456 | 3.2387 | 3.1295 | 0.4403 | -0.6112 | 3.1498 | 3.2228 | -1.2387 | 1.1421 |
| AUSTRIA | 68 | $9 \times 12$ | EW | BHAR(0) | 1.18\% | 0.08\% | 0.10\% | 1.01\% | 0.86\% | 0.06\% | 0.06\% | 0.74\% | 0.26\% |
|  |  |  |  |  | 1.2139 | 1.7187 | 1.6531 | 1.0810 | 1.3545 | 1.7382 | 1.7386 | 1.1930 | 0.5022 |
| BELGIUM | 61 | $3 \times 6$ | MW | BHAR(1) | 0.46\% | 0.20\% | 0.19\% | 0.06\% | 0.26\% | 0.23\% | 0.19\% | -0.15\% | 0.22\% |
|  |  |  |  |  | 0.3956 | 3.1308 | 3.1823 | 0.0543 | 0.2274 | 3.2131 | 3.2515 | -0.1287 | 0.2269 |
| CANADA | 22 | 6 x 9 | MW | BHAR(0) | -0.46\% | 0.55\% | 0.47\% | -1.47\% | -3.12\% | 0.57\% | 0.47\% | -4.16\% | 2.68\% |
|  |  |  |  |  | -0.2092 | 1.8176 | 1.7875 | -0.6282 | -1.0520 | 1.8141 | 1.7977 | -1.3396 | 1.7305 |
| DENMARK | 55 | 6x12 | IVOL | BHAR(0) | 1.01\% | 0.22\% | 0.22\% | 0.56\% | 1.27\% | 0.21\% | 0.19\% | 0.87\% | -0.30\% |
|  |  |  |  |  | 1.5267 | 2.2946 | 2.2781 | 0.8125 | 2.1700 | 2.2131 | 2.2250 | 1.3743 | -0.6997 |
| FINLAND | 71 | 12x6 | MW | BHAR(0) | 1.26\% | 0.27\% | 0.35\% | 0.65\% | 0.51\% | 0.24\% | 0.29\% | -0.02\% | 0.67\% |
|  |  |  |  |  | 0.8416 | 3.0916 | 3.2248 | 0.4376 | 0.3094 | 3.3212 | 3.5708 | -0.0148 | 0.4909 |
| FRANCE | 58 | 9x9 | IVOL | BHAR(0) | 1.28\% | 0.29\% | 0.32\% | 0.67\% | 1.02\% | 0.31\% | 0.30\% | 0.41\% | 0.25\% |
|  |  |  |  |  | 1.7543 | 2.8414 | 2.8964 | 0.8476 | 1.0647 | 2.8390 | 2.8860 | 0.4052 | 0.7307 |
| GERMANY | 62 | $6 \times 12$ | MW | BHAR(0) | 0.41\% | 0.38\% | 0.36\% | -0.33\% | 1.61\% | 0.34\% | 0.31\% | 0.96\% | -1.29\% |
|  |  |  |  |  | 0.4412 | 2.6615 | 2.5905 | -0.3533 | 1.5864 | 2.5466 | 2.5985 | 0.9265 | -1.3663 |
| GREECE | 98 | 3x12 | MW | BHAR(1) | 0.36\% | 0.15\% | 0.17\% | 0.03\% | -1.31\% | 0.14\% | 0.10\% | -1.55\% | 1.59\% |
|  |  |  |  |  | 0.3555 | 2.5787 | 2.6189 | 0.0330 | -0.9801 | 2.6524 | 2.8519 | -1.1437 | 1.4754 |
| HONGKONG | 48 | 9x9 | MW | BHAR(0) | 1.04\% | 0.40\% | 0.44\% | 0.20\% | -0.36\% | 0.42\% | 0.37\% | -1.15\% | 1.35\% |
|  |  |  |  |  | 0.5954 | 2.6316 | 2.6611 | 0.1149 | -0.1915 | 2.6406 | 2.5878 | -0.6111 | 0.6838 |
| IRELAND | 40 | $6 \times 12$ | MW | BHAR(0) | 2.10\% | 0.18\% | 0.21\% | 1.71\% | -0.36\% | 0.18\% | 0.18\% | -0.72\% | 2.43\% |
|  |  |  |  |  | 0.7560 | 1.6879 | 1.5553 | 0.6002 | -0.1326 | 1.6867 | 1.4947 | -0.2586 | 1.9155 |
| ISRAEL | 53 | 9x12 | MW | BHAR(0) | 3.05\% | 0.14\% | 0.18\% | 2.74\% | 2.88\% | 0.14\% | 0.10\% | 2.65\% | 0.09\% |
|  |  |  |  |  | 2.3402 | 2.0242 | 2.0483 | 2.0827 | 1.7675 | 2.0451 | 1.9081 | 1.6178 | 0.0625 |
| ITALY | 80 | 12x6 | MW | BHAR(0) | 0.57\% | 0.17\% | 0.20\% | 0.19\% | 1.23\% | 0.15\% | 0.12\% | 0.96\% | -0.76\% |
|  |  |  |  |  | 0.4924 | 3.7039 | 3.8249 | 0.1688 | 1.5521 | 3.9233 | 3.7260 | 1.2095 | -0.7251 |
| JAPAN | 106 | 3x12 | MW | BHAR(0) | 1.12\% | 0.15\% | 0.15\% | 0.81\% | 0.63\% | 0.13\% | 0.13\% | 0.37\% | 0.44\% |
|  |  |  |  |  | 1.7334 | 3.2928 | 3.3274 | 1.2524 | 1.1039 | 3.3489 | 3.3428 | 0.6397 | 1.6252 |
| NETHERLANDS | 50 | 6x12 | IVOL | BHAR(0) | 1.17\% | 0.21\% | 0.16\% | 0.81\% | 1.46\% | 0.20\% | 0.15\% | 1.11\% | -0.30\% |
|  |  |  |  |  | 1.2764 | 1.9469 | 1.9044 | 0.8382 | 1.7960 | 1.9790 | 1.9389 | 1.3130 | -0.5344 |
| NEWZEALAND | 20 | 12x6 | MW | BHAR(0) | -0.01\% | 0.19\% | 0.23\% | -0.43\% | 0.65\% | 0.23\% | 0.18\% | 0.24\% | -0.67\% |
|  |  |  |  |  | -0.0079 | 1.8273 | 1.7705 | -0.2753 | 0.3754 | 1.6597 | 1.8244 | 0.1323 | $-0.3095$ |
| NORWAY | 56 | 6x12 | MW | BHAR(0) | 0.98\% | 0.21\% | 0.18\% | 0.59\% | 0.74\% | 0.18\% | 0.19\% | 0.37\% | 0.21\% |
|  |  |  |  |  | 0.7680 | 2.1437 | 2.2102 | 0.4512 | 0.5838 | 2.0646 | 2.2078 | 0.2899 | 0.2518 |
| PORTUGAL | 75 | 6x12 | MW | BHAR(0) | 1.69\% | 0.23\% | 0.37\% | 1.09\% | 1.48\% | 0.17\% | 0.15\% | 1.15\% | -0.07\% |
|  |  |  |  |  | 1.2603 | 2.6466 | 2.0769 | 0.8176 | 1.4758 | 2.5710 | 2.8129 | 1.1521 | -0.0540 |
| SINGAPORE | 63 | 3 x 9 | MW | BHAR(0) | -0.36\% | 0.20\% | 0.29\% | -0.85\% | -0.80\% | 0.21\% | 0.24\% | -1.24\% | 0.40\% |
|  |  |  |  |  | -0.4080 | 2.5030 | 2.4355 | -0.9134 | -0.6344 | 2.3389 | $2.4690$ | -1.0174 | $0.2609$ |
| SPAIN | 85 | 12x6 | EW | BHAR(0) | 1.87\% | 0.17\% | 0.14\% | 1.56\% | 1.03\% | 0.15\% | 0.14\% | 0.74\% | 0.82\% |
|  |  |  |  |  | 2.4364 | 3.5306 | $3.1876$ | 2.0507 | 1.5447 | 3.4249 | 3.4804 | 1.1064 | 2.0502 |
| SWEDEN | 56 | $9 \times 6$ | IVOL | CAR(0) | 1.30\% | 0.50\% | 0.54\% | 0.26\% | 1.34\% | 0.35\% | 0.28\% | 0.71\% | -0.45\% |
|  |  |  |  |  | 1.1989 | 10.9710 | 8.6942 | 0.2367 | 1.1561 | 20.7305 | 25.6669 | 0.6192 | -0.7489 |
| SWITZERLAND | 57 | 6x12 | EW | BHAR(0) | 1.49\% | 0.15\% | 0.15\% | 1.18\% | 0.75\% | 0.14\% | 0.13\% | 0.48\% | 0.70\% |
|  |  |  |  |  | 1.9411 | 2.1576 | 2.1263 | 1.4919 | 1.1015 | 2.1661 | 2.1489 | 0.6746 | 1.6918 |
| UK | 38 | 12x3 | IVOL | CAR(0) | 1.83\% | 0.35\% | 0.52\% | 0.96\% | 0.98\% | 0.41\% | 0.38\% | 0.19\% | 0.77\% |
|  |  |  |  |  | 2.0885 | 27.2867 | 23.0830 | 1.0814 | 0.7864 | 22.9164 | 22.7591 | 0.1463 | 1.0733 |
| US | 26 | 6x12 | MW | BHAR(0) | -1.06\% | 0.11\% | 0.12\% | -1.30\% | -0.51\% | 0.12\% | 0.11\% | -0.74\% | -0.55\% |
|  |  |  |  |  | -1.3216 | 1.4192 | 1.4326 | -1.6489 | -0.6802 | 1.3820 | 1.4363 | -1.0493 | -0.9763 |

### 7.7.2. Comparing performances of time-series and cross-sectional momentum strategies based on the winners

Table 7.14 reports the time-series (TSM) and cross-sectional (CSM) momentum strategies
based on the optimal implementations in Table 7.12 solely based on the long-only portfolios of winning stocks during up and down markets. The raw return indicates the momentum returns before the transaction costs for each market and the net returns indicate the returns after transaction costs are considered.

Comparing the transaction costs between the optimal time-series and cross-sectional momentum strategies in both market conditions, the results are largely unchanged in that the time-series momentum strategy produces higher costs than the cross-sectional momentum strategy except in up markets in Germany and down markets in Spain. The transaction costs for the time-series momentum strategy in up markets is higher than they are in down markets in 23 markets. The transaction costs for the cross-sectional momentum strategy in up markets is higher than the costs in down markets in 15 markets.

In the periods when markets have been performing strongly, both momentum strategies under optimal implementations yield significant positive after-transaction cost returns across the markets with the exception of Japan for the time-series momentum strategy, and Hong Kong and Japan for the cross-sectional momentum strategy. The range of the return for the timeseries momentum strategy is from $3.11 \%$ per months in Finland to $0.1 \%$ per month in Japan. The same range for the cross-sectional momentum strategy is from $3.35 \%$ per month in Finland to $0.03 \%$ per month in Japan. In the periods when markets have been performing poorly, the time-series momentum strategy yields significant returns only in Australia at the 5\% level and in Israel at the $10 \%$ level, and the cross-sectional momentum strategy does not produce significant returns in any of the markets. Consistent with the results before the transaction costs that we find in Chapter 6, the two momentum strategies perform more strongly in up markets than in down markets.

The last column (TSM - CSM) in Table 7.14 compares the performances of the two strategies for up and down markets. Although the findings are consistent with our previous results based on raw returns which show that the time-series momentum strategy outperforms the cross-sectional momentum strategy in the majority of markets, with the introduction of
transaction costs, the advantage of the time-series momentum strategy largely disappears in up markets and is significantly weakened in down markets.

## Table 7.14. Profitability from buying stocks from momentum winners in up and down markets

The second column in this table shows the aggregate numbers of months when the market is following up (or down) markets for each market. The third column shows the optimal implementation for each market from Table 7.12. Based on the optimal implementation for each market, this table reports the (raw) return before transaction costs and net return after transaction costs, average monthly transaction costs of winner and loser portfolios for time-series (TSM) and cross-sectional (CSM) following "up" and "down" states of markets during the 252 months from 1992 to 2012. Following the method employed in Cooper et al. (2004), we defined an "up" ("down") month as one in which the market index has risen (fallen) over the previous 12 months. Newey-West adjusted t -statistics are reported below the returns in the table.

| "UP" MARKETS | NO. OF MONTHS | OPTIMAL <br> IMPLEMENTATION |  |  | TSM |  |  | CSM |  |  | DIFFERENCE |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | JxH | Weight | Construction | Raw return <br> (W) | Cost - W | Net return <br> (W) | Raw return (W) | Cost - W | Net return <br> (W) | TSM - CSM |
| AUSTRALIA | 202 | 9x3 | MW | BHAR(0) | 2.60\% | 0.75\% | 1.85\% | 2.27\% | 0.70\% | 1.57\% | 0.27\% |
|  |  |  |  |  | 5.4385 | 8.7320 | 3.9036 | 4.3257 | 8.2985 | 3.0395 | 1.1720 |
| AUSTRIA | 184 | 12x3 | IVOL | CAR(0) | 1.51\% | 0.26\% | 1.25\% | 1.51\% | 0.25\% | 1.26\% | -0.01\% |
|  |  |  |  |  | 4.9396 | 27.9514 | 4.1104 | 4.7324 | 30.4855 | 3.9644 | -0.0735 |
| BELGIUM | 191 | 6x12 | IVOL | BHAR(0) | 1.71\% | 0.08\% | 1.63\% | 1.76\% | 0.08\% | 1.68\% | -0.05\% |
|  |  |  |  |  | 6.3834 | 3.5444 | 6.0136 | 6.4380 | 3.5549 | 6.1385 | -0.3347 |
| CANADA | 230 | 9x3 | MW | CAR(0) | 3.02\% | 0.65\% | 2.37\% | 2.73\% | 0.59\% | 2.15\% | 0.22\% |
|  |  |  |  |  | 5.8095 | 39.2428 | 4.5612 | 5.2282 | 39.0758 | 4.1084 | 1.2101 |
| DENMARK | 197 | 9x3 | MW | CAR(1) | 2.02\% | 0.33\% | 1.69\% | 1.91\% | 0.27\% | 1.63\% | 0.06\% |
|  |  |  |  |  | 5.4378 | 19.6481 | 4.5420 | 4.9666 | 25.0442 | 4.2519 | 0.4119 |
| FINLAND | 181 | 6x12 | MW | BHAR(0) | 3.24\% | 0.13\% | 3.11\% | 3.47\% | 0.12\% | 3.35\% | -0.24\% |
|  |  |  |  |  | 5.9022 | 3.6303 | 5.6520 | 5.1690 | 3.5981 | 4.9800 | -0.6057 |
| FRANCE | 194 | 9x9 | IVOL | BHAR(0) | 1.73\% | 0.18\% | 1.55\% | 1.69\% | 0.17\% | 1.52\% | 0.03\% |
|  |  |  |  |  | 5.9659 | 4.6403 | 5.2785 | 5.4092 | 4.5542 | 4.8333 | 0.3473 |
| GERMANY | 190 | 6x12 | MW | BHAR(0) | 1.73\% | 0.14\% | 1.58\% | 1.58\% | 0.15\% | 1.43\% | 0.16\% |
|  |  |  |  |  | 4.1927 | 3.6757 | 3.8553 | 3.3582 | 3.6131 | 3.0584 | 0.7568 |
| GREECE | 154 | 3x12 | MW | BHAR(1) | 2.25\% | 0.16\% | 2.09\% | 3.44\% | 0.13\% | 3.31\% | -1.22\% |
|  |  |  |  |  | 2.2083 | 3.5025 | 2.0600 | 3.0906 | 3.4915 | 2.9744 | -1.7030 |
| HONGKONG | 204 | 9x9 | MW | BHAR(0) | 1.97\% | 0.30\% | 1.67\% | 1.22\% | 0.26\% | 0.95\% | 0.72\% |
|  |  |  |  |  | 3.1896 | 4.6646 | 2.6786 | 2.0365 | 4.6508 | 1.6013 | 2.0091 |
| IRELAND | 212 | 6x12 | MW | BHAR(0) | 2.64\% | 0.16\% | 2.47\% | 2.39\% | 0.15\% | 2.23\% | 0.24\% |
|  |  |  |  |  | 3.7388 | 3.7934 | 3.5037 | 3.4922 | 3.6444 | 3.2681 | 0.8658 |
| ISRAEL | 199 | 9x3 | MW | BHAR(1) | 2.09\% | 0.53\% | 1.56\% | 2.22\% | 0.45\% | 1.77\% | -0.21\% |
|  |  |  |  |  | 3.3881 | 7.6623 | 2.5534 | 3.6551 | 8.4414 | 2.9422 | -0.6651 |
| ITALY | 172 | 12x9 | MW | BHAR(0) | 1.68\% | 0.11\% | 1.57\% | 2.15\% | 0.09\% | 2.06\% | -0.50\% |
|  |  |  |  |  | 2.9060 | 3.8668 | 2.7250 | 3.5272 | 4.1053 | 3.3886 | -1.1739 |
| JAPAN | 146 | 3x12 | MW | BHAR(0) | 0.18\% | 0.08\% | 0.10\% | 0.12\% | 0.08\% | 0.03\% | 0.06\% |
|  |  |  |  |  | 0.3224 | 3.1205 | 0.1730 | 0.1987 | 3.1551 | 0.0557 | 0.4475 |
| NETHERLANDS | 202 | 9x6 | IVOL | BHAR(0) | 1.63\% | 0.22\% | 1.41\% | 1.59\% | 0.18\% | 1.41\% | 0.00\% |
|  |  |  |  |  | 4.7497 | 5.3597 | 4.0548 | 4.6848 | 5.7887 | 4.1008 | -0.0198 |
| NEWZEALAND | 232 | 6x3 | MW | CAR(0) | 2.77\% | 0.43\% | 2.34\% | 2.31\% | 0.38\% | 1.93\% | 0.41\% |
|  |  |  |  |  | 5.5709 | 35.1204 | 4.7073 | 6.7094 | 36.5825 | 5.5919 | 1.1832 |
| NORWAY | 196 | 9x6 | MW | BHAR(1) | 2.10\% | 0.30\% | 1.80\% | 2.60\% | 0.24\% | 2.35\% | -0.55\% |
|  |  |  |  |  | 3.3762 | 5.4753 | 2.9086 | 4.2265 | 5.8637 | 3.8434 | -1.8565 |
| PORTUGAL | 177 | 6x9 | IVOL | BHAR(1) | 2.34\% | 0.20\% | 2.14\% | 2.32\% | 0.17\% | 2.14\% | 0.00\% |
|  |  |  |  |  | 3.3238 | 4.3398 | 3.0320 | 3.6775 | 4.3694 | 3.3850 | -0.0027 |
| SINGAPORE | 189 | 12x6 | IVOL | BHAR(1) | 1.85\% | 0.38\% | 1.48\% | 1.53\% | 0.29\% | 1.24\% | 0.23\% |
|  |  |  |  |  | 3.1985 | 5.6596 | 2.5227 | 2.8718 | 5.6715 | 2.3052 | 0.9943 |
| SPAIN | 167 | 12x6 | MW | BHAR(0) | 1.95\% | 0.20\% | 1.68\% | 1.54\% | 0.16\% | 1.38\% | 0.30\% |
|  |  |  |  |  | 3.4160 | 5.2118 | 3.0939 | 2.6790 | 5.4969 | 2.4166 | 0.7461 |
| SWEDEN | 196 | 3x9 | MW | BHAR(1) | 2.10\% | 0.20\% | 1.90\% | 2.82\% | 0.19\% | 2.63\% | -0.74\% |
|  |  |  |  |  | 3.7105 | 4.6240 | 3.3655 | 5.0944 | 4.5900 | 4.8047 | -2.2324 |
| SWITZERLAND | 195 | 12x3 | MW | BHAR(0) | 2.08\% | 0.28\% | 1.80\% | 1.85\% | 0.20\% | 1.65\% | 0.15\% |
|  |  |  |  |  | 4.9747 | 8.0265 | 4.3110 | 4.3658 | 8.0057 | 3.8882 | 0.6892 |
| UK | 214 | 12x6 | IVOL | BHAR(0) | 1.74\% | 0.23\% | 1.52\% | 1.61\% | 0.19\% | 1.42\% | 0.10\% |
|  |  |  |  |  | 5.9457 | 5.9683 | 5.1441 | 5.3715 | 5.8541 | 4.7333 | 1.3576 |
| US | 226 | 6x12 | EW | BHAR(0) | 1.77\% | 0.18\% | 1.59\% | 1.79\% | 0.17\% | 1.62\% | -0.03\% |
|  |  |  |  |  | 4.4949 | 4.1804 | 4.0447 | 4.3652 | 4.1896 | 3.9523 | -0.6987 |


| "DOWN" <br> MARKETS | NO. OF MONTHS | OPTIMAL <br> IMPLEMENTATION |  |  | TSM |  |  | CSM |  |  | DIFFERENCE |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | JxH | Weight | Construction | Raw return <br> (W) | Cost - W | Net return <br> (W) | Raw return <br> (W) | Cost - W | Net return (W) | TSM - CSM |
| AUSTRALIA | 50 | 9x3 | MW | $\operatorname{BHAR}(0)$ | 3.37\% | 0.78\% | 2.59\% | 1.13\% | 0.69\% | 0.44\% | 2.15\% |
|  |  |  |  |  | 2.5150 | 4.1022 | 1.9827 | 1.1899 | 4.3293 | 0.4577 | 2.5108 |
| AUSTRIA | 68 | 12x3 | IVOL | CAR(0) | 0.41\% | 0.32\% | 0.09\% | 0.15\% | 0.27\% | -0.12\% | 0.22\% |
|  |  |  |  |  | 0.6717 | 12.4876 | 0.1510 | 0.5805 | 14.2588 | -0.4812 | 0.4196 |
| BELGIUM | 61 | 6x12 | IVOL | BHAR(0) | -0.43\% | 0.15\% | -0.59\% | -0.36\% | 0.14\% | -0.50\% | -0.08\% |
|  |  |  |  |  | -0.8007 | 2.3010 | -1.0770 | -0.6442 | 2.2902 | -0.8924 | -0.4438 |
| CANADA | 22 | $9 \times 3$ | MW | CAR(0) | 2.37\% | 0.85\% | 1.53\% | 0.60\% | 0.69\% | -0.09\% | 1.61\% |
|  |  |  |  |  | 1.4578 | 12.9951 | 0.9463 | 0.3028 | 14.4676 | -0.0453 | 1.5816 |
| DENMARK | 55 | $9 \times 3$ | MW | CAR(1) | 1.24\% | 0.53\% | 0.71\% | 1.15\% | 0.33\% | 0.82\% | -0.11\% |
|  |  |  |  |  | 0.9144 | 11.7788 | 0.5194 | 1.4578 | 12.1888 | 1.0385 | -0.1213 |
| FINLAND | 71 | 6x12 | MW | BHAR(0) | 0.67\% | 0.15\% | 0.52\% | 0.01\% | 0.12\% | -0.11\% | 0.63\% |
|  |  |  |  |  | 0.4317 | 2.3284 | 0.3304 | 0.0073 | 2.3189 | -0.0787 | 0.9322 |
| FRANCE | 58 | 9x9 | IVOL | BHAR(0) | 0.15\% | 0.32\% | -0.17\% | 0.01\% | 0.30\% | -0.28\% | 0.11\% |
|  |  |  |  |  | 0.3122 | 2.8964 | -0.3313 | 0.0257 | 2.8860 | -0.5752 | 0.6030 |
| GERMANY | 62 | 6x12 | MW | BHAR(0) | -0.13\% | 0.36\% | -0.50\% | -0.04\% | 0.31\% | -0.35\% | -0.14\% |
|  |  |  |  |  | -0.1250 | 2.5905 | -0.4657 | -0.0464 | 2.5985 | -0.3641 | -0.4318 |
| GREECE | 98 | 3x12 | MW | BHAR(1) | -0.17\% | 0.17\% | -0.34\% | -1.05\% | 0.10\% | -1.15\% | 0.81\% |
|  |  |  |  |  | -0.1572 | 2.6189 | -0.3240 | -1.1798 | 2.8519 | -1.2981 | 1.0161 |
| HONGKONG | 48 | 9x9 | MW | BHAR(0) | 3.08\% | 0.44\% | 2.64\% | 1.31\% | 0.37\% | 0.94\% | 1.70\% |
|  |  |  |  |  | 1.5799 | 2.6611 | 1.3447 | 0.7791 | 2.5878 | 0.5533 | 1.3866 |
| IRELAND | 40 | 6x12 | MW | BHAR(0) | 0.28\% | 0.21\% | 0.07\% | 0.41\% | 0.18\% | 0.23\% | -0.16\% |
|  |  |  |  |  | 0.1298 | 1.5553 | 0.0329 | 0.2072 | 1.4947 | 0.1164 | -0.3182 |
| ISRAEL | 53 | 9x3 | MW | BHAR(1) | 4.32\% | 0.93\% | 3.39\% | 2.04\% | 0.41\% | 1.63\% | 1.76\% |
|  |  |  |  |  | 2.3229 | 3.9083 | 1.8123 | 2.0378 | 4.3058 | 1.6394 | 1.1123 |
| ITALY | 80 | 12x9 | MW | BHAR(0) | -0.14\% | 0.12\% | -0.26\% | 0.11\% | 0.08\% | 0.03\% | -0.29\% |
|  |  |  |  |  | -0.1381 | 2.9310 | -0.2572 | 0.1440 | 2.8017 | 0.0415 | -0.3136 |
| JAPAN | 106 | 3x12 | MW | BHAR(0) | 0.65\% | 0.15\% | 0.50\% | 0.57\% | 0.13\% | 0.43\% | 0.07\% |
|  |  |  |  |  | 0.8211 | 3.3274 | 0.6335 | 0.7589 | 3.3428 | 0.5857 | 0.2609 |
| NETHERLANDS | 50 | 9x6 | IVOL | BHAR(0) | 2.33\% | 0.42\% | 1.86\% | -0.33\% | 0.32\% | -0.65\% | 2.51\% |
|  |  |  |  |  | 1.1956 | 3.0719 | 0.9779 | -0.4228 | 3.1430 | -0.8020 | 1.6083 |
| NEWZEALAND | 20 | 6x3 | MW | CAR(0) | 2.23\% | 0.57\% | 1.66\% | -0.30\% | 0.37\% | -0.67\% | 2.33\% |
|  |  |  |  |  | 1.1571 | 15.8270 | 0.8635 | -0.3314 | 17.2220 | -0.7446 | 1.2881 |
| NORWAY | 56 | 9x6 | MW | BHAR(1) | 1.11\% | 0.44\% | 0.68\% | 1.29\% | 0.33\% | 0.96\% | -0.29\% |
|  |  |  |  |  | 0.6674 | 3.1819 | 0.4149 | 1.0628 | 3.2972 | 0.8124 | -0.2781 |
| PORTUGAL | 75 | 6x9 | IVOL | BHAR(1) | 0.86\% | 0.24\% | 0.62\% | 0.41\% | 0.23\% | 0.19\% | 0.43\% |
|  |  |  |  |  | 0.8279 | 2.8947 | 0.5986 | 0.4592 | 2.6689 | 0.2086 | 0.5330 |
| SINGAPORE | 63 | 12x6 | IVOL | BHAR(1) | 1.40\% | 0.47\% | 0.93\% | 0.20\% | 0.31\% | -0.12\% | 1.04\% |
|  |  |  |  |  | 0.9274 | 3.5173 | 0.6116 | 0.2201 | 3.5282 | -0.1285 | 0.8910 |
| SPAIN | 85 | 12x6 | MW | BHAR(0) | 0.99\% | 0.14\% | 0.64\% | 0.39\% | 0.15\% | 0.24\% | 0.40\% |
|  |  |  |  |  | 1.4869 | 3.1000 | 1.2052 | 0.5761 | 3.2287 | 0.3560 | 0.6237 |
| SWEDEN | 56 | 3x9 | MW | BHAR(1) | -0.75\% | 0.29\% | -1.04\% | 0.19\% | 0.18\% | 0.01\% | -1.04\% |
|  |  |  |  |  | -0.5207 | 2.3535 | -0.7181 | 0.1385 | 2.5353 | 0.0039 | -1.4185 |
| SWITZERLAND | 57 | 12x3 | MW | BHAR(0) | 1.17\% | 0.44\% | 0.66\% | 0.09\% | 0.28\% | -0.18\% | 0.84\% |
|  |  |  |  |  | 0.9326 | 4.2962 | 0.5514 | 0.1402 | 4.7557 | -0.2744 | 0.8887 |
| UK | 38 | 12x6 | IVOL | BHAR(0) | 0.51\% | 0.39\% | 0.11\% | 0.15\% | 0.31\% | -0.16\% | 0.27\% |
|  |  |  |  |  | 0.4221 | 2.8163 | 0.0945 | 0.1554 | 2.7733 | -0.1555 | 0.7872 |
| US | 26 | 6x12 | EW | BHAR(0) | 1.17\% | 0.13\% | 1.04\% | 1.39\% | 0.13\% | 1.25\% | -0.22\% |
|  |  |  |  |  | 0.4939 | 1.4374 | 0.4372 | 0.5967 | 1.4432 | 0.5378 | -1.0861 |

### 7.8. An alternative approach: Break-even transaction costs

In previous sections, the transaction costs that have been estimated using LOT Y-split model are those for the marginal investor. One deficiency of this approach is that not all investors face the same transaction costs and so the transaction costs that we report above do not apply across the whole investor spectrum. One way to address this issue is to calculate the break-
even transaction costs for each implementation of the two momentum strategies. The breakeven transaction cost is that rate which would reduce the return on the implementation to zero based on the "actual" turnover generated by the implementation (Yufeng, H., Ke, Y., \& Guofu, Z., 2013), One particular advantage of this approach is that it allows every investors to compare their estimate of their own transaction costs with the break-even transaction cost in order to see whether they might expect to earn a profit from implementing the momentum strategy.

The "actual" turnover is based on the difference in weights between stocks in the portfolio at the end of one holding period and the weights in targeted portfolio at the beginning of the subsequent period. Knowing these two portfolios, the purchases and sale of stocks can be calculated and they equate with the actual transactions that would take place if the strategy was being implemented. Then, the break-even transaction cost is estimating by dividing the before-transaction cost return obtained from Chapter five by the aggregate of the actual turnover for both the winner and loser portfolios. The actual turnover and break-even transaction costs for each implementation are reported in the Table 7.7-7.9 in the Appendix.

Table 7.15 below compares the actual turnovers and break-even transaction costs of the timeseries (TSM) and cross-sectional (CSM) momentum strategies for what we refer to as the optimal implementations (see table 5.11). One important observation to be taken from Table 7.15 is that the level of turnover generated by time-series momentum is about $10 \%$ higher than what it is for cross-sectional momentum. Indeed, time-series momentum proves to have the higher turnover in 22 of the 24 with the exceptions being in Finland and Ireland. Despite typically having the higher turnover, time-series momentum has the higher break-even transaction costs in 19 of the 24 markets. However, the higher turnover ratio has little impact on the superior performance of the time-series momentum strategy in terms of the break-even
transaction costs. The last column in the table reports the difference in break-even transaction costs between the time-series and cross-sectional momentum strategies. In the case of timeseries momentum strategies it can be seen that the break-even costs are higher than crosssectional momentum strategies in 19 markets with the exceptions being Belgium, Denmark, Germany, Switzerland and the UK. This is consistent with our previous finings that timeseries momentum remains the better performing strategy after incorporating transactions costs even through the extent of its superiority is eroded by their introduction

## Table 7.15. Break-even transaction costs for optimal time-series and cross-sectional strategies

The optimal implementations are based on before-transaction costs returns in table 5.11. The column (W-L) shows the raw returns, T/O represents the actual turnover ratio for the winner and loser portfolios. The column (Breakeven) shows the Break-even transaction costs, where the costs is calculated by the raw return over the sum of actual turnover ratios on the winner and loser portfolios. The last column shows the difference in breakeven costs between the time-series and cross-sectional momentum strategies under optimal implementation for each market.

| Country | Optimal implementation |  |  | Time-series |  |  |  | Cross-sectional |  |  |  | Breakeven Difference |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | JxH | Weight | Construction | W - L | T/0 (L) | (T/0) W | Breakeven | W - L | T/O (L) | (T/0) W | Breakeven | TSM - CSM |
| AUSTRALIA | $9 \times 3$ | MW | BHAR(0) | 2.76\% | 47.21\% | 39.33\% | 3.19\% | 1.86\% | 43.28\% | 39.03\% | 2.26\% | 0.93\% |
| AUSTRIA | $12 \times 3$ | IVOL | CAR(0) | 1.57\% | 40.46\% | 40.11\% | 1.95\% | 1.40\% | 38.30\% | 37.46\% | 1.84\% | 0.11\% |
| BELGIUM | $12 \times 3$ | IVOL | CAR(1) | 1.79\% | 37.87\% | 36.88\% | 2.39\% | 1.63\% | 30.68\% | 29.25\% | 2.72\% | -0.32\% |
| CANADA | $9 \times 3$ | MW | BHAR(0) | 3.13\% | 47.24\% | 39.50\% | 3.61\% | 2.06\% | 42.37\% | 35.80\% | 2.63\% | 0.98\% |
| DENMARK | $9 \times 3$ | IVOL | BHAR(1) | 2.00\% | 41.51\% | 37.32\% | 2.54\% | 1.74\% | 30.86\% | 30.47\% | 2.83\% | -0.30\% |
| FINLAND | $12 \times 6$ | MW | BHAR(0) | 2.85\% | 21.15\% | 19.62\% | 6.98\% | 1.72\% | 23.32\% | 21.89\% | 3.80\% | 3.19\% |
| FRANCE | $9 \times 3$ | IVOL | CAR(1) | 1.43\% | 42.13\% | 43.29\% | 1.68\% | 1.11\% | 38.66\% | 38.25\% | 1.44\% | 0.24\% |
| GERMANY | 12x3 | IVOL | CAR(0) | 1.85\% | 38.09\% | 36.91\% | 2.46\% | 1.62\% | 32.30\% | 30.73\% | 2.57\% | -0.11\% |
| GREECE | $3 \times 12$ | MW | BHAR(1) | 1.71\% | 43.48\% | 44.04\% | 1.96\% | 1.38\% | 36.50\% | 35.53\% | 1.91\% | 0.04\% |
| HONGKONG | $6 \times 3$ | MW | BHAR(0) | 2.21\% | 53.67\% | 50.01\% | 2.13\% | 1.34\% | 49.53\% | 44.77\% | 1.42\% | 0.71\% |
| IRELAND | 6x12 | MW | BHAR(0) | 3.52\% | 27.94\% | 27.40\% | 6.36\% | 2.36\% | 30.23\% | 29.09\% | 3.98\% | 2.38\% |
| ISRAEL | $9 \times 12$ | MW | BHAR(0) | 2.02\% | 46.92\% | 42.31\% | 2.26\% | 1.66\% | 44.68\% | 37.12\% | 2.03\% | 0.23\% |
| ITALY | $12 \times 6$ | MW | BHAR(0) | 2.26\% | 40.25\% | 37.45\% | 2.91\% | 1.38\% | 27.91\% | 27.34\% | 2.49\% | 0.42\% |
| JAPAN | 3x12 | MW | BHAR(0) | 1.09\% | 15.37\% | 14.81\% | 3.60\% | 0.24\% | 14.23\% | 14.45\% | 0.85\% | 2.75\% |
| NETHERLANDS | 9x3 | EW | BHAR(1) | 2.40\% | 41.31\% | 43.41\% | 2.83\% | 1.58\% | 31.20\% | 31.63\% | 2.52\% | 0.31\% |
| NEWZEALAND | $12 \times 3$ | IVOL | BHAR(0) | 2.82\% | 44.88\% | 44.08\% | 3.17\% | 1.73\% | 41.11\% | 40.65\% | 2.12\% | 1.05\% |
| NORWAY | $9 \times 3$ | IVOL | BHAR(0) | 2.07\% | 43.31\% | 41.96\% | 2.43\% | 1.57\% | 35.94\% | 35.03\% | 2.21\% | 0.22\% |
| PORTUGAL | $6 \times 6$ | MW | BHAR(1) | 2.08\% | 28.45\% | 30.05\% | 3.56\% | 0.89\% | 29.04\% | 28.27\% | 1.55\% | 2.00\% |
| SINGAPORE | $9 \times 3$ | IVOL | BHAR(0) | 1.64\% | 43.75\% | 44.07\% | 1.87\% | 0.87\% | 35.96\% | 34.73\% | 1.23\% | 0.64\% |
| SPAIN | $12 \times 6$ | EW | BHAR(0) | 1.29\% | 20.99\% | 22.04\% | 3.01\% | 1.00\% | 18.84\% | 19.39\% | 2.61\% | 0.40\% |
| SWEDEN | $12 \times 3$ | IVOL | BHAR(1) | 2.81\% | 38.27\% | $37.01 \%$ | 3.73\% | 1.37\% | 31.00\% | 29.99\% | 2.25\% | 1.48\% |
| SWITZERLAND | $12 \times 3$ | EW | $\operatorname{CAR}(0)$ | 1.75\% | 37.84\% | 36.37\% | 2.36\% | 1.32\% | 26.10\% | 26.07\% | 2.52\% | -0.16\% |
| UK | $12 \times 3$ | IVOL | CAR(0) | 2.15\% | 36.45\% | 36.34\% | 2.95\% | 1.85\% | 32.27\% | 30.22\% | 2.96\% | -0.01\% |
| US | $9 \times 3$ | MW | CAR(1) | 0.87\% | 48.07\% | 40.22\% | 0.99\% | 0.64\% | 42.72\% | 36.23\% | 0.82\% | 0.17\% |

### 7.9. Conclusion

Previous chapters have found that both momentum strategies produce positive returns for the 24 markets but that the time-series momentum strategy produces the best investment outcomes largely driven by its better performance during period when markets are performing poorly. In order to investigate whether the apparent profitability of these strategies is exploitable by investors, we have repeated much of the previous analysis but this time is on an after-transaction costs basis.

From a practical perspective, some studies question the viability of momentum strategies for two reasons. One is that momentum strategies may not be profitable after transaction costs are considered (Lesmond et al., 2004). The other is that momentum strategies may not be profitable if short sales are prohibited (Alexander, 2000). This chapter examines both momentum strategies after addressing these concerns. Compared with the study in Lesmond et al. (2004), this study investigates a large number of implementation approaches that have been employed in the majority of momentum literature for each market and applies the more precise transaction cost measurement model used by Goyenko et al. (2009).

We find that based on our 192 implementations, both of the time-series and cross-sectional momentum strategies can still be profitable but this is conditioned on means for implementation used. The findings suggest that in most markets the aggregate of the formation period and holding period in the two momentum strategies should be extended to between 15 and 18 months (as compared with the previous 12 and 15 months) as a result of taking into account transaction costs. We also find in most markets that buy-and-hold portfolio construction along with market weighting is consistent with achieving superior investment outcomes.

We find that optimal implementation of the time-series momentum strategy yields average profits $1.34 \%$ per month over the 24 markets and it is significant in 19 markets. The crosssectional momentum strategy is also found to be profitable in all but the Hong Kong ( $0.12 \%$ loss per month) and yields an average return of $0.87 \%$ per month. The transaction costs from the time-series momentum strategy are higher than the costs from the cross-sectional momentum strategy which is largely a consequence of time-series momentum strategy selecting smaller and growth stocks, and generating a higher turnover over a market cycle.

Comparing the differences between the performance of the two momentum strategies before and after the transaction costs, we find that the time-series momentum strategy continues to outperform cross-sectional momentum strategy in 21 of the 24 markets. However, the outperformance is only now significant in seven markets (Canada, Ireland, Japan, the Netherlands and Sweden at 5\% level and Finland and New Zealand at 10\% level) compared to 13 markets previously. The consistent results that the eroded outperformance in the timeseries momentum strategy has been found based on the long-only portfolio of the winning stocks, which in the case when short-sale is restricted.

## Chapter 8 - Time-series and cross-sectional momentum strategies after adjusting for risk

### 8.1. Introduction

We find in Chapter 7 that the introduction of transaction costs results in a significant reduction in the profitability of the two momentum strategies: based on the use of a $32 \%$ cut off, we find that across all 24 markets that the average return of the optimal implementation of time-series momentum strategy fall to $0.24 \%$ per month from $0.91 \%$, with an equivalent decrease for the cross-sectional momentum strategy being to $0.17 \%$ per month from $0.7 \%$. The optimal implementation for each market however produces positive after-transaction costs return in the 24 markets (19 significant) for the time-series momentum strategy and in 23 markets (15 significant) for the cross-sectional momentum strategy. In addition, the optimal time-series momentum strategy consistently shows superior performance in 21 markets (seven significant) with the outperformance being an average of $0.47 \%$ per month.

One important factor impacting returns has so far been ignored is our analysis: the standard risks involved in using momentum strategies. In order to redress this deficiency in our analysis, in this chapter we used the after-transaction cost (net) returns from Chapter 7 as the basis for calculating two risk-adjusted measures of performance: the Fama-French threefactor model and the Sharpe ratio. ${ }^{35}$

The remainder of this chapter is organised as follows. Sections 8.2 and 8.3 compare the Sharpe ratios and the Fama-French alphas of the two momentum strategies under optimal

[^28]implementation approaches. Section 8.4 compares risk-adjusted profit and the risk factors under alternative market conditions. Conclusions are presented in Section 8.5.

### 8.2. Risk-adjusted measures

### 8.2.1. The Fama-French three-factor model

The common standard risk-adjusted measure used in the literature is the Fama-French threefactor model. This chapter first investigates whether the two momentum strategies yield significant positive excess returns - Fama and French alpha (intercept term, $\alpha_{i}$ ) (as measured by momentum portfolio return minus the risk-free rate) after adjusting in the firm-specific risk (beta), firm size risk, and firm distress risk from the following regression model.

$$
\begin{equation*}
M R_{i}-R f_{i}=\alpha_{i}+\beta 1_{i}\left(R m_{i}-R f_{i}\right)+\beta 2_{i} S M B_{i}+\beta 3_{i} H M L_{i}+\varepsilon_{i} \tag{1}
\end{equation*}
$$

where $M R_{i}$ is momentum return after accounting for the transaction costs at month $\mathrm{t}, R f_{i}$ is the risk-free rate at month $\mathrm{t}, R m_{i}$ is market-weighted index at month $\mathrm{t}, S M B_{i}$ is 'small minus big' at month t , which is calculated by the market average return for the smallest $30 \%$ of stocks minus the market average return of the largest $30 \%$ of stocks in that month. $H M L_{i}$ is 'high minus low' at month t , which is calculated as the market average return for $50 \%$ of stocks with the highest book-to-market ratio minus market average return for $50 \%$ of stocks with the lowest book-to-market ratio.

### 8.2.2. The Sharpe ratio

The Sharpe ratio is a risk-adjusted approach of return that is often used to assess the performance of a portfolio (Sharpe, 1998). It measures the increments in excess returns (as measured by the portfolio return minus the risk-free rate) for each additional unit of risk (as measured by the standard deviation of the portfolio returns).

$$
\begin{equation*}
\text { Sharpe ratio }=\frac{\overline{M P}-R f}{S t d(M P)} \tag{2}
\end{equation*}
$$

where $\overline{\mathrm{MP}}$ is the average momentum return after accounting for the transaction costs, Rf is the average risk-free rate and Std (MP) is momentum portfolio standard deviation over the testing period. Following literature, this chapter compares the risk-adjusted time-series and the cross-sectional momentum returns using the Sharpe measure and the three-factor model.

### 8.3. The risk-adjusted performances of time-series momentum strategies

Based on the after-transaction cost monthly returns from Chapter 7, we apply the two risk measurements discussed in previous section to computer the average monthly Fama and French alpha, and Sharpe ratio of the time-series momentum strategy, and report the results in Table 8.1 and Table 8.2 contained in Appendix 3. The time-series momentum strategy involves forming a long portfolio consisting of the identified winning stocks and a short portfolio consisting of the identified losing stocks with the average monthly returns after the transaction costs reported as the difference between the monthly momentum returns for the two portfolios subtracting the monthly costs of both portfolios. The results all relate to an implementation in which the cut-offs for selecting the stocks to be included in the crosssectional momentum portfolios were set at $16 \%$.

Panels A, B and C of Tables 8.1 and 8.2 in Appendix 3 present the average monthly FamaFrench alpha and Sharpe ratio of time-series momentum strategies when the portfolio weights are based on EW, MW and IVOL, respectively.

### 8.3.1. The risk-adjusted performances of time-series momentum strategies

Table 8.3 summarises the number of 192 implementations of the time-series momentum that yield (i) significant positive and negative Fama-French alpha and, (ii) positive and negative

Sharpe ratio. When judged purely on sign of the two measurements, $41 \%$ of the implementations in the time-series momentum strategy yield positive Fama-French alphas, and $50 \%$ of the implementations produce the positive Sharpe ratios. Ten out of the 24 markets show that more than half of the implementations produce positive returns after adjusting risk using the two measures.

In terms of the significant level of the Fama-French alpha, however, only overall $7 \%$ of the implementations yield significant positive risk-adjusted net returns with half of the 24 markets having no implementations that yield a significant positive Fama-French alpha. After accounting for the transaction costs in previous chapter, we find that less than $10 \%$ of the implementations produces significant positive net return in ten markets (Hong Kong, the US, Japan, Greece, Norway, Portugal, Israel, Spain, Ireland and Singapore). After further adjusting for risk based on the Fama-French alpha, we now find that there is an additional seven markets (Australia, Austria, Canada, Finland, France, Germany and Italy) where the time-series momentum strategy performs poorly with less than $10 \%$ of their implementations yielding significant positive risk-adjusted net return.

The three countries in which the performance of the time-series momentum strategy is eroded most after the application of the Fama-French three-factor model are Italy where the percentage of implementations that yield significant positive performance drops to $4 \%$ from $72 \%$, the UK where it falls to $19 \%$ from $76 \%$ and Denmark where it decreases to $10 \%$ from $66 \%$. The three markets where the performance is best after the risk-adjustment with in excess of $20 \%$ of implementations yielding significant positive returns are New Zealand, the Netherlands and Switzerland.

Chart 8.1 shows the average after-transaction costs (net) return and the Fama-French alpha of the time-series momentum strategy across the 192 implementations analysed for each market.

The investment gain across the 24 markets erodes after adjusting for risk, to $-0.22 \%$ per month from $0.24 \%$ with the biggest reduction being in Italy. The time-series momentum strategy on average produces positive risk-adjusted net return in nine markets (Belgium, Denmark, Finland, Italy, the Netherlands, New Zealand, Sweden, Switzerland and the UK) with the highest in New Zealand at $0.41 \%$ per month. In contrast, the average monthly riskadjusted net returns across the implementations in Australia, Greece, Hong Kong, Israel, Japan, Norway and the US return a loss of in excess of $0.5 \%$ per month.

Chart 8.2 displays the average Sharpe ratios across all of the implementations for each of the 24 markets. This average Sharpe ratio proves to be positive for the time-series momentum strategy in 12 markets on average across all implementations with highest being in the UK with an average Sharpe ratio of 0.1 . Even though half the markets have a positive average Sharpe ratio, it proves that the average across all markets is slightly negative reflecting the relatively high negative Sharpe ratio in markets such as Australia, Hong Kong, Israel and the US.

Based on results of the two risk measures, over half of the implementations would appear to realise positive risk-adjusted net returns in nine markets: Belgium, Denmark, Finland, Italy, the Netherlands, New Zealand, Sweden, Switzerland and the UK.

Table 8.3. Numbers of implementations yield positive/negative time-series momentum riskadjusted net returns

This table reports the numbers of implementations yielding positive and negative average monthly time-series momentum risk-adjusted net returns based on the Fama-French alpha and the Sharpe ratio for each market. The SIGNIFICANT column indicates the aggregate numbers of implementations that generate average monthly returns at the $1 \%, 5 \%$, or $10 \%$ significance level, whereas the NON-SIGNIFICANT column indicates the numbers of strategies producing average monthly returns over $10 \%$ significance level.

|  | Fama-French alpha |  |  |  |  |  |  |  | Sharpe ratio |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | POSITIVE |  |  |  | NEGATIVE |  |  |  | POSITIVE |  | NEGATIVE |  |
|  | SIGNIFICANT | \% | NON SIGNIFICANT | \% | SIGNIFICANT | \% | NON SIGNIFICANT | \% | NO. | \% | NO. | \% |
| AUSTRALIA | 1 | 1\% | 34 | 18\% | 124 | 65\% | 33 | 17\% | 32 | 17\% | 160 | 83\% |
| AUSTRIA | 0 | 0\% | 66 | 34\% | 12 | 6\% | 114 | 59\% | 149 | 78\% | 43 | 22\% |
| BELGIUM | 26 | 14\% | 124 | 65\% | 3 | 2\% | 39 | 20\% | 167 | 87\% | 25 | 13\% |
| CANADA | 8 | 4\% | 55 | 29\% | 50 | 26\% | 79 | 41\% | 77 | 40\% | 115 | 60\% |
| DENMARK | 19 | 10\% | 134 | 70\% | 8 | 4\% | 31 | 16\% | 165 | 86\% | 27 | 14\% |
| FINLAND | 12 | 6\% | 114 | 59\% | 2 | 1\% | 64 | 33\% | 135 | 70\% | 57 | 30\% |
| FRANCE | 0 | 0\% | 49 | 26\% | 36 | 19\% | 107 | 56\% | 64 | 33\% | 128 | 67\% |
| GERMANY | 0 | 0\% | 30 | 16\% | 55 | 29\% | 107 | 56\% | 125 | 65\% | 67 | 35\% |
| GREECE | 0 | 0\% | 23 | 12\% | 100 | 52\% | 69 | 36\% | 20 | 10\% | 172 | 90\% |
| HONGKONG | 0 | 0\% | 19 | 10\% | 118 | 61\% | 55 | 29\% | 23 | 12\% | 169 | 88\% |
| IRELAND | 4 | 2\% | 92 | 48\% | 28 | 15\% | 68 | 35\% | 84 | 44\% | 108 | 56\% |
| ISRAEL | 0 | 0\% | 9 | 5\% | 139 | 72\% | 44 | 23\% | 22 | 11\% | 170 | 89\% |
| ITALY | 7 | 4\% | 109 | 57\% | 10 | 5\% | 66 | 34\% | 167 | 87\% | 25 | 13\% |
| JAPAN | 0 | 0\% | 8 | 4\% | 121 | 63\% | 63 | 33\% | 41 | 21\% | 151 | 79\% |
| NETHERLANDS | 66 | 34\% | 80 | 42\% | 2 | 1\% | 44 | 23\% | 172 | 90\% | 20 | 10\% |
| NEWZEALAND | 47 | 24\% | 109 | 57\% | 3 | 2\% | 33 | 17\% | 147 | 77\% | 45 | 23\% |
| NORWAY | 0 | 0\% | 8 | 4\% | 55 | 29\% | 129 | 67\% | 37 | 19\% | 155 | 81\% |
| PORTUGAL | 0 | 0\% | 47 | 24\% | 36 | 19\% | 109 | 57\% | 36 | 19\% | 156 | 81\% |
| SINGAPORE | 0 | 0\% | 96 | 50\% | 12 | 6\% | 84 | 44\% | 112 | 58\% | 80 | 42\% |
| SPAIN | 0 | 0\% | 31 | 16\% | 43 | 22\% | 118 | 61\% | 23 | 12\% | 169 | 88\% |
| SWEDEN | 26 | 14\% | 131 | 68\% | 8 | 4\% | 27 | 14\% | 156 | 81\% | 36 | 19\% |
| SWITZERLAND | 71 | 37\% | 89 | 46\% | 5 | 3\% | 27 | 14\% | 168 | 88\% | 24 | 13\% |
| UK | 37 | 19\% | 109 | 57\% | 6 | 3\% | 40 | 21\% | 161 | 84\% | 31 | 16\% |
| US | 0 | 0\% | 2 | 1\% | 118 | 61\% | 72 | 38\% | 13 | $7 \%$ | 179 | 93\% |


| POOLED SAMPLE | 14 | $7 \%$ | 65 | $34 \%$ | 46 | $24 \%$ | 68 | $35 \%$ | 96 | $50 \%$ | 96 | $50 \%$ |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## Chart 8.1. Average time-series momentum Fama-French alphas across 192 implementations for each market

This chart plots the pooled average monthly after-transaction costs (net) returns and risk-adjusted net returns based on the Fama-French three-factor model for 192 time-series momentum strategies for each market. The dashed line shows the average monthly returns across the 24 developed markets.


## Chart 8.2. Average monthly Sharpe ratio for the time-series momentum strategy across implementations for each market

This chart reports the pooled average monthly Sharpe ratio for 192 time-series momentum strategies for each market. The dashed line shows the average monthly Sharpe ratio across the 24 developed markets.


### 8.3.2. The weighting method

Within each market, Table 8.4 reports the pooled average monthly net returns and riskadjusted net returns of time-series momentum strategies using equal weight (EW), market weight (MW) and inverse volatility (IVOL) weights (t-statistics in italics). In terms of the Fama-French alpha, the average return for all equally weighted implementations fall from $0.13 \%$ with no risk-adjustment to $-0.34 \%$ per month after the risk-adjustment, from $0.32 \%$ per month to $-0.13 \%$ per month for market weighted portfolios and from $0.26 \%$ per month to $-0.19 \%$ per month for inverse volatility weighted portfolios.

Based on these average returns, there is almost no change in what proves to be the optimal weighting scheme when implementing time-series momentum strategy in any of the countries. Hence, the overall impact of introducing risk into our analysis is to make the result for the three weighting schemes reasonably uniformly unattractive. When judged on the basis of the Fama-French alpha, MW and IVOL each produce the best outcomes in ten countries. For the Sharpe ratio, MW proves best in 12 markets and IVOL in eight.

Table 8.4. Risk-adjusted performance of time-series momentum based on three weights
This table reports the pooled average monthly net (after-transaction costs) returns and risk-adjusted net returns using equal weight (EW), market weight (MW) and inversed volatility weight (IVOL) for each market. The results of net returns are from Table 7.3. We apply the Fama-French three factor model and the Sharpe measure to evaluate the risk-adjusted return on an after-transaction costs basis. T-statistics are reported in italics. The highest return is highlighted in green and the lowest return is marked in red.

|  | Net returns |  |  |  |  |  | Fama-French alpha |  |  |  |  |  | Sharpe ratio |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | EW |  | MW |  | IVOL |  | EW |  | MW |  | IVOL |  | EW |  | MW |  | IVOL |  |
| AUSTRALIA | -0.90\% | -18.0191 | 0.41\% | 7.1437 | -0.36\% | -6.2765 | -1.40\% | -29.0494 |  | -0.0138 | -0.84\% | -15.3059 | -0.31 | -27.0124 | 0.00 | 0.1352 | -0.18 | -13.9627 |
| AUSTRIA | 0.58\% | 17.9456 | 0.30\% | 5.8163 | 0.59\% | 17.3029 | -0.10\% | -3.0880 | -0.48\% | -9.2358 | -0.02\% | -0.6732 | 0.05 | 9.6866 | 0.00 | 0.5856 | 0.06 | 9.1636 |
| BELGIUM | 0.71\% | 21.7033 | 0.57\% | 11.9328 | 0.70\% | 15.5559 | 0.27\% | 9.3253 | 0.08\% | 1.5522 | 0.27\% | 7.1690 | 0.09 | 12.9715 | 0.04 | 6.4042 | 0.09 | 9.3946 |
| CANADA | -0.35\% | -5.6476 | 0.83\% | 11.8354 | 0.10\% | 1.8149 | -0.77\% | -13.8044 | 0.41\% | 6.9886 | -0.31\% | -6.3842 | -0.12 | -10.6623 | 0.06 | 7.6732 | -0.04 | -3.2674 |
| DENMARK | 0.77\% | 17.6884 | 0.70\% | 15.1891 | 0.74\% | 15.4999 | 0.22\% | 5.3671 | 0.13\% | 2.7642 | 0.22\% | 4.8310 | 0.09 | 9.3271 | 0.05 | 7.7916 | 0.08 | 7.9013 |
| Finland | 0.32\% | 6.4403 | 1.00\% | 12.5262 | 0.42\% | 8.5733 | -0.05\% | -1.2358 | 0.56\% | 7.8304 | 0.06\% | 1.4344 | 0.00 | -0.0673 | 0.07 | 8.6888 | 0.01 | 2.0696 |
| FRANCE | 0.10\% | 1.9028 | -0.38\% | -6.3077 | 0.17\% | 3.1044 | -0.24\% | -4.8842 | -0.51\% | -10.0367 | -0.14\% | -2.9269 | -0.04 | -3.5637 | -0.10 | -12.4838 | -0.03 | -2.2062 |
| GERMANY | 0.19\% | 4.6121 | 0.48\% | 9.1781 | 0.42\% | 8.6304 | -0.63\% | -14.3426 | -0.22\% | -3.6525 | -0.30\% | -6.3433 | -0.02 | -2.2981 | 0.03 | 4.0686 | 0.03 | 2.5719 |
| GREECE | -0.36\% | -5.1516 | -0.32\% | -3.8910 | -0.23\% | -3.2715 | -0.91\% | -12.5684 | -1.01\% | -12.9872 | -0.78\% | -10.9086 | -0.11 | -13.3423 | -0.08 | -11.0442 | -0.10 | -11.6510 |
| HONGKONG | -0.84\% | -13.7584 | 0.06\% | 1.0690 | -0.58\% | -10.2857 | -1.23\% | -20.1115 | -0.30\% | -5.4698 | -0.99\% | $-18.2276$ | -0.19 | -19.7376 | -0.03 | -4.3562 | -0.15 | -15.2805 |
| IRELAND | -0.09\% | -1.0184 | 0.45\% | 4.2387 | 0.00\% | 0.0265 | -0.41\% | -5.2859 | 0.48\% | 5.0038 | -0.28\% | $-3.4945$ | -0.04 | -5.1555 | 0.01 | 1.3234 | -0.04 | -4.2393 |
| ISRAEL | -0.76\% | -10.6143 | 0.26\% | 2.8421 | -0.65\% | -9.6330 | -1.50\% | -22.0170 | -0.60\% | -6.6417 | -1.39\% | $-22.4438$ | -0.28 | -16.6165 | -0.04 | -4.1336 | -0.25 | -15.3139 |
| ITALY | 0.94\% | 19.1266 | 0.89\% | 13.4450 | 0.87\% | 19.0354 | 0.17\% | 3.8628 | -0.27\% | -4.7611 | 0.11\% | 2.6035 | 0.10 | 10.9563 | 0.06 | 8.0284 | 0.09 | 10.1774 |
| JAPAN | -0.32\% | -8.7427 | 0.03\% | 0.8400 | -0.26\% | -8.1519 | -0.67\% | -19.3568 | -0.35\% | -10.0340 | -0.60\% | $-20.1718$ | -0.09 | -10.9239 | -0.01 | -0.9347 | -0.08 | -10.2328 |
| NETHERLANDS | 1.02\% | 28.0566 | 0.43\% | 8.2804 | 1.03\% | 22.6014 | 0.60\% | 14.3133 | -0.10\% | -1.7893 | 0.60\% | 12.0684 | 0.13 | 20.0562 | 0.02 | 3.3675 | 0.13 | 17.5872 |
| NEWZEALAND | 0.73\% | 13.3591 | 0.75\% | 10.9314 | 0.99\% | 18.0265 | 0.22\% | 4.2299 | 0.49\% | 7.1084 | 0.52\% | 9.1535 | 0.03 | 3.7354 | 0.03 | 3.9362 | 0.08 | 9.7850 |
| NORWAY | 0.00\% | 0.0580 | 0.08\% | 1.2178 | 0.11\% | 2.2544 | -0.72\% | -15.3719 | -0.65\% | -11.3851 | -0.61\% | -13.1998 | -0.06 | -8.7067 | -0.03 | -5.4079 | -0.04 | -6.3430 |
| PORTUGAL | -0.33\% | -4.4417 | 0.10\% | 1.2145 | -0.08\% | -1.1561 | -0.60\% | -7.8004 | -0.29\% | -3.1457 | -0.35\% | -4.4066 | -0.09 | -10.4763 | -0.02 | -3.8766 | -0.06 | -7.9383 |
| SINGAPORE | 0.00\% | -0.0331 | 0.12\% | 1.9532 | 0.29\% | 5.6727 | -0.20\% | -4.8653 | -0.10\% | -1.5985 | 0.06\% | 1.2900 | -0.01 | -2.1070 | 0.01 | 0.9715 | 0.03 | 3.6176 |
| SPAIN | 0.02\% | 0.4295 | -0.46\% | -6.2491 | -0.05\% | -0.8456 | -0.31\% | -6.3583 | -0.70\% | -10.3896 | -0.37\% | -7.1468 | -0.05 | -6.2566 | -0.10 | -12.9784 | -0.06 | -7.4685 |
| SWEDEN | 0.56\% | 9.2177 | 0.55\% | 8.8760 | 0.79\% | 11.9081 | 0.16\% | 2.6232 | 0.43\% | 6.9198 | 0.46\% | 6.8854 | 0.03 | 3.7097 | 0.02 | 3.7350 | 0.06 | 6.8728 |
| SWITZERLAND | 0.75\% | 18.7330 | 0.35\% | 7.4548 | 0.63\% | 15.3612 | 0.58\% | 13.7211 | 0.08\% | 1.7808 | 0.44\% | 10.3811 | 0.12 | 15.3385 | 0.03 | 3.6791 | 0.10 | 11.0319 |
| UK | 0.77\% | 26.2999 | 0.48\% | 8.0770 | 0.93\% | 27.5502 | 0.14\% | 4.7456 | 0.04\% | 0.8514 | 0.26\% | 8.4732 | 0.12 | 13.0409 | 0.01 | 1.4018 | 0.18 | 15.7842 |
| US | -0.38\% | -11.7275 | 0.01\% | 0.1407 | -0.27\% | -7.6495 | -0.71\% | -22.8345 | -0.36\% | -10.7548 | -0.57\% | -19.0568 | -0.16 | -20.6157 | -0.04 | -6.4183 | -0.14 | -15.6457 |
| POOLED SAMPLE | 0.13\% | 1.1064 | 0.32\% | 4.0254 | 0.26\% | 2.5218 | -0.34\% | -2.8094 | -0.13\% | -1.5612 | -0.19\% | -1.7901 | -0.03 | -1.3958 | 0.00 | -0.0420 | -0.01 | -0.4369 |

### 8.3.3. The formation $(\mathrm{J})$ and holding period (H)

Table 8.5 reports the pooled average monthly the Fama-French alphas and Sharpe ratios across 16 time-series momentum strategies when using the formation period $\mathrm{J}(\mathrm{J}=$ three, six, nine and 12 months) and the holding period $\mathrm{H}(\mathrm{H}=$ three, six, nine and 12 months) for each market.

The findings as reported in Table 7.4 indicate that the time-series momentum strategy tended to produce the highest after-transaction costs (net) returns in a cycle (i.e. sum of formation and holding periods) of between 15 and 18 months in all markets other than Sweden. Across all of the markets, the best combination involves either a nine or 12 months formation period in combination with a six months holding periods. After accounting for the risks in Table 8.5, the pattern remains similar where the momentum cycle in 20 markets continuing to lie in the range of 15 to 18 months with the exceptions being in Norway, Hong Kong, Switzerland and Israel when using the Fama-French alpha, and Hong Kong, Singapore, Greece and Sweden
when using the Sharpe ratio. Compared with the after-transaction costs performance in Table 7.4, the best combination of formation and holding periods remains unchanged in 15 markets when using the Fama-French alpha and 14 markets when using the Sharpe ratio.

## Table 8.5. Risk-adjusted performance of time-series momentum based on formation (J) and holding (H) period

## The Fama-French three-factor alpha

This table reports the pooled average monthly time-series momentum Fama-French alphas based on the formation J ( $\mathrm{J}=$ three, six, nine and 12 months) and the holding H ( H $=$ three, six, nine and 12 months) for each market. T-statistics are reported in italics. The highest return is highlighted in green and the lowest return is highlighted in red.


| ITALY | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | JAPAN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | NETHERLANDS | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{J}=3$ | -0.31\% | -0.45\% | -0.06\% | -0.17\% | $\mathrm{J}=3$ | -1.05\% | -0.63\% | -0.42\% | -0.19\% | $\mathrm{J}=3$ | -0.03\% | 0.09\% | -0.07\% | 0.60\% |
|  | -2.5579 | -2.7582 | -0.6607 | -1.7494 |  | -17.9781 | -19.5302 | -12.2156 | -2.5299 |  | -0.6060 | 0.7763 | -0.4262 | 6.0541 |
| $\mathrm{J}=6$ | -0.13\% | 0.08\% | -0.04\% | -0.51\% | $\mathrm{J}=6$ | -0.94\% | -0.54\% | -0.41\% | -0.20\% | $\mathrm{J}=6$ | -0.14\% | 0.25\% | 0.36\% | 0.73\% |
|  | -1.7001 | 0.8097 | -0.3273 | -3.1355 |  | -13.5209 | -6.3996 | -10.0724 | $-2.8313$ |  | -0.9499 | 2.2569 | 3.3886 | 4.7768 |
| $\mathrm{J}=9$ | 0.25\% | 0.30\% | 0.31\% | 0.00\% | $\mathrm{J}=9$ | -0.86\% | -0.43\% | -0.44\% | -0.38\% | $\mathrm{J}=9$ | 0.49\% | 0.86\% | 0.53\% | 0.64\% |
|  | 2.5585 | 2.5689 | 3.9033 | -0.0279 |  | -16.6363 | -8.4476 | -13.0461 | -6.2866 |  | 3.3464 | 5.3447 | 4.3518 | 5.9966 |
| $\mathrm{J}=12$ | 0.20\% | 0.29\% | 0.15\% | 0.14\% | $\mathrm{J}=12$ | -0.70\% | -0.51\% | -0.53\% | -0.46\% | $\mathrm{J}=12$ | 0.28\% | 0.68\% | 0.36\% | 0.19\% |
|  | 2.5600 | 4.6739 | 2.6539 | 2.1486 |  | -18.0710 | -10.3361 | -9.7146 | -9.6167 |  | 2.3932 | 5.4033 | 2.9481 | 1.1715 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NEWZEALAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | NORWAY | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | PORTUGAL | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.09\% | 0.10\% | 0.05\% | -0.32\% | $\mathrm{J}=3$ | -1.49\% | -0.27\% | -0.51\% | -0.59\% | $\mathrm{J}=3$ | -1.34\% | 0.03\% | 0.09\% | 0.14\% |
|  | -0.6071 | 1.1282 | 0.6806 | -2.6093 |  | -32.6192 | -2.8539 | -4.1608 | -5.4682 |  | -7.6200 | 0.2410 | 0.7288 | 0.9621 |
| $\mathrm{J}=6$ | 0.56\% | 0.40\% | 0.32\% | 0.16\% | $\mathrm{J}=6$ | -1.09\% | -0.52\% | -0.56\% | -0.42\% | $\mathrm{J}=6$ | -0.43\% | 0.06\% | 0.30\% | 0.07\% |
|  | 5.2656 | 4.0484 | 3.4871 | 1.6368 |  | -16.7472 | -9.4679 | -5.5604 | -7.2119 |  | -2.8627 | 0.4814 | 1.9633 | 0.4513 |
| $\mathrm{J}=9$ | 0.68\% | 0.50\% | 0.62\% | 0.39\% | $\mathrm{J}=9$ | -0.64\% | -0.56\% | -0.56\% | -0.83\% | $\mathrm{J}=9$ | -0.98\% | -0.19\% | -0.20\% | -0.23\% |
|  | 11.6589 | 4.3810 | 15.2163 | 5.5882 |  | -4.4726 | -11.0825 | -9.4746 | -14.9694 |  | -8.4508 | -2.1008 | -1.5292 | -2.2134 |
| $\mathrm{J}=12$ | 1.15\% | 1.01\% | 0.64\% | 0.43\% | $\mathrm{J}=12$ | -0.79\% | -0.50\% | -0.67\% | -0.60\% | $\mathrm{J}=12$ | -1.26\% | -1.01\% | -0.76\% | -0.92\% |
|  | 10.3245 | 6.7466 | 7.5146 | 8.9935 |  | -10.6170 | -5.0673 | -10.9832 | -4.7052 |  | -16.0539 | -11.7476 | -9.3860 | -10.2532 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SINGAPORE | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | SPAIN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | SWEDEN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.87\% | 0.04\% | 0.14\% | -0.21\% | $\mathrm{J}=3$ | -1.14\% | -0.91\% | -0.34\% | -0.09\% | $\mathrm{J}=3$ | -1.02\% | 0.11\% | -0.10\% | 0.13\% |
|  | -11.9336 | 0.3016 | 3.6278 | -1.5572 |  | -22.4646 | -6.4058 | -5.1370 | -2.0256 |  | -9.8617 | 1.1957 | -1.0006 | 1.6023 |
| $\mathrm{J}=6$ | -0.42\% | -0.10\% | 0.38\% | 0.06\% | $\mathrm{J}=6$ | -1.21\% | -0.65\% | -0.16\% | -0.46\% | $\mathrm{J}=6$ | 0.21\% | 0.47\% | 0.50\% | 0.37\% |
|  | -5.0486 | -1.3693 | 3.9989 | 1.2529 |  | -14.2727 | -5.4732 | -1.7685 | -3.9096 |  | 2.4100 | 8.2408 | 5.5039 | 4.7348 |
| $\mathrm{J}=9$ | -0.16\% | 0.14\% | 0.01\% | -0.31\% | $\mathrm{J}=9$ | -0.81\% | -0.42\% | -0.06\% | -0.39\% | $\mathrm{J}=9$ | 0.61\% | 0.71\% | 0.64\% | 0.20\% |
|  | -1.6343 | 2.3637 | 0.1162 | -2.2636 |  | -4.9027 | -4.8105 | -0.9800 | -5.8426 |  | 8.6545 | 10.1704 | 10.3692 | 2.2840 |
| $\mathrm{J}=12$ | -0.15\% | 0.16\% | 0.15\% | -0.12\% | $\mathrm{J}=12$ | -0.39\% | 0.03\% | -0.22\% | -0.18\% | $\mathrm{J}=12$ | 0.74\% | 0.69\% | 0.68\% | 0.70\% |
|  | -2.5285 | 2.1672 | 1.7774 | -1.4984 |  | $-3.8686$ | 0.3502 | $-3.0417$ | -7.0283 |  | 7.2529 | 9.4348 | 10.9095 | 4.9391 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SWITZERLAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | UK | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | US | H = 3 | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.43\% | 0.35\% | 0.13\% | 0.60\% | $\mathrm{J}=3$ | -0.46\% | 0.18\% | 0.12\% | 0.33\% | $\mathrm{J}=3$ | -1.14\% | -0.35\% | -0.44\% | -0.31\% |
|  | -4.5096 | 5.3392 | 1.6352 | 5.9681 |  | -6.1335 | 3.0236 | 1.9728 | 6.9277 |  | -20.1259 | -5.4602 | -7.7233 | -7.0732 |
| $\mathrm{J}=6$ | 0.36\% | 0.84\% | 0.40\% | 0.58\% | $\mathrm{J}=6$ | -0.03\% | 0.27\% | 0.22\% | 0.17\% | $\mathrm{J}=6$ | -0.73\% | -0.49\% | -0.36\% | -0.46\% |
|  | 3.5077 | 9.6577 | 3.2365 | 5.6730 |  | -0.2159 | 3.9626 | 4.7177 | 4.9822 |  | -15.0162 | -8.0895 | -5.1146 | -7.1062 |
| $\mathrm{J}=9$ | 0.42\% | 0.67\% | 0.37\% | 0.23\% | $\mathrm{J}=9$ | 0.18\% | 0.45\% | 0.29\% | 0.05\% | $\mathrm{J}=9$ | -0.50\% | -0.29\% | -0.42\% | -0.62\% |
|  | 3.5525 | 6.8495 | 3.0785 | 3.6614 |  | 1.9351 | 6.7041 | 7.0634 | 1.0431 |  | -13.5113 | -5.3479 | -6.3830 | -10.1263 |
| $\mathrm{J}=12$ | 0.47\% | 0.47\% | 0.17\% | 0.27\% | $\mathrm{J}=12$ | 0.29\% | 0.27\% | 0.13\% | -0.10\% | $\mathrm{J}=12$ | -0.64\% | -0.61\% | -0.64\% | -0.76\% |
|  | 9.7143 | 10.1888 | 3.0456 | 4.0411 |  | 3.0599 | 4.0061 | 2.8452 | -2.0263 |  | -12.9577 | -8.8469 | -8.1955 | -9.6616 |

## Sharpe Ratio

This table reports the pooled average monthly time-series momentum Sharpe ratios based on the formation $\mathrm{J}(\mathrm{J}=$ three, six, nine and 12 months) and the holding $\mathrm{H}(\mathrm{H}=$ three, six, nine and 12 months) for each market. T-statistics are reported in italics. The highest ratio is highlighted in green and the lowest ratio is highlighted in red.

| AUSTRALIA | H = 3 | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | AUSTRIA | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | BELGIUM | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{J}=3$ | -0.38 | -0.21 | -0.15 | -0.15 | $\mathrm{J}=3$ | -0.04 | 0.01 | 0.05 | 0.04 | $\mathrm{J}=3$ | -0.05 | 0.02 | 0.04 | 0.07 |
|  | -6.2056 | -4.9195 | -3.1649 | -3.3255 |  | -2.2245 | 1.2651 | 6.0682 | 4.7406 |  | -3.1507 | 1.4741 | 2.0352 | 5.2774 |
| $\mathrm{J}=6$ | -0.20 | -0.12 | -0.12 | -0.16 | $\mathrm{J}=6$ | 0.01 | 0.04 | 0.06 | 0.08 | $\mathrm{J}=6$ | 0.05 | 0.05 | 0.08 | 0.10 |
|  | -5.0508 | -2.6188 | -2.9495 | -3.8734 |  | 0.7135 | 6.7002 | 4.8030 | 6.3753 |  | 3.5924 | 2.6735 | 4.8751 | 9.6639 |
| $\mathrm{J}=9$ | -0.13 | -0.09 | -0.10 | -0.12 | $\mathrm{J}=9$ | 0.05 | 0.06 | 0.06 | 0.06 | $\mathrm{J}=9$ | 0.06 | 0.13 | 0.11 | 0.10 |
|  | -3.0136 | -2.0242 | -2.7105 | -2.8591 |  | 5.6061 | 5.0547 | 6.2072 | 6.4967 |  | 3.8236 | 10.4155 | 8.1669 | 9.1204 |
| $\mathrm{J}=12$ | -0.17 | -0.15 | -0.17 | -0.18 | $\mathrm{J}=12$ | 0.04 | 0.04 | 0.03 | -0.03 | $\mathrm{J}=12$ | 0.11 | 0.12 | 0.09 | 0.07 |
|  | -5.0838 | -4.0810 | -5.1433 | -5.0312 |  | 3.0644 | 2.7198 | 2.5221 | -1.8297 |  | 8.9233 | 11.0693 | 4.7582 | 4.2598 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CANADA | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | DENMARK | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | FINLAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.28 | -0.12 | -0.01 | -0.01 | $\mathrm{J}=3$ | -0.10 | 0.03 | 0.04 | 0.09 | $\mathrm{J}=3$ | -0.09 | -0.06 | 0.04 | 0.05 |
|  | -6.3501 | -4.4246 | $-0.3881$ | -0.6120 |  | -7.3732 | 3.1104 | 1.7756 | 4.8714 |  | -14.4576 | -3.7248 | 3.5756 | 3.9381 |
| $\mathrm{J}=6$ | -0.10 | -0.01 | 0.06 | -0.01 | $\mathrm{J}=6$ | 0.01 | 0.08 | 0.10 | 0.14 | $\mathrm{J}=6$ | -0.02 | 0.05 | 0.04 | 0.05 |
|  | -3.9969 | -0.2089 | 2.4190 | -0.4583 |  | 1.2459 | 9.7128 | 6.9402 | 10.3488 |  | -1.9264 | 4.4892 | 1.6592 | 3.2270 |
| $\mathrm{J}=9$ | -0.01 | 0.03 | 0.02 | -0.02 | $\mathrm{J}=9$ | 0.07 | 0.11 | 0.12 | 0.10 | $\mathrm{J}=9$ | 0.02 | 0.05 | 0.04 | 0.01 |
|  | -0.4680 | 1.5762 | 0.9615 | -0.8377 |  | 9.4934 | 10.7233 | 12.6936 | 9.8330 |  | 2.8275 | 4.6753 | 3.6193 | 0.5098 |
| $\mathrm{J}=12$ | -0.02 | 0.00 | -0.01 | -0.05 | $\mathrm{J}=12$ | 0.07 | 0.13 | 0.09 | 0.10 | $\mathrm{J}=12$ | 0.05 | 0.09 | 0.05 | 0.06 |
|  | -1.0858 | 0.1132 | -0.4014 | -1.9218 |  | 6.1987 | 9.9905 | 4.5587 | 7.7729 |  | 7.7122 | 6.1220 | 4.3351 | 3.6165 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FRANCE | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | GERMANY | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | GREECE | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.30 | -0.13 | -0.06 | -0.06 | $\mathrm{J}=3$ | -0.16 | -0.01 | 0.05 | 0.02 | $\mathrm{J}=3$ | -0.16 | -0.07 | -0.10 | -0.07 |
|  | -10.7443 | -11.5300 | -4.0041 | -5.3510 |  | -8.2303 | -0.5493 | 3.3789 | 1.3344 |  | -11.8690 | $-2.8726$ | -4.1320 | -2.0104 |
| $\mathrm{J}=6$ | -0.14 | -0.07 | -0.01 | -0.02 | $\mathrm{J}=6$ | -0.09 | 0.03 | 0.06 | 0.05 | $\mathrm{J}=6$ | -0.09 | -0.07 | -0.09 | -0.12 |
|  | -10.6619 | -6.1477 | -0.7705 | -1.4062 |  | -8.8133 | 2.9664 | 5.5547 | 4.0255 |  | -8.1448 | -5.3687 | -9.9892 | -12.3303 |
| $\mathrm{J}=9$ | -0.08 | -0.01 | 0.02 | 0.01 | $\mathrm{J}=9$ | 0.00 | 0.05 | 0.03 | 0.05 | $\mathrm{J}=9$ | -0.09 | -0.06 | -0.11 | -0.05 |
|  | -3.6698 | -0.4488 | 1.2708 | 0.9627 |  | -0.5129 | 4.4579 | 2.2113 | 6.1772 |  | -5.2964 | -3.5416 | -19.5662 | $-2.0613$ |
| $\mathrm{J}=12$ | -0.06 | 0.00 | 0.02 | -0.01 | $\mathrm{J}=12$ | 0.01 | 0.04 | 0.05 | 0.02 | $\mathrm{J}=12$ | -0.10 | -0.12 | -0.09 | -0.13 |
|  | -2.7207 | 0.0358 | 1.1640 | -1.1475 |  | 1.0878 | 2.5422 | 3.5966 | 1.7784 |  | -11.5169 | -17.9409 | -5.8859 | -11.5817 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| HONGKONG | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | IRELAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | ISRAEL | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.32 | -0.15 | -0.13 | -0.12 | $\mathrm{J}=3$ | -0.11 | -0.12 | -0.10 | -0.03 | $\mathrm{J}=3$ | -0.42 | -0.32 | -0.28 | -0.29 |
|  | -8.2956 | -4.7718 | -5.3961 | -4.4683 |  | -6.1831 | -7.3624 | -8.5594 | $-5.0185$ |  | -9.5103 | -8.3471 | -5.7504 | -6.1470 |
| $\mathrm{J}=6$ | -0.14 | -0.07 | -0.07 | -0.09 | $\mathrm{J}=6$ | -0.09 | -0.02 | -0.06 | 0.06 | $\mathrm{J}=6$ | -0.25 | -0.21 | -0.22 | -0.17 |
|  | -5.7113 | -4.2276 | -4.1855 | -5.4360 |  | -5.2530 | -1.2663 | -3.1431 | 2.6957 |  | -6.2180 | -4.6575 | -5.7581 | -4.3644 |
| $\mathrm{J}=9$ | -0.12 | -0.09 | -0.08 | -0.07 | $\mathrm{J}=9$ | -0.03 | 0.01 | 0.04 | 0.02 | $\mathrm{J}=9$ | -0.20 | -0.15 | -0.13 | -0.10 |
|  | -5.7119 | -4.6505 | -3.5435 | -3.5387 |  | -4.8961 | 1.7174 | 5.9038 | 3.3103 |  | -5.0255 | -4.1452 | -4.4449 | -2.6380 |
| $\mathrm{J}=12$ | -0.16 | -0.11 | -0.12 | -0.13 | $\mathrm{J}=12$ | 0.02 | 0.01 | 0.02 | 0.00 | $\mathrm{J}=12$ | -0.11 | -0.06 | -0.10 | -0.08 |
|  | -6.0238 | -4.7946 | -5.0707 | -5.0652 |  | 6.8841 | 3.4031 | 3.3863 | 0.4930 |  | -3.7805 | -2.2255 | -4.3082 | -2.3276 |


| ITALY | $\mathrm{H}=3$ | H = 6 | H = 9 | $\mathrm{H}=12$ | JAPAN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | NETHERLANDS | H = 3 | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{J}=3$ | -0.02 | -0.01 | 0.08 | 0.06 | $\mathrm{J}=3$ | -0.20 | -0.11 | -0.06 | 0.00 | $\mathrm{J}=3$ | 0.03 | 0.07 | 0.06 | 0.14 |
|  | -2.4117 | -0.4201 | 5.4400 | 2.9031 |  | -9.1527 | -6.2862 | -3.5545 | 0.1756 |  | 3.5381 | 3.8236 | 2.4839 | 8.7278 |
| $\mathrm{J}=6$ | 0.04 | 0.09 | 0.11 | 0.04 | $\mathrm{J}=6$ | -0.13 | -0.06 | -0.02 | 0.01 | $\mathrm{J}=6$ | 0.02 | 0.08 | 0.10 | 0.15 |
|  | 5.3199 | 5.3381 | 6.5653 | 1.8847 |  | -7.2799 | -3.8890 | -2.1596 | 0.3726 |  | 1.3525 | 4.4562 | 5.6266 | 6.5591 |
| $\mathrm{J}=9$ | 0.09 | 0.13 | 0.13 | 0.10 | $\mathrm{J}=9$ | -0.10 | -0.02 | -0.02 | -0.03 | $\mathrm{J}=9$ | 0.10 | 0.14 | 0.12 | 0.13 |
|  | 8.5932 | 7.3374 | 10.4106 | 6.8352 |  | -8.9117 | -2.4899 | -3.4353 | -2.5006 |  | 4.9848 | 6.6412 | 5.3989 | 7.2209 |
| $\mathrm{J}=12$ | 0.11 | 0.14 | 0.12 | 0.11 | $\mathrm{J}=12$ | -0.07 | -0.04 | -0.04 | -0.05 | $\mathrm{J}=12$ | 0.06 | 0.13 | 0.10 | 0.07 |
|  | 16.1073 | 12.2379 | 9.2357 | 9.6263 |  | -7.9478 | -3.3366 | -3.7938 | -3.8694 |  | 3.9324 | 6.7743 | 4.9590 | 3.0363 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NEWZEALAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | NORWAY | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | PORTUGAL | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.04 | 0.00 | -0.01 | -0.05 | $\mathrm{J}=3$ | -0.18 | -0.03 | -0.04 | -0.03 | $\mathrm{J}=3$ | -0.15 | -0.03 | -0.02 | -0.02 |
|  | -2.1063 | -0.3521 | -0.6613 | -3.2384 |  | -21.6721 | -4.0695 | -2.6023 | -2.4153 |  | -7.1716 | -1.9573 | -0.8446 | -0.9108 |
| $\mathrm{J}=6$ | 0.07 | 0.05 | 0.04 | 0.04 | $\mathrm{J}=6$ | -0.08 | -0.03 | -0.03 | -0.01 | $\mathrm{J}=6$ | -0.07 | -0.02 | 0.01 | -0.01 |
|  | 5.0558 | 3.1392 | 2.0528 | 2.1454 |  | -10.6358 | -4.5360 | -2.6573 | -1.1449 |  | -3.8297 | $-1.2788$ | 0.4133 | -0.4551 |
| $\mathrm{J}=9$ | 0.07 | 0.07 | 0.10 | 0.06 | $\mathrm{J}=9$ | -0.04 | -0.02 | -0.03 | -0.06 | $\mathrm{J}=9$ | -0.13 | -0.05 | -0.04 | -0.04 |
|  | 5.7955 | 3.3520 | 11.6828 | 3.7505 |  | -2.5514 | -3.6659 | -4.9699 | -4.2935 |  | -10.4053 | -5.2024 | -3.4887 | -4.5013 |
| $\mathrm{J}=12$ | 0.12 | 0.11 | 0.08 | 0.06 | $\mathrm{J}=12$ | -0.04 | -0.01 | -0.04 | -0.04 | $\mathrm{J}=12$ | -0.11 | -0.10 | -0.07 | -0.09 |
|  | 12.0456 | 9.0143 | 8.9493 | 7.7722 |  | -4.0874 | -0.8032 | -3.4914 | -2.6369 |  | -8.3632 | -10.7418 | -12.6120 | -9.3651 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SINGAPORE | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | SPAIN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | SWEDEN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.12 | 0.02 | 0.07 | 0.00 | $\mathrm{J}=3$ | -0.20 | -0.15 | -0.07 | -0.02 | $\mathrm{J}=3$ | -0.14 | 0.00 | 0.01 | 0.02 |
|  | -20.5324 | 0.7296 | 9.1000 | -0.1056 |  | -21.7820 | $-13.4578$ | -10.4497 | -4.1282 |  | -13.5349 | -0.2063 | 1.2396 | 2.0377 |
| $\mathrm{J}=6$ | -0.05 | 0.01 | 0.05 | 0.03 | $\mathrm{J}=6$ | -0.17 | -0.10 | -0.03 | -0.07 | $\mathrm{J}=6$ | 0.00 | 0.05 | 0.05 | 0.05 |
|  | -6.5562 | 1.4985 | 5.7301 | 3.8219 |  | -25.5946 | -8.6112 | -2.7226 | -5.3493 |  | 0.5964 | 7.1037 | 3.9090 | 5.0305 |
| $\mathrm{J}=9$ | -0.03 | 0.01 | 0.03 | -0.01 | $\mathrm{J}=9$ | -0.12 | -0.06 | -0.01 | -0.05 | $\mathrm{J}=9$ | 0.05 | 0.08 | 0.08 | 0.03 |
|  | -2.4971 | 1.3314 | 2.4147 | -0.3763 |  | -6.7674 | -5.4730 | -0.9028 | -8.1467 |  | 5.7155 | 7.2318 | 8.2691 | 2.1760 |
| $\mathrm{J}=12$ | -0.02 | 0.04 | 0.05 | 0.03 | $\mathrm{J}=12$ | -0.05 | 0.00 | -0.02 | -0.02 | $\mathrm{J}=12$ | 0.07 | 0.08 | 0.09 | 0.09 |
|  | -2.5912 | 5.1207 | 5.0214 | 2.3723 |  | -4.4446 | 0.1729 | -2.6954 | -5.8662 |  | 4.7978 | 7.0238 | 8.2290 | 8.0772 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SWITZERLAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | UK | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | US | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.09 | 0.07 | 0.06 | 0.15 | $\mathrm{J}=3$ | -0.11 | 0.06 | 0.10 | 0.14 | $\mathrm{J}=3$ | -0.30 | -0.11 | -0.12 | -0.10 |
|  | -5.4998 | 5.4152 | 2.6829 | 10.3425 |  | -5.9878 | 3.2640 | 3.7497 | 5.4278 |  | -11.6960 | -5.1886 | -9.0648 | -4.8530 |
| $\mathrm{J}=6$ | 0.06 | 0.14 | 0.10 | 0.12 | $\mathrm{J}=6$ | 0.05 | 0.12 | 0.12 | 0.16 | $\mathrm{J}=6$ | -0.16 | -0.10 | -0.07 | -0.10 |
|  | 3.1382 | 8.4184 | 3.5391 | 7.7085 |  | 1.8172 | 4.2190 | 4.7566 | 7.0126 |  | -9.7098 | -6.8912 | -4.4764 | -4.7690 |
| $\mathrm{J}=9$ | 0.08 | 0.14 | 0.11 | 0.08 | $\mathrm{J}=9$ | 0.10 | 0.16 | 0.16 | 0.11 | $\mathrm{J}=9$ | -0.10 | -0.05 | -0.07 | -0.10 |
|  | 4.4697 | 7.5051 | 4.9839 | 6.5135 |  | 3.2950 | 7.6271 | 9.0424 | 6.5850 |  | -8.9830 | -4.1237 | -4.4550 | -5.2380 |
| $\mathrm{J}=12$ | 0.11 | 0.10 | 0.05 |  | $\mathrm{J}=12$ | 0.14 | 0.15 | 0.12 | 0.06 | $\mathrm{J}=12$ | -0.12 | -0.09 | -0.10 | -0.13 |
|  | 12.2385 | 14.8789 | 4.5096 | $7.5628$ |  | 3.7420 | 5.0757 | 5.8223 | 3.4367 |  | -9.5693 | -6.1616 | -4.8266 | -5.3169 |

### 8.3.4. The rebalancing methods

Table 8.6 reports the pooled net returns and risk-adjusted net returns of the time-series momentum strategy under different implementations according to four rebalancing methods: CAR (0), BHAR (0), CAR (1), and BHAR (1).

Like previously, it proves that the investment outcomes are not very sensitive to the rebalancing period used. The average Fama-French alphas across the implementations for the time-series momentum strategies using CAR (0) and CAR (1) are $-0.18 \%$ per month and $0.22 \%$ per month, whereas the strategies involving BHAR (0) and BHAR (1) are $-0.21 \%$ per month and $-0.27 \%$ per month. It appears that monthly rebalancing is preferable with there being little difference between imposing a one-month lag or not. Based on the calculated Sharpe ratio, there is hardly any difference in the investment outcomes under any of the rebalancing methods.

## Table 8.6. Risk-adjusted performance of time-series momentum based on portfolio constructions

This table reports net returns, the Fama-French alphas and the Sharpe ratios of the pooled average monthly time-series momentum based on four rebalancing methods: monthly-rebalancing with zero gap (CAR (0)), monthly-rebalancing with 1-month gap (CAR (1)), buy-and-hold with zero gap (BHAR (0)), and buy-and-hold with 1-month gap (BHAR (1)). The results of net returns are from Table 7.5. T-statistics are reported in italics.

|  | Net return |  |  |  |  |  |  |  | Fama-French alpha |  |  |  |  |  |  |  | Sharpe ratio |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | CAR (0) |  | CAR (1) |  | BHAR (0) |  | BHAR (1) |  | CAR (0) |  | CAR (1) |  | BHAR (0) |  | BHAR (1) |  | CAR (0) |  | CAR (1) |  | BHAR (0) |  | BHAR (1) |  |
| AUSTRALIA | 0.15\% | -1.4153 | 0.20\% | -2.1353 | 0.29\% | -2.832 | .48\% | -5.2320 | . $61 \%$ | -5.577 | -.67\% | -7.14 | -0.73\% | -6.969 | -.98\% | -10.19.31 | 18 | -6.30 | 19 | -7.4762 | . 14 | -7.461 | . 14 | -9.99 |
| AUST | 0.53\% | 11.10 | 0.52\% | 12.6301 | 0.49 | 8.3 | 0.43\% | 8.2307 | -0.08\% | -1.6111 | -0.10\% | -2.2030 | -0.28\% | -4.9524 | -0.34\% | -6.0517 | 0.05 | 67 | 0.05 | 6.4596 | 03 | . 404 | 0.02 | 7 |
| BELGIUM | 0.73\% | 18.587 | 0.74\% | 21.8512 | 0.58\% | 9.1704 | 0.59\% | 11.1638 | 0.29\% | 8.3044 | 0.30\% | 9.8080 | 0.14\% | 2.3068 | 0.10\% | 1.8484 | 0.09 | 10.6791 | 0.10 | 13.4263 | 05 | 4.7236 | 0.05 | 5.4889 |
| Canada | 0.27\% | 2.7559 | 0.20\% | 2.2382 | 0.19\% | 1.6255 | 0.11\% | 1.0919 | -0.10\% | -1.0936 | -0.22\% | -2.7176 | -0.24\% | -2.2150 | -0.32\% | -3.5225 | -0.02 | -1.2523 | -0.04 | -2.1971 | -0.03 | -1.9193 | -0.04 | -3.0471 |
| DENMARK | 0.81\% | 17.6499 | 0.79\% | 19.0611 | 0.62\% | 9.6968 | 0.73\% | 13.4082 | 0.29\% | 7.4224 | 0.22\% | 6.9176 | 0.07\% | 1.0620 | 0.18\% | 3.1770 | 0.10 | 8.9854 | 0.09 | 9.7418 | 0.05 | 4.0267 | 0.06 | 6.6153 |
| FINLAND | 0.64\% | 9.0653 | 0.62\% | 9.2143 | 0.53\% | 5.3445 | . $4 \%$ | 5.9104 | 8\% | 719 | 21\% | 4680 | 0.12\% | 1.4010 | 0.14\% | 1.8083 | 0.0 | 1286 | 0.0 | 4.2169 | 0.02 | . 8029 | 0.02 | . 464 |
| FRANCE | -0.08\% | -1.0238 | .10\% | 7332 | -0.16\% | -1.9129 | \% | 72 | -0.34\% | -4.8727 | 20\% | -4.1422 | -0.39\% | -5.6042 | -0.26\% | -5.0012 | -0.0 | -4.4543 | -0.0 | .0000 | -0.07 | 191 | -0.04 | 948 |
| GERMANY | 0.43\% | 7.4465 | .40\% | 8.2491 | 0.34\% | 4.98 | 0.28\% | 5.2851 | -0.36\% | -5.8773 | -0.36\% | -6.8501 | -0.34\% | -4.9 | -0.45\% | -6.6855 | 0.03 | 2.2300 | 0.02 | 2.0892 | 0.0 | 0.5383 | 0.00 | 338 |
| GREECE | -0.55\% | -14.0178 | -0.58\% | -14.7273 | -0.14\% | -1.4546 | 0.07\% | 0.7213 | -1.15\% | -29.5541 | -1.20\% | -31.3660 | -0.72\% | -7.2193 | -0.52\% | -5.2128 | -0.13 | -29.8301 | -0.14 | -28.1950 | -0.0 | -7.661 | -0.04 | -5.0914 |
| HONGKONG | -0.28\% | -3.8473 | -0.42\% | -5.5437 | -0.40\% | -4.5363 | -0.70\% | -7.8241 | -0.71\% | -8.9425 | -0.87\% | -10.8922 | -0.77\% | -8.2923 | -1.01\% | -11.1314 | -0.12 | -7.8472 | -0.14 | -9.0243 | -0.1 | -7.5805 | -0.13 | -10.4752 |
| IRELAND | 0.21\% | 2.7708 | 0.20\% | 2.8851 | 0.10\% | 0.6596 | -0.03\% | -0.1914 | 0.00\% | 0.0347 | -0.04\% | -0.5648 | -0.01\% | -0.0426 | -0.24\% | -1.7413 | -0.02 | -2.3974 | -0.02 | -2.6804 | -0.02 | -1.7827 | -0.03 | -2.8125 |
| ISRAEL | -0.49\% | -5.0297 | -0.43\% | -4.9528 | -0.31\% | -2.5127 | -0.30\% | -2.2979 | -1.26\% | -14.4764 | -1.20\% | -15.4679 | -1.05\% | -8.9888 | -1.15\% | -9.1517 | -0.25 | -9.7748 | -0.24 | -10.2915 | -0.14 | -7.5656 | -0.1 | -7.2040 |
| ITALY | 1.07\% | 20.2051 | 1.03\% | 23.4831 | 0.76\% | 10.6797 | 0.73\% | 11.4414 | 0.22\% | 4.4986 | 0.14\% | 3.5341 | -0.14\% | -2.074 | -0.20\% | -3.1337 | 0.12 | 13.8856 | 0.12 | 15.9629 | 0.05 | 5.2804 | 0.04 | 5.2359 |
| JAPAN | -0.23\% | -5.8836 | -0.22\% | -5.5569 | -0.10\% | -1.9267 | -0.18\% | -3.7156 | -0.60\% | -15.6299 | -0.57\% | -15.4646 | -0.44\% | -9.7544 | -0.56\% | -11.5235 | -0.07 | -7.6663 | -0.0 | -7.3414 | -0.0 | -3.556 | -0.00 | -5.1688 |
| NETHERLANDS | 0.88\% | 18.3519 | 0.74\% | 16.1750 | 0.92\% | 11.8137 | 0.78\% | 9.4840 | 0.41\% | 7.4115 | 0.27\% | 5.1423 | 0.45\% | 5.0563 | 0.33\% | 3.4977 | 12 | 11.7817 | 0.0 | 9.7692 | 0.09 | 8.1354 | 0.07 | 6.3370 |
| NEWZEALAND | 0.99\% | 18.9440 | 0.83\% | 20.7324 | 0.84\% | 9.4608 | 63\% | 6779 | \% | 9.7846 | 0.40\% | 9.3760 | 0.44\% | 4.7891 | 0.24\% | 3.1001 | 08 | 8.5575 | 0.0 | 7.5563 | 0.04 | 3.8014 | . 02 | 1.6376 |
| NORWAY | 0.03\% | 0.6153 | -0.03\% | -0.4805 | 0.14\% | 1.6607 | 0.11\% | 2.0521 | -0.64\% | -12.5997 | -0.74\% | -13.4788 | -0.58\% | -8.1993 | -0.68\% | -12.7640 | -0.05 | -7.1088 | -0.06 | -8.0423 | -0.03 | -3.5351 | -0.03 | -5.5810 |
| PORTUGAL | -0.33\% | -4.7830 | -0.11\% | -2.2702 | -0.10\% | -0.9586 | 0.13\% | 1.2150 | -0.66\% | -9.6989 | -0.44\% | -9.1121 | -0.39\% | -3.2454 | -0.17\% | -1.3934 | -0.09 | -10.8609 | -0.06 | -10.7625 | -0.05 | -4.6598 | -0.03 | -2.7748 |
| SINGAPORE | 0.27\% | 5.4899 | 0.20\% | 4.7360 | 0.11\% | 1.7253 | -0.05\% | -0.6055 | 0.06\% | 1.4234 | -0.05\% | -1.2864 | -0.05\% | -0.8877 | -0.27\% | -3.6813 | 0.03 | 3.6641 | 0.02 | 2.6449 | 0.00 | -0.0167 | -0.02 | -2.1005 |
| SPAIN | -0.08\% | -1.1273 | -0.05\% | -0.7959 | -0.27\% | -2.7307 | -0.25\% | -3.4595 | -0.37\% | -5.8978 | -0.37\% | -6.8517 | -0.57\% | -6.3525 | -0.54\% | -8.3820 | -0.07 | -6.7693 | -0.07 | -7.4176 | -0.07 | -6.6139 | -0.07 | -8.7018 |
| SWEDEN | 0.69\% | 9.9658 | 0.68\% | 12.5329 | 0.53\% | 6.0340 | 0.65\% | 7.8548 | 0.43\% | 5.8583 | 0.37\% | 6.6594 | 0.27\% | 2.9934 | 0.34\% | 4.1732 | 0.05 | 4.8183 | 0.05 | 5.8398 | 0.02 | 2.3226 | 0.03 | 3.8039 |
| SWITZERLAND | 0.58\% | 11.3903 | 0.53\% | 14.8430 | 0.61\% | 8.8404 | 0.58\% | 9.8957 | 0.37\% | 7.1289 | 0.30\% | 7.3425 | 0.41\% | 5.6459 | 0.39\% | 6.0851 | 0.10 | 7.9876 | 0.09 | 9.6355 | 0.08 | 6.1375 | 0.07 | 6.9508 |
| UK | 0.74\% | 11.5749 | 0.70\% | 15.3958 | 0.77\% | 11.6282 | 0.70\% | 14.7812 | 0.15\% | 3.2277 | 0.08\% | 2.3805 | 0.26\% | 5.3521 | 0.10\% | 2.3349 | 0.12 | 6.6204 | 0.10 | 7.4522 | 0.11 | 6.6911 | 0.08 | 7.1465 |
| US | -0.21\% | -4.2073 | -0.18\% | -3.9484 | -0.20\% | -3.8912 | -0.27\% | -6.7462 | -0.52\% | -12.1579 | -0.53\% | -12.3203 | -0.51\% | -12.0628 | -0.63\% | -16.3399 | -0.12 | -9.3050 | -0.12 | -9.3788 | -0.10 | -9.0842 | -0.11 | -12.5490 |
| , | 0.27\% | 2.6646 | 0.25\% | 2.6658 | 0.23\% | 2.6932 | 0.20\% | 2.2669 | -0.18\% | -1.7250 | -0.22\% | -2.2412 | -0.21\% | -2.4478 | -0.27\% | -3.0120 | -0.01 | -0.5731 | -0.02 | -0.7876 | -0.01 | -0.9164 | -0.02 | -1.2777 |

### 8.4. The risk-adjusted performances of cross-sectional momentum strategies

Tables 8.7 and 8.8 in Appendix 3 report the average monthly risk-adjusted performances of $16(\mathrm{~J} \times \mathrm{H})$ cross-sectional momentum strategies across the 24 markets using the Fama-French alpha and the Sharpe ratio, for each of the implementations as outlined in Table 4.1. The reported profits all relate to an implementation where the cut-offs are set at $16 \%$. In each rebalancing period the top $16 \%$ are identified as winning stocks and the bottom $16 \%$ as losing stocks. The strategy used is to buy the portfolio consisting of the identified winning stocks and sell the portfolio consisting of the identified losing stocks with the average monthly aftertransaction costs returns being the difference between the monthly returns of the two portfolios subtracting the transaction costs of the winners and losers. The risk-adjusted net return in the two tables is then estimated using the Fama-French model and the Sharpe ratio.

Panels A, B and C of Tables 8.7 and 8.8 in Appendix 3 show the average monthly FamaFrench alphas and the Sharpe measures of the cross-sectional momentum strategy when the portfolio weights are based on EW, MW and IVOL, respectively.

### 8.4.1. The risk-adjusted performance of cross-sectional momentum strategies

Table 8.9 summarises the number of implementations that yield (i) significant positive and negative Fama-French alphas, and (ii) positive and negative Sharpe ratios of the 192 crosssectional momentum strategies for each market. When pooling all of the 24 markets, the number of implementations that produce positive Fama-French risk-adjusted net returns are $34 \%$ ( $6 \%$ significant) from $59 \%$ ( $23 \%$ significant) before the adjustment, with about $40 \%$ of the implementations in the cross-sectional momentum strategy gaining positive Sharpe ratios.

Hence, we have seen that standard risk measure explains a high proportion of the apparent profitability of cross-sectional (and time-series) momentum strategies.

None of the implementations under either momentum strategies yield significant positive risk-adjusted net returns in 12 markets (Austria, France, Germany, Greece, Hong Kong, Israel, Japan, Norway, Portugal, Singapore, Spain and the US) over our testing period. The findings support that the market efficiency holds in these markets after the transaction costs and investment risks are taken into account. In the other 12 markets, less than $10 \%$ of the implementations in both momentum strategies produce significantly positive risk-adjusted net returns in Australia, Italy, Canada, Ireland and Finland. In contrast, in excess of $20 \%$ of the implementations yield significant positive Fama-French alphas in New Zealand and Switzerland (both time-series and cross-sectional momentum strategies), in Belgium and Denmark (the cross-sectional momentum strategy only) and the Netherlands (the time-series momentum strategy only). The magnitude of these significant positive findings are much higher than one would expect based on statistical inference and so do not provide strong inference of the existence of pricing inefficiencies in these markets nor the existence of exploitable investment opportunities.

Chart 8.3 plots the pooled after-transaction costs (net) returns and risk-adjusted net return using the Fama-French model of 192 cross-sectional momentum strategies for each market. The average risk-adjusted net returns across the 24 markets drops to $-0.29 \%$ per month from $0.11 \%$ (net return). We previously find that the cross-sectional momentum strategy is not profitable in ten of the 24 markets in terms of the pooled net returns. At the other end of the scale we find five markets where the implementations of cross-sectional momentum strategy yield positive risk-adjusted returns: Belgium ( $0.31 \%$ per month), Denmark ( $0.24 \%$ per
month), Finland ( $0.19 \%$ per month), New Zealand ( $0.31 \%$ per month) and Switzerland ( $0.24 \%$ per month).

Chart 8.4 shows the pooled Sharpe ratios across the implementations for each market. The average pooled Sharpe ratios across the 24 markets is -0.04 in the cross-sectional momentum strategy, while -0.01 in the time-series momentum strategy in Chart 8.2. The pooled Sharpe ratios in the cross-sectional momentum strategy appear to be positive in Austria, Belgium, Denmark, Finland, Italy, the Netherlands, New Zealand Switzerland and the UK. In contrast, at the bottom of the scale, the Sharpe ratios appear to be negative in remaining 15 markets with the lowest ratio in Israel at -0.22 .

In sum, based on the findings of the Fama-French alpha and the Sharpe ratio (Chart 8.1 Chart 8.4), the average risk-adjusted net returns from the cross-sectional and time-series momentum strategies are consistently positive in five markets: Belgium, Denmark, Finland, New Zealand and Switzerland. For the time-series momentum strategy, four additional markets (Italy, the Netherlands, New Zealand and the UK) show positive outcomes using either of the two risk-adjustment methods.

Table 8.9. Numbers of implementations yield positive/negative cross-sectional momentum risk-adjusted net returns

This table reports the numbers of implementations yielding positive and negative average monthly crosssectional momentum risk-adjusted returns based on the Fama-French alpha and the Sharpe ratio for each market. The SIGNIFICANT column indicates the aggregate numbers of implementations that generate average monthly returns at the $1 \%, 5 \%$, or $10 \%$ significance level, whereas the NON-SIGNIFICANT column indicates the numbers of strategies producing average monthly returns over $10 \%$ significance level.

|  | Fama-French alpha |  |  |  |  |  |  |  | Sharpe ratio |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | POSITIVE |  |  |  | NEGATIVE |  |  |  | POSITIVE |  | NEGATIVE |  |
|  | SIGNIFICANT | \% | NON <br> SIGNIFICANT | \% | SIGNIFICANT | \% | NON <br> SIGNIFICANT | \% | NO. | \% | NO. | \% |
| AUSTRALIA | 0 | 0\% | 16 | 8\% | 122 | 64\% | 54 | 28\% | 13 | 7\% | 179 | 93\% |
| AUSTRIA | 0 | 0\% | 63 | 33\% | 35 | 18\% | 94 | 49\% | 114 | 59\% | 78 | 41\% |
| BELGIUM | 84 | 44\% | 73 | 38\% | 7 | 4\% | 28 | 15\% | 164 | 85\% | 28 | 15\% |
| CANADA | 1 | 1\% | 46 | 24\% | 58 | 30\% | 87 | 45\% | 51 | 27\% | 141 | 73\% |
| DENMARK | 48 | 25\% | 106 | 55\% | 9 | 5\% | 29 | 15\% | 168 | 88\% | 24 | 13\% |
| FINLAND | 13 | 7\% | 121 | 63\% | 5 | 3\% | 53 | 28\% | 131 | 68\% | 61 | 32\% |
| FRANCE | 0 | 0\% | 49 | 26\% | 32 | 17\% | 111 | 58\% | 49 | 26\% | 143 | 74\% |
| GERMANY | 0 | 0\% | 16 | 8\% | 59 | 31\% | 117 | 61\% | 116 | 60\% | 76 | 40\% |
| GREECE | 0 | 0\% | 6 | 3\% | 101 | 53\% | 85 | 44\% | 5 | 3\% | 187 | 97\% |
| HONGKONG | 0 | 0\% | 1 | 1\% | 144 | 75\% | 47 | 24\% | 0 | 0\% | 192 | 100\% |
| IRELAND | 2 | 1\% | 43 | 22\% | 14 | 7\% | 133 | 69\% | 25 | 13\% | 167 | 87\% |
| ISRAEL | 0 | 0\% | 3 | 2\% | 149 | 78\% | 40 | 21\% | 5 | 3\% | 187 | 97\% |
| ITALY | 0 | 0\% | 40 | 21\% | 18 | 9\% | 134 | 70\% | 158 | 82\% | 34 | 18\% |
| JAPAN | 0 | 0\% | 0 | 0\% | 176 | 92\% | 16 | 8\% | 1 | 1\% | 191 | 99\% |
| NETHERLANDS | 28 | 15\% | 82 | 43\% | 36 | 19\% | 46 | 24\% | 116 | 60\% | 76 | 40\% |
| NEWZEALAND | 38 | 20\% | 131 | 68\% | 3 | 2\% | 20 | 10\% | 153 | 80\% | 39 | 20\% |
| NORWAY | 0 | 0\% | 35 | 18\% | 31 | 16\% | 126 | 66\% | 62 | 32\% | 130 | 68\% |
| PORTUGAL | 0 | 0\% | 39 | 20\% | 15 | 8\% | 138 | 72\% | 31 | 16\% | 161 | 84\% |
| SINGAPORE | 0 | 0\% | 33 | 17\% | 25 | 13\% | 134 | 70\% | 8 | 4\% | 184 | 96\% |
| SPAIN | 0 | 0\% | 101 | 53\% | 20 | 10\% | 71 | 37\% | 101 | 53\% | 91 | 47\% |
| SWEDEN | 0 | 0\% | 104 | 54\% | 8 | 4\% | 80 | 42\% | 94 | 49\% | 98 | 51\% |
| SWITZERLAND | 53 | 28\% | 107 | 56\% | 2 | 1\% | 30 | 16\% | 160 | 83\% | 32 | 17\% |
| UK | 6 | 3\% | 84 | 44\% | 15 | 8\% | 87 | 45\% | 116 | 60\% | 76 | 40\% |
| US | 0 | 0\% | 3 | 2\% | 119 | 62\% | 70 | 36\% | 1 | 1\% | 191 | 99\% |
| POOLED SAMPLE | 11 | 6\% | 54 | 28\% | 50 | 26\% | 76 | 40\% | 77 | 40\% | 115 | 60\% |

## Chart 8.3. Average cross-sectional momentum Fama-French alphas across implementations for each market

This chart plots the pooled average monthly after-transaction costs (net) returns and risk-adjusted net returns based on the Fama-French three-factor model for 192 time-series momentum strategies for each market. The dashed line shows the average monthly returns across the 24 developed markets.


## Chart 8.4. Average monthly Sharpe ratio for the cross-sectional momentum strategy across implementations for each market

This chart reports the pooled average monthly Sharpe ratio for 192 cross-sectional momentum strategies for each market. The dashed line shows the average monthly Sharpe ratio across the 24 developed markets.


### 8.4.2. The weighting method

Table 8.10 outlines the average net returns, Fama-French alphas and Sharpe ratios (t-statistics in italics) of all cross-sectional momentum strategies in terms of three different portfolio weights: equal weight (EW), market weight (MW) and inverse volatility (IVOL) weight.

The introduction of the risk-adjustment has very little impact on the relative performance of the three weighting schemes in 22 markets based on the Fama-French alpha and in 23 markets based on the Sharpe ratio. The strategies using IVOL continue to produce the best investment outcomes in terms of the average risk-adjusted net returns across the 24 markets. On a country-by-country basis, the cross-sectional momentum strategies using MW yield the highest risk-adjusted net returns in ten markets based on either the two risk measures, whereas the strategies using EW and IVOL generate the greatest returns in five and eight markets respectively according to the Fama-French alpha, and in six and seven markets respectively according to the Sharpe ratio.

The findings when using the weighting methods for the cross-sectional momentum strategy are similar to those that have been identified for the time-series momentum strategy. Based on the Fama-French alpha and the Sharpe ratio from the time-series momentum strategy (Table 8.4) and the cross-sectional momentum strategy (Table 8.10), we observe the general finding that the MW and IVOL weighting schemes both achieve better investment outcomes EW. However, EW remains the best weighting schemes in Belgium, France, Italy and Switzerland under both risk-adjusted methods.

Table 8.10. Risk-adjusted performance of cross-sectional momentum strategy based on three weights

This table reports the pooled average monthly net returns, the Fama-French alphas and the Sharpe ratios of cross-sectional momentum strategies using equal weight (EW), market weight (MW) and inversed volatility weight (IVOL) for each market. The results of net returns are from Table 7.8. T-statistics are reported in italics. The highest return is highlighted in green and the lowest return is marked in red.

|  | Net return |  |  |  |  |  | Fama-French alpha |  |  |  |  |  | Sharpe ratio |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | EW |  | MW | IVOL |  |  | EW |  | MW |  | IVOL |  | EW |  | MW |  | IVOL |  |
| AUSTRALIA | -0.72\% | -18.1059 | 0.13\% | 3.0705 | -0.42\% | -7.4048 | -1.23\% | -31.7948 | -0.31\% | -6.5788 | -0.91\% | -15.0167 | -0.28 | -33.1243 | -0.04 | -7.2609 | -0.15 | -16.0764 |
| AUSTRIA | 0.51\% | 14.5196 | 0.01\% | 0.3256 | 0.55\% | 13.8478 | -0.09\% | -2.7245 | -0.65\% | -14.5004 | -0.04\% | -1.2999 | 0.05 | 6.9591 | -0.04 | -6.4541 | 0.06 | 6.7058 |
| belgium | 0.84\% | 21.2993 | 0.52\% | 9.5454 | 0.77\% | 17.0556 | 0.42\% | 10.6551 | 0.16\% | 2.7314 | 0.37\% | 8.3608 | 0.13 | 14.4157 | 0.03 | 4.0971 | 0.12 | 10.9205 |
| CANADA | -0.43\% | -7.6464 | 0.45\% | 8.3609 | -0.10\% | -1.9166 | -0.74\% | -14.9434 | 0.12\% | 2.2266 | -0.38\% | -8.0214 | -0.14 | -14.0042 | 0.02 | 3.2892 | -0.07 | -7.5699 |
| DENMARK | 0.76\% | 18.1742 | 0.68\% | 15.8893 | 0.74\% | 17.5555 | 0.26\% | 6.8772 | 0.18\% | 3.9606 | 0.29\% | 7.4035 | 0.10 | 9.7413 | 0.05 | 7.7245 | 0.10 | 8.9523 |
| FINLAND | 0.29\% | 7.8866 | 0.94\% | 14.9787 | 0.33\% | 8.7524 | 0.00\% | -0.1027 | 0.50\% | 7.9706 | 0.07\% | 1.9135 | 0.00 | -0.7222 | 0.07 | 9.9937 | 0.00 | 0.6164 |
| FRANCE | 0.09\% | 1.8550 | -0.35\% | -5.6513 | 0.00\% | -0.0369 | -0.21\% | -4.5653 | -0.37\% | -6.9082 | -0.28\% | -5.1003 | -0.04 | -4.0466 | -0.10 | -11.3035 | -0.05 | -4.8526 |
| GERMANY | 0.18\% | 4.2470 | 0.34\% | 6.2309 | 0.30\% | 6.1754 | -0.58\% | -14.6605 | -0.28\% | -5.1438 | -0.36\% | -7.4755 | -0.02 | -2.7762 | 0.01 | 1.0661 | 0.01 | 0.5957 |
| GREECE | -0.44\% | -10.1949 | 0.04\% | 0.7107 | -0.31\% | -7.0286 | -1.05\% | -23.7507 | -0.53\% | -9.6605 | -0.90\% | -19.8653 | -0.15 | -26.6429 | -0.05 | -12.2635 | -0.13 | -22.0471 |
| HONGKONG | -1.08\% | -23.0430 | -0.37\% | -9.1958 | -0.97\% | -22.6728 | -1.45\% | -29.8291 | -0.66\% | -15.1077 | -1.29\% | -28.4681 | -0.26 | -41.7643 | -0.09 | -19.5153 | -0.23 | -38.2566 |
| IRELAND | -0.06\% | -1.2306 | -0.28\% | -3.2619 | 0.06\% | 1.1534 | -0.37\% | -8.9726 | -0.13\% | -1.5862 | -0.26\% | -5.4899 | -0.05 | -9.0556 | -0.05 | -8.1146 | -0.04 | -5.5889 |
| ISRAEL | -0.69\% | -17.3884 | 0.09\% | 1.6754 | -0.63\% | -17.1042 | -1.43\% | -39.5677 | -0.70\% | -13.0190 | -1.36\% | -42.5558 | -0.31 | -31.5926 | -0.06 | -9.4100 | -0.28 | -25.6611 |
| ITALY | 0.73\% | 22.9515 | 0.62\% | 12.2829 | 0.64\% | 21.4501 | -0.08\% | -3.3896 | -0.51\% | -12.5525 | -0.15\% | -6.3798 | 0.07 | 10.9982 | 0.03 | 4.7039 | 0.06 | 8.6971 |
| JAPAN | -0.59\% | -17.0941 | -0.46\% | -13.2897 | -0.58\% | -17.5707 | -0.87\% | -24.7640 | -0.80\% | -21.9288 | -0.84\% | -25.4588 | -0.16 | -21.6975 | -0.09 | -17.0365 | -0.15 | -22.2194 |
| NETHERLANDS | 0.72\% | 21.8314 | -0.30\% | -7.6831 | 0.62\% | 16.8709 | 0.31\% | 9.5999 | -0.81\% | -17.1114 | 0.25\% | 7.2407 | 0.10 | 13.0026 | -0.08 | -17.2017 | 0.07 | 9.0623 |
| NEWZEALAND | 0.73\% | 19.1390 | 0.53\% | 13.9619 | 0.879 | 30.5211 | 0.25\% | 6.1825 | 0.27\% | 6.4555 | 0.41\% | 12.6863 | 0.0 | 6.0416 | 0.00 | 0.5416 | 0.08 | 12.9162 |
| NORWAY | 0.15\% | 3.3707 | 0.28\% | 3.8127 | 0.20\% | 4.3897 | -0.37\% | -8.7777 | -0.23\% | -3.7024 | -0.29\% | -6.9264 | -0.05 | -6.1514 | -0.02 | -2.1625 | -0.04 | -4.9434 |
| PORTUGAL | -0.17\% | -3.0853 | 0.16\% | 4.1813 | 0.17\% | 3.8583 | -0.46\% | -8.3786 | -0.28\% | -7.2197 | -0.15\% | -3.0295 | -0.08 | -9.9841 | -0.02 | -5.7566 | -0.03 | -4.9262 |
| SINGAPORE | -0.29\% | -8.2747 | -0.44\% | -10.4999 | -0.23\% | -6.3547 | -0.30\% | -9.0614 | -0.38\% | -8.7678 | -0.19\% | -5.4392 | -0.07 | -12.5333 | -0.08 | -14.6099 | -0.06 | -10.1227 |
| SPAIN | 0.35\% | 9.1545 | -0.02\% | -0.2811 | 0.40\% | 9.3562 | -0.01\% | -0.4447 | -0.33\% | $-5.6395$ | 0.08\% | 2.0875 | 0.00 | -0.5909 | -0.05 | -5.6121 | 0.00 | 0.5475 |
| SWEDEN | 0.35\% | 11.6870 | -0.16\% | -3.3267 | 0.43\% | 13.0321 | 0.00\% | -0.0957 | -0.28\% | -5.3778 | 0.16\% | 4.3085 | 0.00 | 0.3870 | -0.05 | -11.2620 | 0.01 | 2.5841 |
| SWITZERLAND | 0.56\% | 22.6442 | 0.19\% | 4.8755 | 0.49\% | 15.7140 | 0.41\% | 18.2802 | 0.01\% | 0.3079 | 0.30\% | 11.6584 | 0.10 | 16.3401 | 0.01 | 0.7923 | 0.08 | 10.4475 |
| UK | 0.63\% | 19.5295 | -0.03\% | -0.5196 | 0.71\% | 20.8590 | 0.03\% | 1.0216 | -0.45\% | -10.6152 | 0.10\% | 3.2152 | 0.06 | 7.4858 | -0.06 | -8.1687 | 0.09 | 9.1948 |
| US | -0.51\% | -15.9522 | -0.22\% | -4.6915 | -0.49\% | -12.4061 | -0.76\% | -24.8497 | -0.41\% | -9.7434 | -0.68\% | -22.8920 | -0.17 | -26.6719 | -0.08 | -10.5274 | -0.17 | -22.6235 |
| POOLED SAMPLE | 0.08\% | 0.6869 | 0.10\% | 1.2439 | 0.15\% | 1.4135 | -0.35\% | -3.0139 | -0.29\% | -4.0350 | -0.25\% | -2.4312 | -0.05 | -1.8199 | -0.03 | -3.1750 | -0.03 | -1.3512 |

### 8.4.3. The formation (J) and holding period (H)

Table 8.11 reports the average pooled monthly Fama-French alphas and Sharpe ratios across 16 cross-sectional momentum strategies when using the formation period $\mathrm{J}(\mathrm{J}=$ three, six, nine and 12 months) and the holding period $\mathrm{H}(\mathrm{H}=$ three, six, nine and 12 months) for each market.

Consistent with the findings of time-series momentum strategies (see Table 8.5), we continue to find for the cross-sectional momentum strategy the highest risk-adjusted net returns range between 15 and 18 months in 18 markets using the Fama-French alpha and in 17 markets using the Sharpe ratio.

When dealing with raw returns (see Chapter 5), we find that the time-series and crosssectional momentum strategies produced the highest returns with a momentum cycle between 12 and 15 months composed of a formation period of between 9 and 12 months and a holding period of three months. Once transaction costs are introduced (see Chapter 7), we find that
the optimal momentum cycle lay between 15 and 18 months with a shorter formation period and a longer holding period. Now, with risk-adjusted net returns, the best cycle for both momentum strategies lies in the range between 15 and 18 months in 20 markets using the time-series momentum strategy and in 17 market using the cross-sectional momentum strategy with the formation and holding periods that produce the best outcomes being unchanged in 11 markets for the time-series momentum strategies and in 13 markets for cross-sectional momentum strategies.

## Table 8.11. Risk-adjusted performance of cross-sectional momentum based on formation (J) and holding (H) period

Three-factor model - This table reports the pooled average monthly cross-sectional momentum Fama-French alphas based on the formation J ( $\mathrm{J}=$ three, six, nine and 12 months) and the holding $\mathrm{H}(\mathrm{H}=$ three, six, nine and 12 months) for each market. T-statistics are reported in italics. The highest return is highlighted in green and the lowest return is highlighted in red.

| AUSTRALIA | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ | AUSTRIA | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | BELGIUM | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{J}=3$ | -1.77\% | -0.66\% | -0.58\% | -0.42\% | $\mathrm{J}=3$ | -0.80\% | -0.60\% | -0.43\% | -0.43\% | $\mathrm{J}=3$ | -0.50\% | -0.02\% | -0.11\% | 0.12\% |
|  | -11.1061 | -4.0037 | -4.8896 | -3.1553 |  | -5.0033 | -5.8573 | -4.2748 | -4.0363 |  | -6.3154 | -0.2887 | -0.7443 | 1.8819 |
| $\mathrm{J}=6$ | -1.08\% | -0.63\% | -0.86\% | -0.69\% | $\mathrm{J}=6$ | -0.29\% | -0.30\% | -0.16\% | -0.07\% | $\mathrm{J}=6$ | 0.21\% | 0.52\% | 0.56\% | 0.38\% |
|  | -6.3611 | -4.0023 | -4.5005 | -6.0771 |  | -3.6346 | -2.5842 | -1.6163 | -0.8663 |  | 6.7531 | 18.0550 | 18.4391 | 6.7574 |
| $\mathrm{J}=9$ | -0.83\% | -0.58\% | -0.60\% | -0.80\% | $\mathrm{J}=9$ | -0.01\% | 0.07\% | -0.05\% | -0.03\% | $\mathrm{J}=9$ | 0.51\% | 0.78\% | 0.63\% | 0.40\% |
|  | -6.0289 | -3.8861 | -5.3451 | -6.4902 |  | -0.1549 | 0.7535 | -0.5407 | -0.3368 |  | 7.1124 | 13.0308 | 12.6432 | 7.5169 |
| $\mathrm{J}=12$ | -0.86\% | -0.77\% | -0.98\% | -0.93\% | $\mathrm{J}=12$ | -0.13\% | -0.18\% | -0.33\% | -0.37\% | $\mathrm{J}=12$ | 0.55\% | 0.49\% | 0.43\% | 0.06\% |
|  | -6.5208 | -6.2035 | -10.0362 | -8.9712 |  | $-1.2478$ | -2.1667 | -3.3301 | $-5.2747$ |  | 5.6597 | 6.6577 | 6.5965 | 0.9393 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CANADA | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | DENMARK | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | FINLAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -1.23\% | -0.57\% | -0.12\% | -0.25\% | $\mathrm{J}=3$ | -0.56\% | 0.07\% | 0.07\% | 0.19\% | $\mathrm{J}=3$ | -0.64\% | -0.13\% | 0.25\% | 0.03\% |
|  | -7.4831 | -4.2297 | -1.0105 | -2.0427 |  | -12.7387 | 1.4900 | 1.1875 | 5.6167 |  | -6.7662 | -1.6640 | 3.0285 | 0.3807 |
| $\mathrm{J}=6$ | -0.59\% | -0.13\% | 0.07\% | -0.15\% | $\mathrm{J}=6$ | 0.37\% | 0.39\% | 0.36\% | 0.35\% | $\mathrm{J}=6$ | -0.01\% | 0.32\% | 0.62\% | 0.44\% |
|  | -4.4157 | -0.9606 | 0.4822 | $-1.3887$ |  | 11.2962 | 10.1123 | 6.3622 | 6.4495 |  | -0.2404 | 5.7965 | 4.0877 | 5.6724 |
| $\mathrm{J}=9$ | -0.03\% | 0.03\% | -0.15\% | -0.36\% | $\mathrm{J}=9$ | 0.46\% | 0.47\% | 0.42\% | 0.00\% | $\mathrm{J}=9$ | 0.39\% | 0.58\% | 0.26\% | 0.21\% |
|  | -0.2223 | 0.2403 | -1.0209 | -3.7105 |  | 7.9083 | 7.6648 | 11.8842 | 0.0355 |  | 9.3754 | 3.7629 | 2.1898 | 1.5347 |
| $\mathrm{J}=12$ | -0.20\% | -0.31\% | -0.55\% | -0.82\% | $\mathrm{J}=12$ | 0.56\% | 0.51\% | 0.27\% | -0.04\% | $\mathrm{J}=12$ | 0.19\% | 0.25\% | 0.21\% | 0.08\% |
|  | -2.3262 | -2.6027 | -5.3598 | -8.5455 |  | 8.2931 | 11.3700 | 5.8743 | -0.7601 |  | 4.5110 | 2.9332 | 1.6332 | 0.8830 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FRANCE | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H =9 | $\mathrm{H}=12$ | GERMANY | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | GREECE | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -1.41\% | -0.56\% | -0.33\% | -0.39\% | $\mathrm{J}=3$ | -1.49\% | -0.65\% | -0.36\% | -0.35\% | $\mathrm{J}=3$ | -1.32\% | -0.51\% | -0.66\% | -0.33\% |
|  | -16.2056 | -6.8162 | -6.2514 | -3.1568 |  | -32.9897 | -6.1097 | -6.5497 | $-2.6337$ |  | -13.1603 | -5.3731 | -14.8492 | -2.7779 |
| $\mathrm{J}=6$ | -0.63\% | -0.22\% | -0.10\% | -0.09\% | $\mathrm{J}=6$ | -0.76\% | -0.22\% | -0.07\% | -0.09\% | $\mathrm{J}=6$ | -0.73\% | -0.53\% | -0.60\% | -0.64\% |
|  | -8.6790 | -5.6762 | -2.0442 | $-1.5631$ |  | -18.3067 | -2.4543 | -1.0517 | -1.3056 |  | -6.7058 | -6.2416 | -8.0922 | -9.7679 |
| $\mathrm{J}=9$ | -0.42\% | -0.15\% | 0.00\% | -0.10\% | $\mathrm{J}=9$ | -0.46\% | -0.16\% | -0.22\% | -0.35\% | $\mathrm{J}=9$ | -0.62\% | -0.64\% | -0.84\% | -1.14\% |
|  | -4.3840 | -1.9991 | -0.0105 | -3.1223 |  | -12.4712 | -3.0657 | -4.6710 | -5.7760 |  | -6.6230 | -11.4831 | -8.3720 | -12.6288 |
| $\mathrm{J}=12$ | -0.10\% | 0.01\% | 0.02\% | -0.11\% | $\mathrm{J}=12$ | -0.35\% | -0.28\% | -0.31\% | -0.42\% | $\mathrm{J}=12$ | -0.90\% | -1.07\% | -1.15\% | -1.54\% |
|  | -1.9639 | 0.4694 | 0.7239 | -2.3249 |  | -6.4305 | -4.9834 | -6.0721 | -7.6096 |  | -10.6941 | -10.6948 | -17.6669 | -11.4674 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| HONGKONG | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | IRELAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | ISRAEL | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -1.88\% | -0.88\% | -0.78\% | -0.83\% | $\mathrm{J}=3$ | -0.50\% | -0.56\% | -0.72\% | -0.24\% | $\mathrm{J}=3$ | -1.99\% | -1.25\% | -1.02\% | -1.11\% |
|  | -14.8315 | -8.9578 | -7.7021 | -9.7910 |  | -4.1949 | -3.1750 | -3.7691 | -2.8783 |  | -19.5533 | -12.3251 | -7.2683 | -12.0675 |
| $\mathrm{J}=6$ | -1.07\% | -0.78\% | -0.68\% | -0.96\% | $\mathrm{J}=6$ | -0.18\% | 0.02\% | -0.43\% | 0.37\% | $\mathrm{J}=6$ | -1.26\% | -1.04\% | -1.02\% | -0.94\% |
|  | -7.9945 | -6.4247 | -5.8014 | -10.4682 |  | -1.2786 | 0.1648 | -3.1534 | 1.8630 |  | -9.0583 | -8.1401 | -10.5395 | -11.9792 |
| $\mathrm{J}=9$ | -1.18\% | -1.00\% | -1.13\% | -1.26\% | $\mathrm{J}=9$ | -0.40\% | -0.24\% | -0.16\% | -0.07\% | $\mathrm{J}=9$ | -1.09\% | -0.99\% | -1.10\% | -0.87\% |
|  | -11.9911 | -8.5544 | -8.8461 | -11.7689 |  | -5.2720 | -3.1346 | -2.6781 | -0.6737 |  | -6.0291 | -6.9000 | -10.8676 | -4.3874 |
| $\mathrm{J}=12$ | -1.40\% | -1.21\% | -1.53\% | -1.54\% | $\mathrm{J}=12$ | -0.20\% | -0.11\% | -0.09\% | -0.51\% | $\mathrm{J}=12$ | -1.22\% | -1.13\% | -1.19\% | -1.36\% |
|  | -11.6244 | -9.3945 | -12.6224 | -12.1809 |  | -1.8814 | -1.7962 | -0.9267 | -8.1605 |  | -14.1504 | -19.0352 | -15.3334 | -19.4178 |


| ITALY | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | JAPAN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | NETHERLANDS | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{J}=3$ | -0.78\% | -0.40\% | -0.06\% | -0.12\% | $\mathrm{J}=3$ | -1.37\% | -0.86\% | -0.67\% | -0.42\% | $\mathrm{J}=3$ | -0.69\% | -0.39\% | -0.17\% | -0.07\% |
|  | -9.6686 | -5.3384 | -1.0906 | -3.9153 |  | -55.2133 | -22.9942 | -12.6347 | -29.3506 |  | -6.6256 | -2.4053 | -1.0573 | -0.8455 |
| $\mathrm{J}=6$ | -0.42\% | -0.16\% | -0.15\% | -0.20\% | $\mathrm{J}=6$ | -1.24\% | -0.98\% | -0.64\% | -0.46\% | $\mathrm{J}=6$ | -0.37\% | -0.07\% | 0.07\% | 0.31\% |
|  | -6.1858 | -1.8692 | -1.8206 | -4.4833 |  | -35.1621 | -16.9790 | -23.1649 | $-10.3293$ |  | -1.7956 | -0.3796 | 0.5121 | 2.8351 |
| $\mathrm{J}=9$ | -0.17\% | -0.23\% | -0.13\% | -0.42\% | $\mathrm{J}=9$ | -1.05\% | -0.71\% | -0.63\% | -0.66\% | $\mathrm{J}=9$ | -0.11\% | 0.02\% | 0.19\% | 0.07\% |
|  | -1.5161 | -1.7611 | -1.9494 | -3.5929 |  | -27.5612 | -32.7128 | -23.7266 | -22.6318 |  | -0.5140 | 0.1264 | 1.3334 | 0.5492 |
| $\mathrm{J}=12$ | -0.18\% | -0.11\% | -0.22\% | -0.25\% | $\mathrm{J}=12$ | -0.96\% | -0.92\% | -0.93\% | -0.85\% | $\mathrm{J}=12$ | -0.06\% | -0.02\% | 0.03\% | -0.05\% |
|  | -2.2555 | -2.8007 | -5.9435 | -7.0166 |  | -42.4223 | -31.1022 | -19.6170 | -33.3177 |  | -0.2727 | -0.0848 | 0.1968 | -0.3418 |
| NEWZEALAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | NORWAY | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | PORTUGAL | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.10\% | 0.27\% | 0.06\% | -0.11\% | $\mathrm{J}=3$ | -1.27\% | -0.41\% | -0.20\% | -0.20\% | $\mathrm{J}=3$ | -1.13\% | -0.17\% | -0.26\% | -0.09\% |
|  | -0.9874 | 4.2041 | 0.6706 | -1.0707 |  | -22.0009 | -7.3615 | -6.9221 | -5.8260 |  | -5.1259 | -1.6374 | -2.4294 | -1.5636 |
| $\mathrm{J}=6$ | 0.44\% | 0.43\% | 0.45\% | 0.06\% | $\mathrm{J}=6$ | -0.59\% | -0.10\% | 0.06\% | -0.03\% | $\mathrm{J}=6$ | -0.66\% | -0.13\% | -0.05\% | -0.11\% |
|  | 6.0441 | 7.8888 | 15.3469 | 0.6627 |  | -11.5375 | -2.1136 | 0.6454 | -0.4356 |  | -6.3835 | -1.8710 | -0.5768 | -2.9692 |
| $\mathrm{J}=9$ | 0.62\% | 0.56\% | 0.46\% | 0.34\% | $\mathrm{J}=9$ | -0.03\% | 0.14\% | -0.24\% | -0.10\% | $\mathrm{J}=9$ | -0.40\% | -0.08\% | -0.10\% | -0.12\% |
|  | 9.5413 | 17.9959 | 11.8792 | 6.6328 |  | -0.5268 | 2.0903 | -5.7945 | -0.8247 |  | -5.0260 | -1.2067 | -1.2773 | -1.8328 |
| $\mathrm{J}=12$ | 0.53\% | 0.49\% | 0.20\% | 0.26\% | $\mathrm{J}=12$ | -0.26\% | -0.38\% | -0.43\% | -0.67\% | $\mathrm{J}=12$ | -0.45\% | -0.31\% | -0.33\% | -0.40\% |
|  | 12.4778 | 12.9342 | 5.0157 | 3.7205 |  | -5.1354 | -5.3151 | -9.0408 | -8.7090 |  | -5.0066 | -5.4358 | -7.1552 | -12.8122 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SINGAPORE | H = 3 | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | SPAIN | H = 3 | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | SWEDEN | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -1.04\% | -0.41\% | 0.04\% | -0.18\% | $\mathrm{J}=3$ | -0.76\% | -0.56\% | -0.13\% | -0.17\% | $\mathrm{J}=3$ | -0.38\% | -0.06\% | 0.08\% | -0.08\% |
|  | -17.1068 | -4.8120 | 0.8472 | -5.7465 |  | -9.0585 | -5.4619 | -1.8386 | $-1.8561$ |  | -3.2757 | -1.3786 | 1.9169 | -0.8607 |
| $\mathrm{J}=6$ | -0.34\% | -0.18\% | -0.16\% | -0.09\% | $\mathrm{J}=6$ | -0.50\% | -0.09\% | 0.02\% | -0.01\% | $\mathrm{J}=6$ | 0.11\% | 0.24\% | 0.31\% | 0.05\% |
|  | -4.4225 | -1.8998 | -3.2634 | -1.6867 |  | -4.2067 | -0.9948 | 0.3771 | -0.3960 |  | 2.7306 | 4.6394 | 5.4799 | 1.1293 |
| $\mathrm{J}=9$ | -0.30\% | -0.22\% | -0.12\% | -0.44\% | $\mathrm{J}=9$ | -0.04\% | 0.11\% | 0.10\% | -0.03\% | $\mathrm{J}=9$ | 0.14\% | 0.14\% | 0.01\% | -0.30\% |
|  | -3.9477 | -5.2432 | -1.8628 | -8.3575 |  | -0.3393 | 0.9996 | 1.2178 | -0.4802 |  | 1.3584 | 1.2193 | 0.0735 | -2.3949 |
| $\mathrm{J}=12$ | -0.32\% | -0.18\% | -0.38\% | -0.36\% | $\mathrm{J}=12$ | 0.11\% | 0.22\% | 0.25\% | 0.06\% | $\mathrm{J}=12$ | 0.01\% | -0.08\% | -0.37\% | -0.44\% |
|  | -6.9729 | -2.8155 | -6.8254 | -5.5660 |  | 1.6189 | 6.0963 | 6.6755 | 1.0533 |  | 0.0488 | -0.7257 | -3.2249 | -5.9964 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SWITZERLAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | H = 12 | UK | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | US | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.28\% | 0.11\% | 0.13\% | 0.22\% | $\mathrm{J}=3$ | -0.69\% | -0.20\% | -0.03\% | -0.07\% | $\mathrm{J}=3$ | -1.25\% | -0.65\% | -0.59\% | -0.48\% |
|  | -2.9591 | 1.6238 | 2.3322 | 4.0124 |  | -4.8291 | -2.8208 | -0.4295 | -1.2177 |  | -46.5122 | -16.5163 | -6.8331 | -12.6774 |
| $\mathrm{J}=6$ | 0.12\% | 0.33\% | 0.34\% | 0.43\% | $\mathrm{J}=6$ | -0.18\% | -0.02\% | 0.11\% | 0.04\% | $\mathrm{J}=6$ | -0.73\% | -0.45\% | -0.54\% | -0.45\% |
|  | 1.3785 | 6.9116 | 7.0581 | 7.0821 |  | -1.2115 | -0.2447 | 2.3213 | 0.5429 |  | -26.4565 | -11.9237 | -6.4438 | -6.7863 |
| $\mathrm{J}=9$ | 0.30\% | 0.38\% | 0.36\% | 0.17\% | $\mathrm{J}=9$ | 0.02\% | 0.17\% | 0.01\% | -0.23\% | $\mathrm{J}=9$ | -0.40\% | -0.36\% | -0.47\% | -0.68\% |
|  | 3.8999 | 7.1102 | 6.9062 | 3.0972 |  | 0.2179 | 3.1345 | 0.1718 | -4.3856 |  | -6.4006 | -4.3076 | -5.1063 | -8.9772 |
| $\mathrm{J}=12$ | 0.42\% | 0.47\% | 0.26\% | 0.12\% | $\mathrm{J}=12$ | 0.05\% | -0.03\% | -0.19\% | -0.45\% | $\mathrm{J}=12$ | -0.58\% | -0.59\% | -0.77\% | -0.86\% |
|  | 4.9758 | 7.1720 | 5.2287 | 2.6274 |  | 0.3330 | -0.2910 | -2.7200 | -7.1703 |  | -7.0173 | -7.1147 | -9.8459 | -9.7789 |

Sharpe ratios - This table reports the pooled average monthly cross-sectional momentum Sharpe ratios based on the formation $\mathrm{J}(\mathrm{J}=$ three, six, nine and 12 months) and the holding $\mathrm{H}(\mathrm{H}=$ three, six, nine and 12 months) for each market. T -statistics are reported in italics and highest return for each market is highlighted. The highest return is highlighted in green and the lowest return is highlighted in red.

| AUSTRALIA | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | H = 12 | AUSTRIA | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | BELGIUM | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{J}=3$ | -0.32 | -0.16 | -0.14 | -0.15 | $\mathrm{J}=3$ | -0.11 | -0.06 | -0.01 | -0.02 | $\mathrm{J}=3$ | -0.07 | 0.00 | 0.02 | 0.05 |
|  | -7.1964 | -4.5202 | -4.0409 | -3.9912 |  | -7.1438 | -4.4082 | -0.4953 | -0.7726 |  | -6.2717 | 0.3770 | 0.7069 | 3.0386 |
| $\mathrm{J}=6$ | -0.15 | -0.12 | -0.13 | -0.16 | $\mathrm{J}=6$ | 0.00 | 0.02 | 0.05 | 0.07 | $\mathrm{J}=6$ | 0.08 | 0.14 | 0.15 | 0.14 |
|  | -5.1247 | -3.6622 | -4.4956 | -4.8462 |  | -0.3107 | 1.3663 | 3.2653 | 4.0372 |  | 7.3962 | 10.7315 | 10.8641 | 7.8088 |
| $\mathrm{J}=9$ | -0.13 | -0.10 | -0.13 | -0.17 | $\mathrm{J}=9$ | 0.06 | 0.08 | 0.07 | 0.06 | $\mathrm{J}=9$ | 0.13 | 0.17 | 0.16 | 0.12 |
|  | -4.9190 | -3.6445 | -4.4999 | -5.3804 |  | 4.7113 | 5.0387 | 4.4987 | 3.3632 |  | 6.8489 | 12.3330 | 9.5000 | 6.0620 |
| $\mathrm{J}=12$ | -0.13 | -0.14 | -0.20 | -0.21 | $\mathrm{J}=12$ | 0.05 | 0.05 | 0.02 | -0.01 | $\mathrm{J}=12$ | 0.15 | 0.14 | 0.12 | 0.05 |
|  | -5.2507 | -4.9789 | -7.2058 | -6.2070 |  | 2.8196 | 3.2110 | 1.3754 | -0.5731 |  | 6.1114 | 6.0683 | 6.2112 | 2.3546 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CANADA | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | DENMARK | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | FINLAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.25 | -0.14 | -0.03 | -0.04 | $\mathrm{J}=3$ | -0.12 | 0.02 | 0.05 | 0.10 | $\mathrm{J}=3$ | -0.11 | -0.03 | 0.05 | 0.01 |
|  | -6.7596 | -5.0406 | -1.4184 | -1.8832 |  | -10.5398 | 2.1909 | 3.3948 | 7.7621 |  | -6.2376 | -2.2195 | 4.6121 | 0.5573 |
| $\mathrm{J}=6$ | -0.12 | -0.04 | 0.00 | -0.02 | $\mathrm{J}=6$ | 0.06 | 0.09 | 0.12 | 0.15 | $\mathrm{J}=6$ | -0.01 | 0.04 | 0.07 | 0.08 |
|  | -5.2205 | -1.8698 | 0.1473 | -0.8369 |  | 8.5955 | 6.7308 | 5.9977 | 10.9378 |  | -1.7639 | 5.8285 | 4.8081 | 6.5174 |
| $\mathrm{J}=9$ | -0.04 | -0.01 | -0.02 | -0.05 | $\mathrm{J}=9$ | 0.11 | 0.12 | 0.14 | 0.07 | $\mathrm{J}=9$ | 0.04 | 0.05 | 0.03 | 0.02 |
|  | -2.1174 | -0.4174 | -0.9345 | $-2.8453$ |  | 7.8828 | 7.0588 | 12.0548 | 3.8113 |  | 8.2317 | 3.5895 | 2.2248 | 0.8665 |
| $\mathrm{J}=12$ | -0.04 | -0.04 | -0.06 | -0.12 | $\mathrm{J}=12$ | 0.15 | 0.15 | 0.11 | 0.05 | $\mathrm{J}=12$ | 0.02 | 0.04 | 0.04 | 0.02 |
|  | -3.0826 | -2.2501 | -3.5593 | -5.0910 |  | 7.4863 | 10.2487 | 10.0788 | 4.1615 |  | 3.5500 | 3.1916 | 2.1695 | 1.4792 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FRANCE | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | GERMANY | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | GREECE | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.28 | -0.14 | -0.08 | -0.08 | $\mathrm{J}=3$ | -0.19 | -0.07 | 0.00 | -0.02 | $\mathrm{J}=3$ | -0.18 | -0.08 | -0.11 | -0.07 |
|  | -18.7543 | -12.9092 | -5.6903 | -5.2098 |  | -21.0108 | -5.8737 | 0.3725 | -1.0838 |  | -9.4105 | -4.8722 | -8.6041 | -2.7805 |
| $\mathrm{J}=6$ | -0.14 | -0.06 | -0.03 | -0.02 | $\mathrm{J}=6$ | -0.05 | 0.02 | 0.06 | 0.05 | $\mathrm{J}=6$ | -0.10 | -0.08 | -0.09 | -0.09 |
|  | -10.0754 | -5.2677 | -2.4044 | -1.4148 |  | -15.5808 | 2.9361 | 7.8901 | 5.9162 |  | -6.7200 | -6.0794 | -7.6841 | -6.1814 |
| $\mathrm{J}=9$ | -0.09 | -0.04 | 0.00 | -0.02 | $\mathrm{J}=9$ | 0.00 | 0.04 | 0.03 | 0.01 | $\mathrm{J}=9$ | -0.09 | -0.08 | -0.11 | -0.14 |
|  | -4.8607 | -2.3464 | -0.0424 | -2.1970 |  | 0.1979 | 4.6842 | 4.4795 | 1.0598 |  | -7.0086 | -8.7233 | -7.3460 | -10.1308 |
| $\mathrm{J}=12$ | -0.03 | 0.00 | 0.00 | -0.02 | $\mathrm{J}=12$ | 0.02 | 0.03 | 0.02 | 0.00 | $\mathrm{J}=12$ | -0.11 | -0.12 | -0.14 | -0.17 |
|  | -2.3665 | -0.0984 | 0.5136 | -4.2196 |  | 2.4951 | 4.2248 | 1.9161 | -0.4871 |  | -9.2686 | -8.8067 | -11.1118 | $-10.1870$ |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| HONGKONG | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | IRELAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | ISRAEL | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.29 | -0.18 | -0.17 | -0.18 | $\mathrm{J}=3$ | -0.10 | -0.11 | -0.11 | -0.05 | $\mathrm{J}=3$ | -0.39 | -0.28 | -0.25 | -0.27 |
|  | -8.7217 | -7.9933 | -7.3402 | -7.8040 |  | -8.0859 | -6.6963 | -7.4211 | -6.0752 |  | -8.0294 | -6.8717 | -5.5711 | -6.8000 |
| $\mathrm{J}=6$ | -0.19 | -0.14 | -0.14 | -0.19 | $\mathrm{J}=6$ | -0.06 | -0.03 | -0.06 | 0.03 | $\mathrm{J}=6$ | -0.23 | -0.19 | -0.20 | -0.19 |
|  | -7.7347 | -6.1553 | -6.0290 | -8.0963 |  | -6.4304 | -4.3469 | -5.1072 | 1.8696 |  | -6.2465 | -5.3919 | -6.3419 | -5.0814 |
| $\mathrm{J}=9$ | -0.19 | -0.16 | -0.17 | -0.21 | $\mathrm{J}=9$ | -0.07 | -0.04 | -0.01 | -0.01 | $\mathrm{J}=9$ | -0.19 | -0.17 | -0.19 | -0.18 |
|  | $-9.1249$ | -8.0789 | -7.1868 | -8.1837 |  | -10.5578 | -5.1280 | -2.4787 | $-0.7496$ |  | -5.0844 | -5.3012 | -5.3392 | -4.1271 |
| $\mathrm{J}=12$ | -0.22 | -0.19 | -0.22 | -0.22 | $\mathrm{J}=12$ | -0.04 | -0.02 | -0.02 | -0.06 | $\mathrm{J}=12$ | -0.18 | -0.17 | -0.19 | -0.22 |
|  | -9.3714 | -7.8718 | -9.2824 | -7.4242 |  | -4.2374 | -2.6695 | -1.6816 | -8.6868 |  | -7.0383 | -6.9031 | -6.5997 | -6.7435 |


| ITALY | H = 3 | $\mathrm{H}=6$ | H = 9 | H = 12 | JAPAN | H = 3 | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | NETHERLANDS | $\mathrm{H}=3$ | $\mathrm{H}=6$ | H = 9 | $\mathrm{H}=12$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{J}=3$ | -0.08 | 0.00 | 0.07 | 0.06 | $\mathrm{J}=3$ | -0.25 | -0.15 | -0.12 | -0.06 | $\mathrm{J}=3$ | -0.10 | -0.03 | 0.01 | 0.01 |
|  | -14.6608 | -0.5269 | 7.5059 | 8.1400 |  | -15.2604 | -9.8288 | -10.4978 | -4.6537 |  | -8.6486 | -1.3875 | 0.5740 | 0.2663 |
| $\mathrm{J}=6$ | 0.01 | 0.05 | 0.07 | 0.07 | $\mathrm{J}=6$ | -0.20 | -0.16 | -0.10 | -0.07 | $\mathrm{J}=6$ | -0.01 | 0.04 | 0.06 | 0.10 |
|  | 0.8681 | 4.3521 | 5.3285 | 8.4489 |  | -13.5844 | -11.5327 | -11.9514 | -4.5091 |  | -0.4427 | 1.2713 | 2.2821 | 3.8420 |
| $\mathrm{J}=9$ | 0.07 | 0.08 | 0.09 | 0.04 | $\mathrm{J}=9$ | -0.16 | -0.10 | -0.09 | -0.11 | $\mathrm{J}=9$ | 0.03 | 0.05 | 0.08 | 0.06 |
|  | 5.8681 | 6.1715 | 9.9358 | 2.3865 |  | -14.1626 | -11.6209 | -9.3596 | -8.2419 |  | 0.9937 | 1.5566 | 3.1094 | 2.2528 |
| $\mathrm{J}=12$ | 0.08 | 0.09 | 0.09 | 0.06 | $\mathrm{J}=12$ | -0.13 | -0.13 | -0.15 | -0.15 | $\mathrm{J}=12$ | 0.04 | 0.05 | 0.05 | 0.04 |
|  | 8.8178 | 16.8057 | 20.6209 | 7.2924 |  | -19.8640 | $-13.1820$ | -15.1037 | -12.4809 |  | 1.4347 | 1.8270 | 2.0044 | 1.8014 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| NEWZEALAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | NORWAY | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | PORTUGAL | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.03 | 0.04 | 0.00 | -0.01 | $\mathrm{J}=3$ | -0.22 | -0.10 | -0.04 | -0.03 | $\mathrm{J}=3$ | -0.15 | -0.05 | -0.04 | -0.02 |
|  | -1.7476 | 3.4795 | 0.1103 | -0.5219 |  | -23.6403 | -12.2961 | -7.8060 | -3.5333 |  | -4.5847 | -2.6090 | -2.9876 | -1.8832 |
| $\mathrm{J}=6$ | 0.06 | 0.06 | 0.06 | 0.02 | $\mathrm{J}=6$ | -0.10 | -0.02 | 0.02 | 0.03 | $\mathrm{J}=6$ | -0.09 | -0.04 | -0.02 | -0.02 |
|  | 3.3399 | 3.7888 | 6.3163 | 0.8666 |  | -18.2485 | -2.6574 | 1.4215 | 1.9491 |  | -6.7140 | -3.4579 | $-2.1673$ | -2.3268 |
| $\mathrm{J}=9$ | 0.08 | 0.08 | 0.06 | 0.04 | $\mathrm{J}=9$ | 0.00 | 0.03 | 0.00 | 0.01 | $\mathrm{J}=9$ | -0.05 | -0.02 | -0.01 | -0.01 |
|  | 5.3831 | 7.5420 | 6.4568 | 2.7187 |  | -0.8404 | 5.0408 | -0.6051 | 0.3056 |  | -4.7608 | -2.1341 | -1.3131 | -1.1351 |
| $\mathrm{J}=12$ | 0.07 | 0.07 | 0.03 | 0.02 | $\mathrm{J}=12$ | -0.02 | -0.02 | -0.02 | -0.07 | $\mathrm{J}=12$ | -0.05 | -0.04 | -0.04 | -0.05 |
|  | 5.1722 | 7.9615 | 3.7335 | 2.9332 |  | -3.3035 | -2.8386 | -2.1928 | -4.7669 |  | -4.8161 | -5.4639 | -7.5583 | -6.7999 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SINGAPORE | $\mathrm{H}=3$ | H=6 | H = 9 | $\mathrm{H}=12$ | SPAIN | $\mathrm{H}=3$ | H = 6 | $\mathrm{H}=9$ | $\mathrm{H}=12$ | SWEDEN | $\mathrm{H}=3$ | H=6 | H = 9 | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.19 | -0.10 | -0.02 | -0.05 | $\mathrm{J}=3$ | -0.18 | -0.13 | -0.04 | -0.03 | $\mathrm{J}=3$ | -0.08 | -0.03 | 0.01 | -0.03 |
|  | -27.1761 | -8.6257 | -2.0997 | -9.2475 |  | -25.7562 | -11.7769 | -3.3574 | -2.3169 |  | -6.0809 | -3.0458 | 0.9867 | -1.6288 |
| $\mathrm{J}=6$ | -0.07 | -0.05 | -0.05 | -0.03 | $\mathrm{J}=6$ | -0.10 | -0.02 | 0.01 | 0.00 | $\mathrm{J}=6$ | 0.00 | 0.02 | 0.02 | 0.00 |
|  | -10.6357 | -4.9937 | -10.1742 | -3.0613 |  | -7.6857 | -1.5167 | 0.8188 | 0.7711 |  | -0.6458 | 3.0836 | 2.6684 | -0.2418 |
| $\mathrm{J}=9$ | -0.07 | -0.06 | -0.05 | -0.09 | $\mathrm{J}=9$ | -0.01 | 0.02 | 0.03 | 0.00 | $\mathrm{J}=9$ | 0.01 | 0.01 | 0.00 | -0.04 |
|  | -9.0567 | -11.7994 | -4.8122 | -19.5280 |  | -0.7915 | 1.3563 | 2.0450 | 0.3355 |  | 0.5214 | 0.7779 | -0.2784 | -3.0877 |
| $\mathrm{J}=12$ | -0.07 | -0.05 | -0.08 |  | $\mathrm{J}=12$ |  |  | 0.06 |  | $\mathrm{J}=12$ |  |  | -0.05 | -0.04 |
|  | -16.8761 | -6.9951 | $-9.8366$ | $-7.0187$ |  | $1.7537$ | $9.3865$ | 11.6880 | $3.3145$ |  | $-0.3831$ | -0.3446 | -3.3758 | -3.2763 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SWITZERLAND | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | UK | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ | US | $\mathrm{H}=3$ | $\mathrm{H}=6$ | $\mathrm{H}=9$ | $\mathrm{H}=12$ |
| $\mathrm{J}=3$ | -0.07 | 0.01 | 0.04 | 0.07 | $\mathrm{J}=3$ | -0.14 | -0.03 | 0.02 | 0.02 | $\mathrm{J}=3$ | -0.30 | -0.18 | -0.14 | -0.14 |
|  | -4.8181 | 0.8128 | 2.1481 | 4.1002 |  | -7.6073 | -1.1282 | 0.8521 | 0.9027 |  | -19.0975 | -18.6625 | -15.2834 | -7.8321 |
| $\mathrm{J}=6$ | 0.03 | 0.07 | 0.07 | 0.13 | $\mathrm{J}=6$ | 0.01 | 0.04 | 0.06 | 0.11 | $\mathrm{J}=6$ | -0.17 | -0.10 | -0.12 | -0.09 |
|  | 1.4791 | 5.9763 | 4.3943 | 7.0445 |  | 0.2501 | 1.7817 | 2.7205 | 4.4738 |  | -16.1534 | -10.8377 | -8.1104 | -4.2322 |
| $\mathrm{J}=9$ | 0.06 | 0.08 | 0.09 | 0.05 | $\mathrm{J}=9$ | 0.05 | 0.08 | 0.08 | 0.03 | $\mathrm{J}=9$ | -0.11 | -0.09 | -0.10 | -0.14 |
|  | 3.7531 | 5.1440 | 6.8246 | 4.0229 |  | 1.8805 | 3.6798 | 3.9835 | 1.9031 |  | -9.7672 | -6.6883 | -5.5861 | -6.9492 |
| $\mathrm{J}=12$ | 0.10 | 0.12 | 0.08 | 0.05 | $\mathrm{J}=12$ | 0.07 | 0.08 | 0.04 | -0.02 | $\mathrm{J}=12$ | -0.13 | -0.11 | -0.14 | -0.16 |
|  | 5.0746 | 8.4548 | 7.7970 | 6.6711 |  | 2.3300 | 3.2655 | 2.0103 | $-1.5363$ |  | -10.4417 | -7.1610 | -7.3915 | -6.9752 |

### 8.4.4. The rebalancing methods

Table 8.12 reports the pooled risk-adjusted performance of the cross-sectional momentum strategies under different implementation approaches according to four rebalancing methods: CAR (0), BHAR (0), CAR (1), and BHAR (1).

In terms of the average risk-adjusted net returns across the 24 markets after risk-adjustment, the returns reduces to $-0.23 \%$ from $0.16 \%$ per month and $-0.28 \%$ to $0.13 \%$ per month for using CAR (0) and CAR (1). The equivalent downtrends appear in the strategies using BHAR, with a decrease to $-0.28 \%$ from $0.11 \%$ per month using BHAR (0), and to $-0.38 \%$ from $0.04 \%$ per month using BHAR (1). There is very little variation in the Sharpe ratio across the four weighting schemes. On balance, the use of monthly rebalancing without a lag (CAR (0)), proves to be the slightly better form of implementation. However, overall there is little difference between the performances of cross-sectional (and time-series) momentum strategy under all four of the weighting schemes.

## Table 8.12. Risk-adjusted performance of cross-sectional momentum based on portfolio constructions

This table reports the pooled average monthly cross-sectional momentum Sharpe ratios and Fama-French alphas based on four rebalancing methods: monthly-rebalancing with zero gap (CAR (0)), monthly-rebalancing with 1-month gap (CAR (1)), buy-and-hold with zero gap (BHAR (0)), and buy-and-hold with 1-month gap (BHAR (1)). Tstatistics are reported in italics.

|  | Net return |  |  |  |  |  |  |  | Fama-French alpha |  |  |  |  |  |  |  | Sharpe ratio |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | CAR (0) |  | CAR (1) |  | BHAR (0) |  | BHAR (1) |  | CAR (0) |  | CAR (1) |  | BHAR (0) |  | BHAR (1) |  | CAR (0) |  | CAR (1) |  | BHAR (0) |  | BHAR (1) |  |
| AUSTRALIA | -0.25\% | -3.1418 | -0.28\% | -4.3209 | -0.28\% | -3.5978 | -0.53\% | -7.5711 | -0.72\% | -8.8963 | -0.76\% | -11.3078 | -0.73\% | -8.8402 | -1.04\% | -13.3119 | -0.17 | -8.3085 | -0.18 | -9.8121 | -0.14 | -9.1694 | 0.14 | -11.920 |
| AUSTRIA | 0.42\% | 8.3559 | 0.36\% | 6.7593 | 0.35\% | 5.5416 | 0.29\% | 4.6465 | -0.15\% | -3.3914 | -0.25\% | -4.5955 | -0.26\% | -4.2761 | -0.37\% | -5.5996 | 0.04 | 3.4809 | 0.02 | 2.1900 | 0.02 | 1.6035 | 0.01 | 0.7344 |
| BELGIUM | 0.73\% | 14.4440 | 0.73\% | 15.3904 | 0.71\% | 10.1646 | 0.67\% | 11.1780 | 0.34\% | 6.8039 | 0.35\% | 7.6786 | 0.32\% | 4.7315 | 0.25\% | 3.9604 | 0.11 | 8.5995 | 0.11 | 9.1808 | 0.09 | 6.1307 | 0.08 | 6.5375 |
| CANADA | 0.10\% | 1.1407 | 0.02\% | 0.3037 | -0.08\% | -0.9434 | -0.16\% | -2.2644 | -0.15\% | -1.8313 | -0.29\% | -3.8131 | -0.38\% | -4.7695 | -0.52\% | -7.9634 | -0.05 | -3.1115 | -0.07 | -4.2299 | -0.06 | -5.0698 | -0.07 | -6.8557 |
| DENMARK | 0.84\% | 18.2364 | 0.77\% | 18.2197 | 0.65\% | 12.1447 | 0.64\% | 13.5008 | 0.40\% | 9.5567 | 0.29\% | 7.5443 | 0.14\% | 2.7876 | 0.14\% | 2.9693 | 0.12 | 9.9875 | 0.10 | 9.4039 | 0.06 | 5.3530 | 0.06 | 5.7475 |
| FINLAND | 0.57\% | 8.9990 | 0.55\% | 8.8574 | 0.49\% | 5.5848 | 0.48\% | 7.4986 | 0.26\% | 4.7490 | 0.22\% | 3.9305 | 0.14\% | 1.7263 | 0.14\% | 2.4809 | 0.03 | 3.5289 | 0.03 | 3.3076 | 0.01 | 1.4591 | 0.01 | 1.8743 |
| FRANCE | -0.09\% | -1.2140 | 0.05\% | 0.8403 | -0.19\% | -2.3525 | -0.10\% | -1.4387 | -0.29\% | -4.5611 | -0.18\% | -3.9302 | -0.38\% | -5.3602 | -0.30\% | -5.3329 | -0.07 | -5.3941 | -0.05 | -4.2494 | -0.08 | -5.9378 | -0.06 | -5.8277 |
| GERMANY | 0.34\% | 5.9906 | 0.30\% | 6.7059 | 0.28\% | 3.9065 | 0.17\% | 3.4390 | -0.38\% | -6.7249 | -0.40\% | -8.6409 | -0.37\% | -5.1086 | -0.48\% | -8.9308 | 0.01 | 0.8328 | 0.00 | 0.2625 | 0.00 | -0.2952 | -0.02 | -2.4060 |
| GREECE | -0.23\% | -5.3884 | -0.26\% | -6.7052 | -0.21\% | -2.7571 | -0.24\% | -3.3044 | -0.82\% | -17.2732 | -0.85\% | -20.3704 | -0.80\% | -9.7697 | -0.84\% | -10.9634 | -0.12 | -15.6298 | -0.13 | -17.1048 | -0.1 | -10.2449 | -0.10 | -11.1523 |
| HONGKONG | -0.6 | -10.4597 | -0.76\% | -11.58 | -0.79\% | -11.7437 | -1.00\% | -15.5865 | -0.99\% | -13.7683 | .10\% | -15.3693 | -1.13\% | -15.5765 | -1.31\% | -19.5525 | 19 | -14.5787 | -0.22 | -14.7818 | -0.17 | -14.5378 | -0.20 | -17.2954 |
| IRELAND | 0.04\% | 1.0534 | -0.04\% | -1.0523 | -0.07\% | -0.6233 | -0.31\% | -3.1373 | -0.10\% | -2.3919 | -0.21\% | -6.2539 | -0.18\% | -2.0223 | -0.51\% | -6.6080 | -0.04 | -8.3037 | -0.0 | -13.1732 | -0.04 | -3.8897 | -0.00 | -7.0810 |
| ISRAEL | -0.41\% | -6.0904 | -0.42\% | -7.1127 | -0.42\% | -4.952 | -0.39\% | -5.0559 | -1.15\% | -18.3197 | -1.18\% | -22.4110 | -1.13\% | -13.8104 | -1.19\% | -16.9535 | -0.24 | -11.5259 | -0.25 | -12.2633 | -0.19 | -11.0301 | -0.19 | -11.3532 |
| ITALY | 0.69\% | 15.1872 | 0.71\% | 20.2205 | 0.63\% | 13.2254 | 0.61\% | 12.6745 | -0.20\% | -4.5232 | -0.19\% | -5.6665 | -0.30\% | -6.2275 | -0.31\% | -6.2279 | 0.06 | 7.3006 | 0.07 | 9.5106 | 0.0 | 5.5613 | - | 5.1924 |
| JAPAN | -0.58\% | -16.0390 | -0.50\% | -16.0953 | -0.50\% | -10.9641 | -0.60\% | -13.2083 | -0.87\% | -22.8577 | -0.78\% | -24.2323 | -0.79\% | -18.6493 | -0.91\% | -19.9069 | -0.15 | -18.4728 | -0.14 | -17.4370 | -0.11 | -11.9873 | -0.13 | -14.8922 |
| NETHERLANDS | 0.41\% | 5.5038 | 0.37\% | 5.0418 | 0.36\% | 4.4047 | 0.24\% | 2.9055 | -0.01\% | -0.0637 | -0.04\% | -0.4913 | -0.08\% | -0.8722 | -0.21\% | -2.1752 | 0.04 | 2.9663 | 0.03 | 2.3710 | 0.03 | 2.2637 | 0.01 | 0.7932 |
| NEWZEALAND | 0.78\% | 26.4697 | 0.67\% | 21.6670 | 0.76\% | 14.7384 | 0.62\% | 10.6824 | 0.37\% | 12.9986 | 0.26\% | 9.2915 | 0.35\% | 6.4104 | 0.26\% | 4.3751 | 0.06 | 8.5548 | 0.04 | 5.7206 | 0.05 | 4.7688 | 0.02 | 2.2720 |
| NORWAY | 0.19\% | 3.2517 | 0.13\% | 2.4227 | 0.28\% | 3.7983 | 0.24\% | 3.4051 | -0.29\% | -5.9727 | -0.39\% | -8.2551 | -0.19\% | -3.0646 | -0.31\% | -4.6230 | -0.04 | -4.2042 | -0.06 | -5.5492 | -0.02 | -1.9621 | -0.03 | -2.9217 |
| PORTUGAL | 0.01\% | 0.1792 | 0.09\% | 2.1393 | 0.02\% | 0.2691 | 0.10\% | 1.6710 | -0.34\% | -5.9039 | -0.27\% | -6.5659 | -0.34\% | -4.9160 | -0.25\% | -3.8873 | -0.06 | -5.6886 | -0.04 | -6.7894 | -0.04 | -5.1626 | -0.03 | -4.5481 |
| SINGAPOR | -0.31\% | -8.2507 | -0.36\% | -9.1547 | -0.27\% | -5.5806 | -0.33\% | -6.2378 | -0.28\% | -7.9071 | -0.37\% | -9.9250 | -0.18\% | -3.8296 | -0.34\% | -6.3175 | -0.07 | -12.7096 | -0.08 | -14.4519 | -0.05 | -8.3191 | -0.07 | -8.8390 |
| SPAIN | 0.29\% | 5.2750 | 0.31\% | 6.1542 | 0.19\% | 2.2623 | 0.17\% | 2.6088 | -0.03\% | -0.5828 | -0.05\% | -1.1576 | -0.12\% | -1.5608 | -0.16\% | -2.9909 | -0.01 | -1.1088 | -0.01 | -0.9020 | -0.02 | -1.6919 | -0.03 | -2.8843 |
| SWEDEN | 0.27\% | 5.3851 | 0.20\% | 4.0370 | 0.21\% | 3.3369 | 0.14\% | 2.2324 | 0.05\% | 1.0204 | -0.05\% | -1.1864 | -0.03\% | -0.4959 | -0.12\% | -1.9286 | 0.00 | -0.5622 | -0.02 | -2.3372 | -0.01 | -1.5320 | -0.02 | -2.7788 |
| SWITZERLAND | 0.46\% | 12.1396 | 0.41\% | 13.0755 | 0.46\% | 8.3389 | 0.34\% | 7.1847 | 0.29\% | 7.9989 | 0.20\% | 6.0224 | 0.31\% | 6.3193 | 0.18\% | 4.4813 | 0.08 | 8.1869 | 0.06 | 7.9437 | 0.07 | 5.7888 | 0.04 | 4.1325 |
| UK | 0.53\% | 7.6945 | 0.46\% | 7.9972 | 0.44\% | 5.9152 | 0.32\% | 5.0095 | -0.01\% | -0.1781 | -0.13\% | -2.6769 | -0.05\% | -0.8928 | -0.24\% | -4.5591 | 0.06 | 3.7495 | 0.03 | 2.7329 | 0.03 | 2.1221 | 0.00 | 0.1667 |
| US | -0.39\% | -7.9776 | -0.35\% | -7.7386 | -0.40\% | -6.9689 | -0.48\% | -10.7629 | -0.56\% | -12.6562 | -0.61\% | -13.0010 | -0.56\% | -12.3334 | -0.74\% | -18.1094 | -0.14 | -13.6196 | -0.15 | -12.9288 | -0.12 | -11.9502 | -0.14 | -16.1929 |
| POOLED SAMPLE | 0.16\% | 1.7150 | 0.13\% | 1.5017 | 0.11\% | 1.2376 | 0.04\% | 0.4121 | -0.23\% | -2.6255 | -0.28\% | $-3.2728$ | -0.28\% | -3.3062 | -0.38\% | -4.2473 | -0.03 | -1.5745 | -0.04 | -1.9254 | -0.03 | -2.0139 | -0.04 | $-2.7325$ |

### 8.5. Comparing risk-adjusted performances of time-series and crosssectional momentum strategies under optimal implementation

The conclusion that can be drawn from the general analysis the risk-adjusted net returns for both the time-series and the cross-sectional momentum strategies on risk-adjusted net return is that both strategies perform poorly across more than half of the 24 markets. Based on the Fama-French alpha, only around $6 \%$ of the implementations produces the significant positive risk-adjusted net returns with none of the returns from the two momentum strategies being significant positive in Austria, France, Germany, Greece, Hong Kong, Israel, Japan, Norway, Portugal, Singapore, Spain and the US. The average pooled risk-adjusted net return in terms of the Fama-French alpha is $-0.22 \%$ per month for the time-series momentum strategy, and $0.29 \%$ per month for the cross-sectional momentum strategy.

We previously find that the optimal time-series momentum strategy outperforms the optimal cross-sectional momentum strategy both before and after the transaction costs. We now seek to establish whether this finding is robust when risk is taken into account. Since the FamaFrench regression model provides statistical significance level for each coefficient in the model, we focus on results using the Fama-French three-factor risk model for the following analysis.

Table 8.13 reports the estimates of the three-factor model of the time-series (TSM) and the cross-sectional (CSM) momentum strategies under optimal implementations, and associated Newey-West t-statistics (in italics). Similar to the procedure utilised previously, we determined the optimum implementation by aggregating the Fama-French alpha of the timeseries and the cross-sectional momentum strategies under each implementation and then choosing the implementation with the highest aggregate alpha.

The first thing to report is that in 11 of the markets the combination of the formation period and holding periods remained the same as those reported in Table 7.11 (i.e. using returns after transaction costs are considered). Although the optimal investment cycle for the two momentum strategies (i.e. the sum of formation and holding periods) for many markets remains in the range of 15 to 18 months, in others the introduction of risk has resulted in a slight lengthening of this period. Previously we find that using market values to assign weights in the portfolios is part of the optimal implementation in 16 of our 24 markets (Table 7.12). After introducing risks into our analysis by way of the Fama-French three-factor model, we find that the optimal weighting scheme in the various markets is almost equally split between using market weights (MW) and weights based on the inverse of each stock's volatility (IVOL). Finally, we observe that the buy-and-hold approach (BHAR) consistently provides the best investment outcomes for rebalancing under both of the momentum strategies.

The 'constant' column reports the risk-adjusted net return $(\alpha)$ from the three-factor model for the two momentum strategies. The risk-adjusted net returns of the time-series momentum strategy are positive in 22 of the 24 markets and are significant in ten markets at the $5 \%$ level. The returns for the cross-sectional momentum strategy are positive in 23 markets and are significant in five markets at the 5\% level. The range of risk-adjusted returns from the timeseries momentum is between $2.88 \%$ per month in Ireland to being very slightly negative in both Norway and the US. The equivalent range for cross-sectional momentum returns is between $1.95 \%$ per month in Ireland and $-0.2 \%$ per month in Japan.

Although the overall performance of the two momentum strategies in the 192 implementations becomes weak after adjusting for risk, the optimal time-series momentum strategy still produces significant positive returns in ten markets, and the cross-sectional
momentum strategy yields significant positive returns in five markets. However none of these markets are in the US and the developed Asian markets. The findings support Griffin et al. (2005) and Hameed and Kusnadi (2002), who find that the momentum effect is stronger in western markets than Asian markets, with the performance being particularly poor in the Japanese market. If investors' behaviour "truly" impacts the momentum effect, one of the possible explanations could be attributed to cultural differences between western and Asian investors (Liu \& Lee, 2001). Most studies find that the cross-sectional momentum strategy is effective in the US markets, however, Lesmond et al. (2004) argue that the cross-sectional momentum strategy is non-profitable in the US markets after accounting for transaction costs. Based on our results in Section 7.6, we find that when transaction costs are taken into account, the cross-sectional momentum strategy under optimal implementation yield returns of around $0.45 \%$ per month and the time-series momentum strategy yield around $0.14 \%$ per month in the US market. After further adjusting the standard risks by using the Fama-French threefactor model, this study did not find statistically significant abnormal returns from the two momentum strategies in the US markets over our testing period.

The coefficients on the size premium (SMB) and value premium (HML) variables suggest that in most markets the long/short, winner/loser portfolios are tilted towards small (SMB < 0) and growth (HML < 0) stocks. The large cap tilt applies in all markets other than Hong Kong and is significant in about half the cases. This finding is at variance with accepted wisdom that momentum performance is largely driven by a tilt towards small cap stocks (Hong et al, 2000) but Asness et al. (2014) has argued that this is largely a myth. The growth tilt apples in all but Australia and Japan (time-series momentum only) but there are very few instances of it being significant. In addition, the results in the table generally highlight a negative relationship (Market-Rf < 0) between time-series momentum returns and market risk. This
indicates that in most of the markets any excess returns attributed to the two momentum strategies are not accompanied by higher market risk.

In the last column of Table 8.13, we report the differences between the risk-adjusted net returns for the two momentum strategies under optimal implementation in each of the 24 markets. The most important finding that is identified here is that after adjusting for risk the time-series momentum again outperforms the cross-sectional momentum in 19 of 24 markets, but not in Belgium, Hong Kong, Israel, Norway and the US, with the extent of outperformance varying from $0.09 \%$ per month in Greece to $1.35 \%$ per month in New Zealand. The superiority of the time-series momentum strategy is significant in Canada, Italy, the Netherlands, New Zealand, Sweden and Switzerland at the 5\% significance level, and Finland and the UK at the $10 \%$ significance level. In contrast, the optimal cross-sectional momentum strategy is superior in five markets, but in no case is this difference significant.

After comparing the two momentum strategies under numerous implementations, firstly using raw returns, next introducing the transaction costs and finally applying both the transaction costs and risk-adjustment, the main conclusion that can be drawn from the analysis to date is that, based on the average returns from optimal implementations across the 24 markets, the monthly returns erode from $2.09 \%$ per month (raw returns) to $1.34 \%$ (net returns) to $0.9 \%$ per month (risk-adjusted net return) for the time-series momentum strategy and from $1.43 \%$ per month (raw returns) to $0.87 \%$ (net returns) to $0.51 \%$ per month (riskadjusted net return) for the cross-sectional momentum strategy. The superior performance of the time-series momentum strategy also progressively weakens falling from $0.66 \%$ per month (raw returns) to $0.47 \%$ (net returns) and finally to $0.39 \%$ (risk-adjusted net return). The number of market in that the time-series momentum strategy outperforms has also been on a downward trend from 24 markets (13 significant) on raw return basis, to 21 markets (seven
significant) on net return basis, to finally 19 markets (nine significant) on risk-adjusted net return basis. However, it is clear that time-series momentum remains the superior strategy after account is taken of both implementation costs and risk.

## Table 8.13. Risk factors of momentum strategies under optimal implementation approaches

This table reports coefficients from the Fama-French three-factor model: $M R_{i}-R f_{i}=\alpha_{i}+\beta 1_{i}\left(R m_{i}-R f_{i}\right)+$ $\beta 2_{i} S M B_{i}+\beta 3_{i} H M L_{i}$, where $M R_{i}$ is momentum return under optimal implementation approach after transaction costs at month $\mathrm{t}, R f_{i}$ is the risk-free rate at month $\mathrm{t}, R m_{i}$ is market-weighted index at month $\mathrm{t}, S M B_{i}$ is calculated by the market average return for the smallest $30 \%$ of stocks minus the market average return of the largest $30 \%$ of stocks in that month. $H M L_{i}$ is calculated as the market average return for $50 \%$ of stocks with the highest book-to-market ratio minus market average return for $50 \%$ of stocks with the lowest book-to-market ratio. The last column reports the difference between risk-adjusted returns from time-series momentum strategy (TSM) and cross-sectional momentum strategy (CSM) for each market from 1992 to 2012. Newey-West adjusted t -statistics are reported below the returns in the table.

| Country | Optimal implementation |  |  | TSM |  |  |  | CSM |  |  |  | Difference |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | JxH | Weight | Construction | Constant | Market - Rf | SMB | HML | Constant | Market - Rf | SMB | HML | TSM - CSM |
| AUSTRALIA | $9 \times 6$ | MW | BHAR(0) | 0.0079 | 0.0401 | -0.1222 | 0.0363 | 0.0018 | -0.1529 | -0.0320 | 0.0805 | 0.0061 |
|  |  |  |  | 1.5535 | 0.3875 | -1.5690 | 0.2655 | 0.3569 | -1.5012 | -0.4176 | 0.5974 | 1.2717 |
| AUSTRIA | 6x12 | IVOL | BHAR(1) | 0.0051 | 0.2320 | -0.0181 | -0.0208 | 0.0021 | 0.2280 | -0.0998 | -0.0538 | 0.0029 |
|  |  |  |  | 1.2951 | 1.8745 | -0.1362 | -0.2625 | 0.6563 | 2.2313 | -0.9102 | -0.8219 | 1.1274 |
| BELGIUM | $9 \times 6$ | MW | BHAR(1) | 0.0067 | -0.3312 | -0.4728 | -0.1373 | 0.0115 | -0.7033 | -0.6039 | -0.2547 | -0.0048 |
|  |  |  |  | 1.1479 | -1.3300 | -1.7326 | -1.2194 | 2.5229 | -3.6148 | -2.8329 | $-2.8962$ | -0.9884 |
| CANADA | 6 x 9 | MW | BHAR(0) | 0.0189 | 0.1140 | -0.0178 | -0.3359 | 0.0091 | 0.0124 | -0.0311 | -0.3777 | 0.0099 |
|  |  |  |  | 2.8258 | 0.8208 | -0.1303 | -2.7762 | 1.4698 | 0.0970 | -0.2475 | -3.3857 | 2.2582 |
| DENMARK | 6x12 | IVOL | BHAR(0) | 0.0084 | -0.1293 | -0.1645 | 0.0113 | 0.0057 | -0.0409 | -0.1928 | -0.0269 | 0.0027 |
|  |  |  |  | 2.7853 | -1.6408 | -1.8633 | 0.2221 | 2.2133 | -0.6071 | -2.5519 | -0.6177 | 1.1857 |
| FINLAND | 12x6 | MW | BHAR(0) | 0.0184 | -0.1804 | -0.3476 | -0.1511 | 0.0073 | -0.1213 | -0.2496 | -0.1703 | 0.0111 |
|  |  |  |  | 2.4188 | -1.4499 | -2.2478 | -2.0211 | 1.0743 | -1.0905 | -1.8055 | -2.5480 | 1.6901 |
| FRANCE | 9 x 9 | IVOL | BHAR(0) | 0.0035 | -0.3667 | -0.4077 | -0.0445 | 0.0024 | -0.3761 | -0.4318 | -0.0288 | 0.0011 |
|  |  |  |  | 1.3907 | -5.5151 | -4.7565 | -0.9138 | 0.8742 | -5.1697 | -4.6037 | $-0.5408$ | 0.7521 |
| GERMANY | 6x9 | MW | BHAR(0) | 0.0067 | -0.3713 | -0.2698 | -0.1035 | 0.0044 | -0.4964 | -0.4092 | -0.0928 | 0.0022 |
|  |  |  |  | 1.1243 | -3.0398 | -1.8316 | -0.8948 | 0.7469 | -4.0597 | -2.7754 | -0.8020 | 0.4515 |
| GREECE | 3x12 | MW | BHAR(1) | 0.0045 | 0.0013 | -0.3556 | 0.0754 | 0.0036 | -0.0731 | -0.2125 | 0.0590 | 0.0009 |
|  |  |  |  | 0.6370 | 0.0171 | -4.7879 | 0.7546 | 0.4571 | -0.8435 | -2.5583 | 0.5280 | 0.1173 |
| HONGKONG | 6 x 9 | MW | BHAR(0) | 0.0006 | 0.0097 | 0.0237 | -0.1524 | 0.0008 | -0.1380 | -0.0721 | -0.1359 | -0.0003 |
|  |  |  |  | 0.0913 | 0.1193 | 0.2610 | -1.4796 | 0.1687 | -2.1283 | -1.0010 | -1.6629 | -0.0453 |
| IRELAND | 6x12 | MW | BHAR(0) | 0.0288 | -0.2490 | -0.1941 | 0.0389 | 0.0195 | -0.1527 | 0.0610 | -0.0177 | 0.0094 |
|  |  |  |  | 2.8296 | -1.3923 | -1.2211 | 0.4001 | 2.1397 | -0.9558 | 0.4300 | -0.2042 | 1.5610 |
| ISRAEL | 9 x 12 | MW | BHAR(0) | 0.0068 | -0.1201 | -0.2942 | -0.2166 | 0.0073 | -0.1323 | -0.1216 | 0.0431 | -0.0006 |
|  |  |  |  | 1.0967 | -1.1338 | -2.7067 | -2.3495 | 1.3583 | -1.4301 | -1.2802 | 0.5356 | -0.1051 |
| ITALY | $9 \times 6$ | EW | CAR(0) | 0.0078 | -0.2295 | -0.3347 | -0.1073 | 0.0020 | -0.3410 | -0.4929 | -0.0701 | 0.0058 |
|  |  |  |  | 2.1512 | -3.7196 | -3.6647 | -1.5204 | 0.7002 | -7.0028 | -6.8370 | $-1.2590$ | 2.7924 |
| JAPAN | 6x12 | MW | BHAR(0) | 0.0024 | -0.1396 | -0.4368 | 0.0029 | -0.0021 | 0.0993 | -0.2507 | -0.0092 | 0.0044 |
|  |  |  |  | 0.6075 | -2.0273 | -5.2913 | 0.0377 | -0.5875 | 1.5931 | -3.3561 | -0.1298 | 1.6759 |
| NETHERLANDS | $6 \times 12$ | IVOL | BHAR(0) | 0.0141 | -0.1137 | -0.2387 | 0.0205 | 0.0081 | -0.0452 | -0.1072 | -0.0202 | 0.0060 |
|  |  |  |  | 3.6578 | -1.4104 | -2.3532 | 0.3431 | 2.9195 | -0.7805 | -1.4728 | -0.4702 | 1.9248 |
| NEWZEALAND | 12x6 | MW | BHAR(0) | 0.0213 | -0.4527 | -0.0808 | -0.0683 | 0.0077 | -0.3208 | -0.0881 | 0.0019 | 0.0135 |
|  |  |  |  | 3.2120 | -2.6913 | -0.5191 | -0.6804 | 1.7117 | -2.7913 | -0.8282 | 0.0272 | 2.4127 |
| NORWAY | 6x12 | MW | BHAR(0) | -0.0006 | -0.2595 | -0.6534 | 0.0641 | 0.0053 | -0.0864 | -0.3504 | 0.0065 | -0.0059 |
|  |  |  |  | -0.0957 | -2.3438 | -4.8508 | 0.6928 | 1.0639 | -1.0128 | -3.3746 | 0.0916 | -1.2117 |
| PORTUGAL | 6x9 | IVOL | BHAR(1) | 0.0117 | -0.5714 | -0.0297 | -0.1215 | 0.0049 | -0.6966 | -0.1559 | -0.0877 | 0.0068 |
|  |  |  |  | 1.5391 | -3.2897 | -0.1640 | -1.0387 | 0.7133 | -4.4219 | -0.9490 | $-0.8263$ | 1.4776 |
| SINGAPORE | 12x6 | IVOL | BHAR(0) | 0.0049 | -0.0407 | -0.2289 | 0.0407 | 0.0018 | -0.2930 | -0.2169 | -0.1096 | 0.0031 |
|  |  |  |  | 0.8604 | -0.4398 | -2.5333 | 0.4170 | 0.4530 | -4.5915 | -3.4816 | $-1.6290$ | 0.7113 |
| SPAIN | 12x6 | IVOL | BHAR(0) | 0.0051 | -0.3437 | -0.3249 | 0.0004 | 0.0036 | -0.1716 | -0.1728 | -0.1079 | 0.0015 |
|  |  |  |  | 1.1550 | -3.8643 | -2.9609 | 0.0042 | 1.0366 | -2.4674 | -2.0137 | $-1.6008$ | 0.4275 |
| SWEDEN | 12x3 | IVOL | BHAR(1) | 0.0133 | -0.4702 | -0.4135 | 0.0245 | 0.0030 | -0.3712 | -0.3279 | -0.0180 | 0.0102 |
|  |  |  |  | 2.4540 | -5.7566 | -4.3207 | 0.3153 | 0.7195 | -5.8196 | -4.3881 | -0.2966 | 2.3377 |
| SWITZERLAND | $6 \times 6$ | EW | BHAR(0) | 0.0128 | -0.4266 | -0.2172 | -0.1376 | 0.0064 | -0.3136 | -0.3527 | -0.0525 | 0.0065 |
|  |  |  |  | 3.6187 | -4.4367 | -1.7965 | -1.9924 | 2.3713 | -4.3038 | -3.8492 | $-1.0040$ | 2.1409 |
| UK | $12 \times 3$ | IVOL | BHAR(0) | 0.0075 | -0.0964 | -0.1665 | -0.0884 | 0.0047 | -0.1804 | -0.2260 | -0.1602 | 0.0028 |
|  |  |  |  | 3.3138 | -1.8223 | -3.0490 | -1.6911 | 1.7914 | -2.9313 | -3.5580 | -2.6334 | 1.9210 |
| US | $9 \times 6$ | MW | BHAR(0) | -0.0003 | -0.0707 | -0.2417 | -0.0849 | 0.0007 | -0.2476 | -0.0478 | -0.2173 | -0.0009 |
|  |  |  |  | -0.0618 | -0.8141 | -2.1490 | -0.4160 | 0.1475 | -2.5464 | -0.3793 | -0.9506 | -0.3884 |

### 8.6. Risk-adjusted momentum performances in up and down markets

Previously, we find that both optimal time-series (TSM) and cross-sectional (CSM) momentum strategies perform better in up periods than in down periods. Based on raw return, it appears to be on average $2.32 \%$ per month for the time-series momentum strategy and $1.74 \%$ per month for the cross-sectional momentum strategy in up periods and is $1.08 \%$ and $1.66 \%$ higher than their returns in down periods respectively. In addition, the time-series momentum strategy outperforms the cross-sectional momentum strategies in 20 markets in up periods and in 22 markets in down periods. After accounting for the transaction costs, we find the pattern of the two momentum strategies performing better in up periods is maintained with the difference being $1.09 \%$ for the time-series momentum strategy and $1.08 \%$ for the crosssectional momentum strategy.

Compared the optimal performance of the two momentum strategies using raw return, we observe that the superior performance of the time-series momentum strategy is a result of its outperformance in down periods with the difference (TSM - CSM) being 1.16\% per month in down periods compared to $0.57 \%$ per month in up periods. After accounting for the transaction costs, however, the magnitude of superior performance of the time-series momentum strategy in down periods is significantly diluted with the average return across the 24 markets falling from $1.16 \%$ per month to $0.46 \%$ per month.

This section now examines and compares the two momentum strategies under the two market states when account is taken of risk-adjusted using the Fama-French three factor model. Similar with the method employed by Daniel and Moskowitz (2013), we apply the following regression model to the optimal implementation for each market:

$$
\begin{gathered}
M R_{i}-R f_{i}=\left(\beta 0_{i}+D \beta 1_{i}\right)+\left[\beta 2_{i}\left(R m_{i}-R f_{i}\right)+D * \beta 3_{i}\left(R m_{i}-R f_{i}\right)\right]+\left[\beta 4_{i} S M B_{i}+D *\right. \\
\left.\beta 5_{i} S M B_{i}\right]+\left[\beta 6_{i} H M L_{i}+D * \beta 7_{i} H M L_{i}\right]
\end{gathered}
$$

where $M R_{i}$ is momentum return after transaction costs at month $\mathrm{t}, R f_{i}$ is risk-free rate at month $\mathrm{t}, R m_{i}$ is market-weighted index at month $\mathrm{t}, S M B_{i}$ is small minus big at month t , which is calculated by the market average return for the smallest $30 \%$ of stocks minus the market average return of the largest $30 \%$ of stocks in that month. $H M L_{i}$ is high minus low at month t , which is calculated by the market average return for $50 \%$ of stocks with the highest book-to-market ratio minus market average return for $50 \%$ of stocks with the lowest book-tomarket ratio. D is a dummy variable (an indicator of ex-ante market conditions) that equals oneif the cumulative return of the market index over the last 12 months is non-negative and equals zero otherwise. The constant $\beta 0$ and the coefficients of the three risk terms ( $\beta 2, \beta 4$ and $\beta 6$ ) are an attempt to capture risk-adjusted returns and risk estimates when the market is following down states, whereas the sum coefficients at each component $(\beta 1+\beta 0, \beta 3+\beta 2$, $\beta 5+\beta 4$ and $\beta 7+\beta 6$ ) in the regression capture the risk-adjusted returns and risk factors in up markets. ${ }^{36}$

Based on the optimal implementations identified in Table 8.13, Table 8.14 reports the regression results of optimal time-series (TSM) and cross-sectional (CSM) momentum riskadjusted net returns and standard risk factors following up and down markets during the 252 months from 1992 to 2012.

The column (Constant + D) in TSM and CSM reports the risk-adjusted net returns in up periods, whereas the column (Constant) reports the returns in down periods. The findings are largely consistent with those discussed above for both raw and net returns with the performance of the two momentum strategies being much stronger in up markets than in down markets. For the time-series momentum strategy, the average return across the 24

[^29]markets for the time-series momentum strategy is $1.02 \%$ per month in up markets with the returns being positive in 22 markets (significant in 12 markets), whereas it produces $-0.42 \%$ per month with the return in seven markets being positive (none significant) in down markets. For the cross-sectional momentum strategy, the average return is $0.63 \%$ per month with 19 markets being positive (significant in 11 markets) in up markets, and $-1.15 \%$ per month with four markets being positive but none of them is significant in down markets.

The column (Market-Rf, SMB and HML) of TSM and CSM report the market risk, size premium and value premium when markets have been performing strongly and markets that have been performing poorly. Similar with findings in Section 8.5 , the results consistently suggest that in most markets the time-series and cross-sectional momentum gains are negatively related with standard risk premium. Ten markets are significant using the timeseries momentum strategy and seven markets are significant using the cross-sectional momentum strategy in up market state, and ten markets are significant using the time-series momentum strategy and 18 markets are significant using the cross-sectional momentum strategy in down market state. The two momentum strategies bias towards growth stocks in 14 markets (four significant) in the time-series momentum strategy and 13 markets (five significant) in the cross-sectional momentum strategy in up market state, and in 16 markets (five significant) in the case of the time-series momentum strategy and 16 markets (seven significant) in the case of the cross-sectional momentum strategy in down market state. The results in Table 8.14 demonstrate that the two momentum strategies run a positive market risk in up periods with 14 markets (four significant) for the time-series momentum strategy and 18 markets (none is significant) for the cross-sectional momentum strategy, and a negative market risk in down periods with 23 markets for the time-series momentum strategy (17 significant) and the cross-sectional momentum strategy (20 significant).

The last column of Table 8.14 reports the differences (TSM - CSM) between the riskadjusted net returns for the two momentum strategies under optimal implementation in each of the 24 markets when the market is in up and down states. In terms of raw returns, the timeseries momentum strategy outperforms the cross-sectional momentum strategy on average by $0.57 \%$ per month in up periods and by $1.16 \%$ per month in down periods. After accounting for the transaction costs, the superior performance of the time-series momentum strategy is on average $0.47 \%$ per month in up states, whereas the outperformance becomes reduces significantly to $0.46 \%$ per month in down periods.

After we introduce risk on an-after transaction cost basis, the superiority of the time-series momentum strategy across most of the markets in up and down periods remain largely unchanged. Table 8.14 highlights that the time-series momentum strategy continues to outperform the cross-sectional momentum strategy in 19 markets (six significant) in up periods with an average difference being $0.39 \%$ per month, and in 18 markets (six significant) in down markets with an average difference rebounded being $0.73 \%$ per month. The outperformance of time-series momentum strategy in down periods after adjusting for risk suggests that the time-series momentum strategy contains lower level of risk than the crosssectional momentum strategy, particularly when markets have been performing poorly.

Table 8.14. Risk factors of momentum strategies under optimal implementation approaches in up and down markets

This table reports the risk-adjusted time-series and cross-sectional momentum returns under optimal implementations when ex-ante markets follow up and down markets by using following regression: $M R_{i}-$ $R f_{i}=\left(\beta 0_{i}+D * \beta 1_{i}\right)+\left[\beta 2_{i}\left(R m_{i}-R f_{i}\right)+D * \beta 3_{i}\left(R m_{i}-R f_{i}\right)\right]+\left[\beta 4_{i} S M B_{i}+D * \beta 5_{i} S M B_{i}\right]+$ $\left[\beta 6_{i} H M L_{i}+D * \beta 7_{i} H M L_{i}\right]$, where $M R_{i}$ is momentum return after transaction costs at month $\mathrm{t}, R f_{i}$ is risk-free rate at month $\mathrm{t}, R m_{i}$ is market-weighted index at month $\mathrm{t}, S M B_{i}$ is calculated by the market average return for the smallest $30 \%$ of stocks minus the market average return of the largest $30 \%$ of stocks in that month. $H M L_{i}$ is calculated by the market average return for $50 \%$ of stocks with the highest book-to-market ratio minus market average return for $50 \%$ of stocks with the lowest book-to-market ratio. D is a dummy variable (an indicator of ex-ante market conditions) that equals oneif the cumulative return of the market index over the last 12 months is non-negative and equals zero otherwise. The last two columns report the difference between risk-adjusted returns from time-series momentum strategy (TSM) and cross-sectional momentum strategy (CSM) for each market when markets are in up and down. For the results in up market, Newey-West adjusted Wald test are reported below the returns in the table for each component in the regression based on the hypothesis, H 0 sum of the coefficients equals to zero. $\mathrm{H} 0: \beta 1+\beta 0=0, \mathrm{H} 0: \beta 3+\beta 2=0, \mathrm{H} 0: \beta 5+\beta 4=0, \mathrm{H} 0: \beta 7+\beta 6=0$. For the results in down market, Newey-West adjusted t-statistics are reported below the returns in the table.

| "UP" MARKETS | NO. OF MONTHS | OPTIMAL IMPLEMENTATIONS |  |  | TSM |  |  |  | CSM |  |  |  | TSM - CSM |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | JxH | Weight | Construction | Constant + D | Market - Rf | SMB | HML | Constant + D | Market - Rf | SMB | HML | Constant + D |
| AUSTRALIA | 202 | $9 \times 6$ | MW | $\operatorname{BHAR}(0)$ | 0.0105 | 0.0415 | -0.1730 | -0.0063 | 0.0068 | 0.0974 | 0.0491 | 0.1436 | 0.0037 |
|  |  |  |  |  | 2.0104 | 0.3805 | -1.6641 | -0.0509 | 1.4151 | 0.7683 | 0.3187 | 1.1366 | 0.9276 |
| AUSTRIA | 184 | $6 \times 12$ | IVOL | BHAR(1) | 0.0052 | 0.5173 | 0.1423 | 0.0006 | 0.0019 | 0.4180 | 0.0149 | -0.0801 | 0.0033 |
|  |  |  |  |  | 1.1998 | 2.8337 | 0.8253 | 0.0046 | 0.5259 | 2.5085 | 0.0970 | -0.9345 | 1.0832 |
| BELGIUM | 191 | 9 x 6 | MW | BHAR(1) | 0.0052 | 0.1780 | -0.3213 | -0.2801 | 0.0100 | -0.0886 | -0.3112 | -0.2806 | -0.0048 |
|  |  |  |  |  | 0.7608 | 0.5470 | -0.9327 | $-2.1460$ | 2.3790 | -0.4196 | -1.5060 | -2.2315 | -0.7490 |
| CANADA | 230 | $6 \times 9$ | MW | BHAR(0) | 0.0211 | 0.2071 | 0.0605 | -0.2779 | 0.0115 | 0.1746 | 0.0349 | -0.3052 | 0.0095 |
|  |  |  |  |  | 2.9887 | 1.1711 | 0.3664 | $-1.7411$ | 2.0080 | 1.2469 | 0.2189 | -2.1508 | 2.2802 |
| DENMARK | 197 | 6x12 | IVOL | BHAR(0) | 0.0103 | -0.0351 | -0.1556 | 0.0587 | 0.0068 | 0.0260 | -0.1768 | 0.0149 | 0.0035 |
|  |  |  |  |  | 2.8831 | -0.2862 | -1.2080 | 0.8138 | 2.0011 | 0.2369 | -1.8282 | 0.2526 | 1.4482 |
| FINLAND | 181 | $12 \times 6$ | MW | BHAR(0) | 0.0174 | 0.2019 | -0.4433 | 0.0748 | 0.0065 | 0.1102 | -0.3623 | -0.0156 | 0.0109 |
|  |  |  |  |  | 1.9091 | 0.8771 | -1.3969 | 0.7729 | 0.9381 | 0.7861 | -2.6004 | -0.1620 | 1.2931 |
| FRANCE | 194 | 9 x 9 | IVOL | BHAR(0) | 0.0006 | -0.0083 | -0.2656 | -0.0270 | -0.0002 | 0.0887 | -0.1739 | 0.0122 | 0.0009 |
|  |  |  |  |  | 0.2138 | -0.0970 | -3.4060 | -0.6761 | -0.0879 | 0.7905 | -1.8570 | 0.2995 | 0.5045 |
| GERMANY | 190 | 6x9 | MW | BHAR(0) | 0.0106 | -0.1392 | -0.4328 | 0.0581 | 0.0025 | 0.0525 | -0.2771 | 0.0153 | 0.0081 |
|  |  |  |  |  | 1.5270 | -0.7253 | -1.8501 | 0.5368 | 0.3796 | 0.2634 | -1.0302 | 0.1284 | 1.4530 |
| GREECE | 154 | $3 \times 12$ | MW | BHAR(1) | 0.0073 | 0.4229 | -0.2916 | 0.0723 | 0.0170 | 0.3398 | 0.0489 | 0.0724 | -0.0097 |
|  |  |  |  |  | 0.9101 | 3.2085 | -2.6339 | 0.3432 | 1.7282 | 1.7737 | 0.2352 | 0.3790 | -1.0822 |
| HONGKONG | 204 | 6 x 9 | MW | BHAR(0) | -0.0009 | 0.2662 | -0.0476 | -0.0075 | -0.0017 | 0.0564 | -0.0783 | 0.0054 | 0.0007 |
|  |  |  |  |  | -0.1354 | 2.5506 | -0.2393 | -0.0697 | -0.3442 | 0.6474 | -0.7499 | 0.0549 | 0.1049 |
| IRELAND | 212 | $6 \times 12$ | MW | BHAR(0) | 0.0347 | -0.3733 | -0.2526 | 0.0547 | 0.0280 | -0.3944 | -0.0027 | -0.0003 | 0.0067 |
|  |  |  |  |  | 3.0103 | -1.3258 | -0.8986 | 0.6865 | 2.5616 | -1.5940 | -0.0115 | -0.0036 | 1.0290 |
| ISRAEL | 199 | $9 \times 12$ | MW | BHAR(0) | 0.0026 | -0.0460 | -0.3127 | -0.2826 | 0.0027 | 0.0464 | -0.0303 | -0.0084 | -0.0001 |
|  |  |  |  |  | 0.3441 | -0.4052 | -2.4354 | -2.6180 | 0.5087 | 0.3480 | -0.3483 | -0.0671 | -0.0139 |
| ITALY | 172 | 9 x 6 | EW | CAR(0) | 0.0100 | 0.0768 | -0.1421 | -0.1728 | 0.0049 | -0.0457 | -0.2962 | -0.1445 | 0.0051 |
|  |  |  |  |  | 2.3143 | 0.6210 | -0.9021 | $-1.8630$ | 1.5488 | -0.5939 | -3.1418 | -2.0088 | 2.1629 |
| JAPAN | 146 | 6x12 | MW | BHAR(0) | 0.0072 | 0.1730 | -0.4550 | -0.1406 | 0.0019 | 0.4034 | -0.2532 | -0.1681 | 0.0053 |
|  |  |  |  |  | 1.5557 | 1.2845 | -3.7777 | -1.3375 | 0.4237 | 3.1042 | -1.7133 | -2.1891 | 1.4481 |
| NETHERLANDS | 202 | $6 \times 12$ | IVOL | BHAR(0) | 0.0158 | 0.0481 | -0.1258 | 0.0620 | 0.0064 | 0.2607 | 0.0978 | -0.0032 | 0.0094 |
|  |  |  |  |  | 3.9124 | 0.4369 | -0.8440 | 0.9319 | 2.3095 | 2.6504 | 1.0279 | -0.0631 | 2.7777 |
| NEWZEALAND | 232 | $12 \times 6$ | MW | $\operatorname{BHAR}(0)$ | 0.0230 | -0.4092 | -0.1475 | -0.0870 | 0.0086 | -0.2728 | -0.0459 | 0.0067 | 0.0144 |
|  |  |  |  |  | 2.5142 | -1.2999 | -0.8489 | -0.7781 | 1.7061 | -1.5115 | -0.2956 | 0.0644 | 1.8996 |
| NORWAY | 196 | 6x12 | MW | BHAR(0) | 0.0044 | -0.2544 | -0.6670 | 0.0880 | 0.0088 | 0.0877 | -0.2322 | 0.0046 | -0.0044 |
|  |  |  |  |  | 0.6347 | -1.5525 | -3.4016 | 0.7926 | 1.8399 | 0.8576 | -1.8194 | 0.0567 | -0.7868 |
| PORTUGAL | 177 | 6 x 9 | IVOL | BHAR(1) | 0.0214 | -0.6282 | -0.1022 | -0.0350 | 0.0154 | -0.5058 | -0.1008 | 0.1106 | 0.0059 |
|  |  |  |  |  | 2.4408 | -2.8646 | -0.5740 | $-0.2459$ | 1.9356 | -3.4800 | -0.6385 | 1.1700 | 1.2774 |
| SINGAPORE | 189 | 12x6 | IVOL | BHAR(0) | 0.0073 | 0.2865 | 0.0218 | -0.0302 | 0.0061 | 0.0456 | -0.0002 | -0.1264 | 0.0012 |
|  |  |  |  |  | 1.6203 | 2.1824 | 0.1432 | -0.2287 | 1.7366 | 0.5331 | -0.0023 | -1.7369 | 0.3114 |
| SPAIN | 167 | 12x6 | IVOL | BHAR(0) | -0.0013 | 0.0692 | -0.3261 | 0.2523 | -0.0008 | 0.2679 | -0.0586 | 0.0181 | -0.0005 |
|  |  |  |  |  | -0.2273 | 0.3274 | -2.0453 | 1.2754 | -0.1915 | 2.5180 | -0.5274 | 0.2195 | -0.0849 |
| SWEDEN | 196 | 12x3 | IVOL | BHAR(1) | 0.0117 | -0.2106 | -0.6121 | -0.0193 | -0.0023 | -0.0147 | -0.2846 | -0.0171 | 0.0140 |
|  |  |  |  |  | 2.0992 | -1.7067 | -4.7795 | $-0.2057$ | -0.4557 | -0.1772 | -2.7868 | -0.1803 | 3.5008 |
| SWITZERLAND | 195 | 6x6 | EW | BHAR(0) | 0.0148 | -0.2328 | -0.0871 | -0.0973 | 0.0049 | 0.1174 | -0.0719 | 0.0192 | 0.0099 |
|  |  |  |  |  | 3.3179 | -1.2073 | -0.5373 | -1.0571 | 1.4611 | 0.8613 | -0.4930 | 0.3465 | 2.0160 |
| UK | 214 | 12x3 | IVOL | BHAR(0) | 0.0068 | 0.0169 | -0.1999 | -0.0639 | 0.0063 | 0.0830 | -0.0781 | -0.1120 | 0.0005 |
|  |  |  |  |  | 2.8327 | 0.1822 | -2.4461 | -0.8709 | 2.0076 | 0.6774 | -0.6117 | -1.2981 | 0.3439 |
| US | 226 | 9x6 | MW | BHAR(0) | 0.0001 | 0.0737 | -0.2221 | 0.0679 | -0.0004 | 0.1545 | 0.1121 | -0.1256 | 0.0005 |
|  |  |  |  |  | 0.0259 | 0.5516 | -1.4137 | 0.2138 | -0.0901 | 0.9563 | 0.7171 | -0.3741 | 0.2460 |


| "DOWN" MARKETS | NO. OF <br> MONTHS | OPTIMAL IMPLEMENTATIONS |  |  | TSM |  |  |  | CSM |  |  |  | $\begin{gathered} \text { TSM - CSM } \\ \hline \text { Constant } \\ \hline \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | JxH | Weight | Construction | Constant | Market - Rf | SMB | HML | Constant | Market - Rf | SMB | HML |  |
| AUSTRALIA | 50 | $9 \times 6$ | MW | BHAR(0) | -0.0018 | 0.1433 | 0.0707 | 0.2080 | -0.0195 | -0.7400 | -0.5513 | -0.1555 | 0.0177 |
|  |  |  |  |  | -0.1514 | 0.7268 | 0.3949 | 0.7100 | $\underline{-1.7606}$ | -3.9832 | -3.2679 | -0.5633 | 1.6975 |
| AUSTRIA | 68 | 6x12 | IVOL | BHAR(1) | -0.0002 | -0.2591 | -0.2566 | 0.1940 | 0.0001 | -0.1340 | -0.2585 | 0.1513 | -0.0003 |
|  |  |  |  |  | -0.0262 | -1.2488 | -1.1250 | 1.4465 | 0.0130 | -0.7784 | -1.3662 | 1.3599 | -0.0544 |
| BELGIUM | 61 | $9 \times 6$ | MW | BHAR(1) | -0.0052 | -0.9524 | -0.5056 | -0.0294 | -0.0016 | -1.6030 | -1.0207 | -0.2585 | -0.0036 |
|  |  |  |  |  | -0.4325 | -2.2004 | -0.9744 | -0.1895 | -0.1720 | -4.8555 | -2.5788 | -2.1848 | -0.3490 |
| CANADA | 22 | 6 x 9 | MW | BHAR(0) | -0.0197 | -0.0200 | -0.5032 | -0.8644 | -0.0415 | -0.2844 | -0.5326 | -0.8902 | 0.0218 |
|  |  |  |  |  | -0.8332 | -0.0740 | -1.4751 | -1.5549 | -1.9294 | -1.1589 | -1.7187 | $-1.7629$ | 1.3970 |
| DENMARK | 55 | 6x12 | IVOL | BHAR(0) | -0.0027 | -0.3183 | -0.2421 | -0.0651 | -0.0010 | -0.1611 | -0.2606 | -0.1076 | -0.0017 |
|  |  |  |  |  | -0.3763 | -2.4240 | -1.3857 | -0.6713 | -0.1547 | -1.4214 | -1.7280 | $-1.2862$ | -0.3176 |
| FINLAND | 71 | $12 \times 6$ | MW | BHAR(0) | 0.0026 | -0.6060 | -0.2592 | -0.3112 | -0.0025 | -0.3399 | -0.0680 | -0.2764 | 0.0052 |
|  |  |  |  |  | 0.1984 | -3.0783 | -0.9528 | -3.0152 | -0.2039 | -1.8697 | -0.2708 | $-2.8989$ | 0.4194 |
| FRANCE | 58 | 9 x 9 | IVOL | BHAR(0) | -0.0024 | -0.9914 | -0.7497 | -0.0095 | -0.0083 | -1.2517 | -1.1403 | -0.0159 | 0.0059 |
|  |  |  |  |  | -0.5215 | -9.3786 | -4.7332 | -0.1273 | -1.7274 | -11.4852 | -6.9832 | -0.2067 | 1.9944 |
| GERMANY | 62 | 6 x 9 | MW | BHAR(0) | -0.0126 | -0.5966 | 0.1813 | -0.3153 | -0.0065 | -1.1318 | -0.4644 | 0.0260 | -0.0061 |
|  |  |  |  |  | -1.0057 | -3.2783 | 0.6565 | -1.6239 | -0.5179 | -6.2056 | -1.6778 | 0.1339 | -0.5734 |
| GREECE | 98 | $3 \times 12$ | MW | BHAR(1) | -0.0103 | -0.6046 | -0.2687 | -0.0313 | -0.0301 | -0.6264 | -0.5619 | -0.1106 | 0.0198 |
|  |  |  |  |  | -0.9996 | -5.5974 | -2.3087 | -0.1954 | -2.5905 | -5.1398 | -4.2787 | -0.6119 | 1.6776 |
| HONGKONG | 48 | 6x9 | MW | BHAR(0) | 0.0040 | -0.4594 | 0.5669 | -0.2967 | 0.0067 | -0.4457 | 0.1139 | -0.4384 | -0.0027 |
|  |  |  |  |  | 0.2955 | -3.4203 | 2.8989 | -1.3524 | 0.6067 | -4.0784 | 0.7158 | -2.4553 | -0.1948 |
| IRELAND | 40 | 6x12 | MW | BHAR(0) | 0.0064 | -0.1203 | -0.1849 | 0.0182 | -0.0103 | 0.1557 | -0.0143 | -0.0451 | 0.0167 |
|  |  |  |  |  | 0.2267 | -0.3963 | -0.5430 | 0.1078 | -0.4160 | 0.5782 | -0.0474 | -0.3004 | 1.0150 |
| ISRAEL | 53 | $9 \times 12$ | MW | BHAR(0) | 0.0196 | -0.2903 | -0.2013 | -0.0831 | 0.0148 | -0.7181 | -0.6859 | 0.0620 | 0.0049 |
|  |  |  |  |  | 1.4424 | -1.2142 | -0.7002 | -0.4336 | 1.2769 | -3.5345 | -2.8082 | 0.3810 | 0.4212 |
| ITALY | 80 | $9 \times 6$ | EW | CAR(0) | -0.0033 | -0.6477 | -0.4414 | -0.0908 | -0.0113 | -0.7516 | -0.6591 | -0.0391 | 0.0080 |
|  |  |  |  |  | -0.4845 | -7.4287 | -2.4022 | -0.8468 | -2.2275 | -11.4904 | -4.7811 | -0.4859 | 1.9054 |
| JAPAN | 106 | 6x12 | MW | BHAR(0) | -0.0057 | -0.3972 | -0.4467 | 0.1224 | -0.0088 | -0.1514 | -0.2796 | 0.1237 | 0.0031 |
|  |  |  |  |  | -0.9975 | -4.4475 | -3.8135 | 1.2020 | -1.7155 | -1.8860 | -2.6545 | 1.3519 | 0.7654 |
| NETHERLANDS | 50 | 6x12 | IVOL | BHAR(0) | 0.0012 | -0.3814 | -0.4743 | -0.0919 | 0.0040 | -0.4728 | -0.5056 | -0.1084 | -0.0028 |
|  |  |  |  |  | 0.1426 | -3.1092 | -2.4944 | -0.8622 | 0.7080 | -5.7529 | -3.9691 | $-1.5178$ | -0.4067 |
| NEWZEALAND | 20 | $12 \times 6$ | MW | BHAR(0) | -0.0098 | -1.0444 | 0.0246 | 0.3850 | -0.0263 | -1.3027 | -1.1309 | 0.1757 | 0.0165 |
|  |  |  |  |  | -0.3715 | -1.6490 | 0.0370 | 0.7185 | -1.4584 | -3.0210 | -2.4966 | 0.4818 | 0.7384 |
| NORWAY | 56 | 6x12 | MW | BHAR(0) | -0.0233 | -0.3535 | -0.8121 | 0.0567 | -0.0236 | -0.5933 | -0.8493 | 0.0773 | 0.0003 |
|  |  |  |  |  | -1.5460 | -1.7111 | -3.3209 | 0.3827 | -2.1022 | -3.8499 | -4.6566 | 0.6994 | 0.0295 |
| PORTUGAL | 75 | 6 x 9 | IVOL | BHAR(1) | -0.0098 | -0.5222 | 0.1219 | -0.2697 | -0.0258 | -1.1985 | -0.4066 | -0.3383 | 0.0160 |
|  |  |  |  |  | -0.6914 | -1.5918 | 0.2964 | -1.4745 | -2.0542 | -4.1099 | -1.1125 | -2.0812 | 1.9207 |
| SINGAPORE | 63 | $12 \times 6$ | IVOL | BHAR(0) | -0.0096 | -0.5604 | -0.6804 | 0.2071 | -0.0196 | -0.8347 | -0.6095 | 0.0222 | 0.0099 |
|  |  |  |  |  | -0.9230 | -3.9632 | -4.7293 | 1.7421 | -3.0956 | -9.7551 | -7.0016 | 0.3088 | 1.1287 |
| SPAIN | 85 | $12 \times 6$ | IVOL | BHAR(0) | 0.0056 | -0.8613 | -0.4528 | -0.0567 | -0.0040 | -0.8796 | -0.6168 | -0.0014 | 0.0096 |
|  |  |  |  |  | 0.7461 | -5.9145 | -2.2499 | -0.4482 | -0.7312 | -8.2326 | -4.1771 | -0.0152 | 1.4951 |
| SWEDEN | 56 | 12x3 | IVOL | BHAR(1) | -0.0053 | -0.8546 | -0.2851 | 0.2879 | -0.0187 | -1.1370 | -0.9597 | 0.2274 | 0.0135 |
|  |  |  |  |  | -0.4505 | -5.8497 | -1.4303 | 2.0206 | -2.1922 | -10.6562 | -6.5919 | 2.1857 | 1.4201 |
| SWITZERLAND | 57 | 6x6 | EW | BHAR(0) | -0.0039 | -0.7589 | -0.4998 | -0.1814 | -0.0068 | -0.9285 | -0.7032 | -0.1033 | 0.0029 |
|  |  |  |  |  | -0.4933 | -5.2420 | -2.0988 | $-1.8319$ | -1.2867 | -9.5016 | -4.3744 | $-1.5465$ | 0.4399 |
| UK | 38 | 12x3 | IVOL | BHAR(0) | 0.0057 | -0.2772 | -0.0778 | -0.1474 | -0.0111 | -0.6272 | -0.5615 | -0.2398 | 0.0168 |
|  |  |  |  |  | 0.9867 | -3.3299 | -0.7923 | -1.7443 | -1.7339 | -6.8317 | -5.1836 | $-2.5727$ | 5.2548 |
| US | 26 | 9x6 | MW | BHAR(0) | -0.0212 | -0.3739 | 0.2275 | -0.4346 | -0.0250 | -0.9783 | -0.0795 | -0.2450 | 0.0039 |
|  |  |  |  |  | -1.7870 | -2.3235 | 0.5880 | -1.0219 | -2.0092 | -5.7824 | -0.1955 | -0.5480 | 0.6162 |

### 8.7. Conclusion

This chapter investigates the implications of risk for the time-series and cross-sectional momentum strategies. We examine the risk-adjusted performance of the net returns for 192 implementations using the Sharpe ratio and the Fama-French alpha. The finding is the same irrespective of whether the Sharpe ratio or the three-factor model is used.

The standard risk factors explains a high proportion of the apparent net gains of the timeseries and cross-sectional momentum strategies. In terms of the Fama-French alpha, only around $6 \%$ of the implementations produce the significant positive risk-adjusted net returns
with none of the returns from the two momentum strategies being significant positive in half of the 24 markets. The average risk-adjusted net return is $-0.22 \%$ per month for the timeseries momentum strategy, and $-0.29 \%$ per month for the cross-sectional momentum strategy. The magnitude of these significant positive findings does not provide strong inference of the existence of pricing inefficiencies in these markets nor the existence of exploitable investment opportunities.

Although positive gains from the two momentum strategies are not a generalizable case in our 24 markets, the study observes that the optimum implementation in the most markets involves a combination of investment cycle in the range between 15 and 18 months a buy-and-hold portfolio construction policy and the use of market or inversed-volatility portfolio weighting schemes.

It is clear that time-series momentum remains the superior strategy after account is taken of both implementation costs and risk. The time-series momentum strategy continues to outperform the cross-sectional momentum strategy in 19 of the 24 markets with an average $0.39 \%$ per month. The superiority of the time-series momentum strategy appears in 19 markets with significant in nine markets: Canada ( $0.99 \%$ per month), Finland ( $1.11 \%$ per month), Italy ( $0.58 \%$ per month), Japan ( $0.44 \%$ per month), the Netherlands $(0.60 \%$ per month), New Zealand (1.35\% per month), Sweden ( $1.02 \%$ per month), Switzerland ( $0.65 \%$ per month) and the UK ( $0.28 \%$ per month).

After we introduce risk on an-after transaction cost basis, the time-series momentum strategy continues to outperform the cross-sectional momentum strategy in 19 markets (six significant) in up periods with an average difference being $0.39 \%$ per month, and in 18 markets (six significant) in down markets with an average difference being $0.73 \%$ per month. The finding
suggests that the time-series momentum strategy contains lower level of risk than the crosssectional momentum strategy, especially when markets have been performing poorly.

## Chapter 9 - Conclusions

### 9.1. Introduction

This chapter provides us with the opportunity to summarise the main findings of the thesis and to introduce some possible future research topics. The objectives and the contributions of the study are summarised in Sections 9.2 and 9.3, respectively. In Section 9.4 the main findings are reviewed and their implications are briefly discussed.

### 9.2. Objectives

Since the analysis by Jegadeesh and Titman (1993), numerous studies have found that profits that can be realised from following a momentum-based strategy of buying recent strongly performing stocks (winners) and selling recent underperforming stocks (losers). Momentum strategies have proved to be robust across time, countries and asset classes, leading Fama (1998) to observe that momentum remains the "premier unexplained anomaly". Therefore, the existence of the momentum abnormal returns continues to challenge the market efficiency theory.

Momentum investment strategies are used, either explicitly or implicitly, by numerous fund managers. Up until recently, the concentration has been on the cross-sectional momentum strategy in which stocks are allocated to the winner or loser portfolios on the basis of their relative performances over some prior period, but more recently attention has begun to switch to the time-series momentum strategy where stocks are chosen on the basis of their absolute, rather than their relative performance over some prior period. In this thesis, we fill this apparent gap in the momentum literature by compares the time-series and cross-sectional momentum strategies applied to international stock markets.

The research objective is to evaluate the performance of the two momentum strategies, and to provide insights into why they might behave differently. In addition, we look across a broad spectrum of ways to implement the strategies to provide insights into how they inter-relate with the two momentum strategies and which perform the best. As discussed in section 1.4, we address the following questions:

1. How do time-series and cross-sectional momentum strategies perform in terms of (i) before-transaction costs (raw) returns, (ii) after-transaction cost (net) returns and (iii) net returns adjusted for risk?
2. Which of cross-sectional and time-series momentum strategies yields the superior investment performance?
3. Why does the performance of the two momentum strategies differ?
4. Does the absolute and relative performance of the two momentum strategies vary through the market cycle?
5. A further by-product of our research is that it provides insights as to the optimal way to implement the investment strategies.

We address the above questions using data across the 24 stock markets (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the UK and the US) using data from 1992 to 2012.

We first consider the performance of time-series and cross-sectional momentum strategies on the basis of the raw returns generated over a large number of different implementations in order to arrive at an assessment of the ability of each of the two momentum strategies to generate returns for investors. We then proceed to introduce the transaction costs and then
risk in order to determine whether the investment opportunities identified in our initial analysis could be exploited.

### 9.3. Findings

This section summarises the main findings that emerged from the thesis to answer the research questions and outlines the academic implications of these findings as well as their implications for investors seeking to outperform the market.

In total 192 implementations for each of the momentum strategies are evaluated each using three different cut-offs for stocks to be included in the momentum portfolios (i.e. including $32 \%, 60 \%$ and all stocks in either the winner or loser portfolios). We first find that the momentum raw returns decreases as we widen the cut-offs and so include more stocks into the momentum portfolios. The extension of the cut-offs from $32 \%$ to $100 \%$ results in a reduction in the returns on the momentum portfolios by approximately $50 \%$ on average based on the pooled data for the 24 markets. Having established this, we then use the $32 \%$ cut-offs over the remainder of our analysis.

We find that the transaction costs and standard risk explain most profitability of the timeseries and cross-sectional momentum strategies. In terms of the Fama-French alpha determined using after-transaction costs return, about $6 \%$ on average of the implementations evaluated produce significant positive risk-adjusted net returns. There are absolutely no implementations that yield significant positive returns in Austria, France, Germany, Greece, Hong Kong, Israel, Japan, Norway, Portugal, Singapore, Spain and the US., while less than 5\% of the implementations in Australia, Canada, and Ireland. The findings support that the market efficiency hypothesis still holds across the most markets in our sample and the existence of exploitable investment opportunities is rare.

We particularly concentrate on the optimal implementations of both the time-series and crosssectional momentum strategies across the 24 markets. Common characteristics of these optimal implementations for the risk-adjusted net returns are that they combine a formation and a holding period of between 15 and 18 months, a buy-and-hold portfolio construction policy and the use of either a market or inversed-volatility portfolio weighting scheme.

Our main findings for the two momentum strategies based on raw returns, net returns and risk-adjusted net returns are summarised in Table 9.1. The overall performance of the two momentum strategies is eroded from $2.09 \%$ (raw return) to $1.34 \%$ (net return) and to $0.9 \%$ (Fama-French alpha) for the time-series momentum strategy, and from $1.43 \%$ (raw return) to $0.87 \%$ (net return) and finally to $0.51 \%$ (Fama-French alpha) for the cross-sectional momentum strategy. At each of the three steps along the way, this study finds that the timeseries momentum strategy continues to outperform the cross-sectional momentum strategy; however the magnitude of the superior performance is diluted with an average difference from $0.66 \%$ (raw return) to $0.47 \%$ (net return) and to $0.39 \%$ (Fama-French alpha).

Table 9.1. Summary of optimal time-series and cross-sectional momentum strategies based on raw returns, net returns and risk-adjusted net returns

| $\begin{aligned} & \hline \text { Optimal } \\ & \text { implementation } \end{aligned}$ | TSM | CSM | TSM - CSM |
| :---: | :---: | :---: | :---: |
| Raw return | Time-series momentum strategy yields positive returns in 24 markets ( 24 significant) with an average $2.09 \%$ per month across the 24 markets. | Cross-sectional momentum strategy yields positive returns in 24 markets ( 20 significant) with an average $1.43 \%$ per month across the 24 markets. | Time-series momentum strategy outperforms crosssectional momentum strategy in 24 markets ( 13 significant) with an average $0.66 \%$ per month across the 24 markets. |
| Net return | Time-series momentum strategy yields positive returns in 24 markets (19 significant) with an average $1.34 \%$ per month across the 24 markets. | Cross-sectional momentum strategy yields positive returns in 23 markets ( 15 significant) with an average $0.87 \%$ per month across the 24 markets. | Time-series momentum strategy outperforms crosssectional momentum strategy in 21 markets ( 7 significant) with an average $0.47 \%$ per month across the 24 markets. |
| Risk-adjusted net return -Fama-French alpha | Time-series momentum strategy yields positive returns in 22 markets ( 10 significant) with an average $0.9 \%$ per month across the 24 markets. | Cross-sectional momentum strategy yields positive returns in 23 markets (7 significant) with an average $0.51 \%$ per month across the 24 markets. | Time-series momentum strategy outperforms crosssectional momentum strategy in 19 markets ( 5 significant) with an average $0.39 \%$ per month across the 24 markets. |

Consistent with Cooper et al. (2004), we find that the major contribution to the outperformance of the momentum strategies occur in period when market perform strongly. In addition, we find that the superior performance of the time-series momentum strategy relative to the cross-sectional momentum strategy comes during periods when the markets have been performing poorly but that this advantage also erodes as we proceed from raw returns to net returns to risk-adjusted net returns.

One possible explanation for the superiority of the time-series momentum strategy is that it forms portfolios of slightly smaller capitalization stocks with a greater spread in past performance between the winner and loser stocks. Both of these features suggest that the time-series momentum strategy will outperform the cross-sectional momentum strategy. On the other hand, the transaction costs and risk from the time-series momentum strategy are higher than the costs from the cross-sectional momentum strategy which is largely a consequence of time-series momentum strategy selecting smaller and growth stocks, and generating a higher turnover over a market cycle, so it is not surprising that the outperformance of the time-series momentum strategy becomes smaller after adjusting for risk on an after-transaction costs basis.

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## Appendix

## Appendix 1. Determining the cut-off points for the time-series momentum strategies

Step 2 (b) - Stock selection (in-sample upper and lower cut-off points): We first estimate the returns for each stock over the formations period, named formation return, and then calculate the mean and standard deviation of these returns over the whole sample period. Assuming these returns are normal distributed, we determine the cut-offs that will result in the required number of stocks being allocated to either winner or loser portfolios across the whole sample period. For example, if the number of stocks required is $32 \%$, then the cut-offs would be set at plus and minus one standard deviation from the mean.

The process starts with creating a formation-return matrix which contains average returns of each stock over the formation period ( $\mathrm{J}=$ three, six, nine and twelve months) at the end of each month if using monthly rebalancing or at the end of each holding period if using buy-and-hold portfolio. For example, assume a sample ( $4 \times 12$ ) contains four stocks for 12 months (from month $t$ to month $t+12$ ). The first three months ( $t$ to $t+3$ ) are skipped as preparation periods when the formation period is three months. The matrix ( $4 \times 9$ ) then contains formation returns which are the average returns over the last three months for each stock at end of each month when using monthly rebalancing. The matrix contains formation returns which are the average returns over the last three months at the end of each holding period when using buy-and-hold portfolio construction.

|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Stock a | a 1 | a 2 | a 3 | a 4 | a 5 | a 6 | a 7 | a 8 | a 9 | a 10 | a 11 | a 12 |
| Stock b | b 1 | b 2 | b 3 | b 4 | b 5 | b 6 | b 7 | b 8 | b 9 | b 10 | b 11 | b 12 |
| Stock c | c 1 | c 2 | c 3 | c 4 | c 5 | c 6 | c 7 | c 8 | c 9 | c 10 | c 11 | c 12 |
| Stock d | d 1 | d 2 | d 3 | d 4 | d 5 | d 6 | d 7 | d 8 | d 9 | d 10 | d 11 | d 12 |

Matrix (4 x 9) of formation return if monthly rebalancing:

|  |  |  |  | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Stock a |  |  | ave(a1,a2,a3) | ave(a2,a3,a4) |  |  |  |  |  |  |  |  |
| Stock b |  |  |  |  |  |  |  |  |  |  |  |  |
| Stock c |  |  |  |  |  |  |  |  |  |  |  |  |
| Stock d |  |  |  |  |  |  |  |  |  |  |  |  |

The upper and lower levels are set by the cut-offs at $\mathrm{x} \%$ standard deviation above, and $\mathrm{x} \%$ standard deviation below, the mean of the formation-return matrix. Adjusting the scale factor $\mathrm{x} \%$ can determine the upper and lower cut-offs in time-series momentum strategies in order to have the same (or closed) number of stocks as the one used in cross-sectional momentum strategies, with different cut-offs, such as $16 \%$ or $30 \%$. Winner portfolios contain stocks that are above the upper level whereas loser portfolios contain stocks that are below the lower level.

This is an effective "in-sample" means of calculating the cut-offs as they are based on the mean and standard deviations of the returns of the stocks in the each market over the entire sample period. In addition, the study also determined which stocks were "out-of-sample" by setting new cut-offs at each calendar month based on the history of stock returns available at the time.

Step 2 (c) - Stock selection (out-of-sample upper and lower cut-off points): Rather than using the entire sample period to determine the cut-offs and then applying them each time portfolio is formed, at each period we set the cut-offs by using the mean plus and minus one standard deviation from the mean based on the sample where return of each stock over the
formation period. All eligible stocks above upper levels (or below lower levels) where the levels are one standard deviation above (or below) the mean based on their J -month $(\mathrm{J}=$ three, six, nine and twelve months) formation returns, are selected as winners and losers at the end of each month t if month rebalancing is being used, or at the end of each holding period $\mathrm{t}+\mathrm{H}$ if using buy-and-hold is being used. The upper and lower levels vary over different time periods. The "out-of-sample" method provides a robustness check for comparing crosssectional and time-series momentum strategies while investing in approximately one-third of the sample.

## Appendix 2. Momentum implementation examples

Chart 10.1 displays an example for a $3 \times 3(\mathrm{~J} \times \mathrm{H})$ time-series momentum portfolio with BHAR (0). All eligible stocks in the market are assigned to a winner or loser portfolios based on whether their average returns over the past J months $(\mathrm{J}=3)$ are above or below the predetermined cut off point or points (see Section 4.2.2. for estimating pre-determined cut-off levels in the time-series momentum strategy). For instance, winner (loser) portfolio P2 comprises stocks with returns higher (lower) than the cut-off point over the previous January to March period. The portfolio will be held for next $\mathrm{H}(\mathrm{H}=3)$ months, which in the case are April, May and Jun. This procedure is rolled forward at the end of each holding period of H months to produce new winner, loser and momentum portfolios.

Chart 10.1. 3x3 momentum portfolio with buy-and-hold (BHAR (0)) implementation

| Buy-and-hold (Non-overlapping) for winner/loser portfolio |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Time $\begin{gathered}\text { Jan-00 } \\ \\ \text { P1 }\end{gathered}$ | $\begin{gathered} \text { Feb-00 } \\ \text { P1 } \end{gathered}$ | $\begin{aligned} & \text { Mar-00 } \\ & \text { P1 } \end{aligned}$ | Apr-00 | May-00 | Jun-00 | Jul-00 | Aug-00 | Sep-00 | Oct-00 | Nov-00 |
|  |  | $\downarrow$ | P2 | P2 | P2 | P3 | $\begin{gathered} \text { P3 } \\ \downarrow \end{gathered}$ | $\stackrel{\mathrm{P} 3}{\downarrow}$ | $\ldots$ |  |
| Monthly return for winner/loser |  | return at <br> Mar-00 | return at <br> Apr-00 | return at May-00 | return at <br> Jun-00 | return at Jul-00 | return at Aug-00 |  | $\ldots$ |  |

After re-structure, the buy-and-hold portfolio can be shown as:


Chart 10.2 (A) shows an example for a $3 \times 3$ momentum portfolio with CAR (0). The monthly rebalancing framework can be built by rebalancing (repeating the above stock selection
procedure) the winner and loser portfolios monthly. In fact, the framework of monthly rebalancing is achieved by creating multiple buy-and-hold portfolios. The number of buy-and-hold portfolios in monthly rebalancing is controlled by the holding periods H. For example, $3 \times 3$ monthly rebalancing is achieved by creating three buy-and-hold portfolios. The first buy-and-hold portfolio starts at the beginning of the testing period $t$, the second buy-andhold portfolio starts one-month later $\mathrm{t}+1$, and the third buy-and-hold portfolio starts two months later $t+2$. By the time that the forth buy-and-hold portfolio starts at $t+3$, it is the end of holding period for the first portfolio.

Chart 10.3 shows the example of a $3 \times 3$ momentum construction with a one-month gap.

Chart 10.2(A). Monthly rebalancing (Overlapping) implementation strategy

| Monthly Rebalancing (Overlapping) for winner/loser portfolio |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Time Jan-00 <br>  P1 | $\begin{gathered} \text { Feb-00 } \\ \text { P1 } \\ \text { P2 } \end{gathered}$ | Mar-00 | Apr-00 | May-00 | Jun-00 | Jul-00 | Aug-00 | Sep-00 | Oct-00 | Nov-00 |
|  |  | P1 |  |  |  |  |  |  |  |  |
|  |  | P2 | P2 |  |  |  |  |  |  |  |
|  |  | P3 | P3 | P3 |  |  |  |  |  |  |
|  |  |  | P4 | P4 | P4 |  |  |  |  |  |
|  |  |  |  | P5 | P5 | P5 |  |  |  |  |
|  |  |  |  |  | P6 | P6 | P6 |  |  |  |
|  |  |  |  |  |  | P7 | P7 | P7 |  |  |
|  |  |  |  |  |  |  | P8 | P8 | P8 |  |
|  |  | $\downarrow$ | $\downarrow$ | $\downarrow$ | $\downarrow$ | $\downarrow$ | $\downarrow$ |  | P9 |  |
| Monthly return for winner/loser |  |  | Average return at Apr-00 | Average return at May-00 | Average return at Jun-00 | Average return at Jul-00 |  | Average return at Sep-00 |  | .. |

Re-structure location of the portfolio

| Monthly Rebalancing (Overlapping) for winner/loser portfolio |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Time Jan-00 <br>  P1 | $\begin{gathered} \text { Feb-00 } \\ \text { P1 } \\ \text { P2 } \end{gathered}$ | Mar-00 | Apr-00 | May-00 | Jun-00 | Jul-00 | Aug-00 | Sep-00 | Oct-00 | Nov-00 |
|  |  | P1 |  |  | $\uparrow$ |  |  |  |  |  |
|  |  | P2 | P2 |  |  |  |  |  |  |  |
|  |  | P3 | P3 | P3 |  |  |  |  |  |  |
|  |  |  | P4 | P4 | P4 |  |  |  |  |  |
|  |  |  |  | P5 | P5 | P5 |  |  |  |  |
|  |  |  |  |  | P6 | P6 | P6 |  |  |  |
|  |  |  |  |  |  | P7 | P7 | P7 |  |  |
|  |  |  |  |  |  |  | P8 | P8 | P8 |  |
|  |  | $\downarrow$ | $\downarrow$ | $\downarrow$ | $\downarrow$ | $\downarrow$ | $\downarrow$ | P9 | P9 | .. |
| Monthly return for winner/loser |  | Average return at Mar-00 | Average return at Apr-00 | Average return at May-00 | Average return at Jun-00 | Average return at Jul-00 | Average return at Aug-00 | Average return at Sep-00 |  | .. |

Chart 10.2(B). Monthly rebalancing portfolio construction is consistent with H numbers of buy-and-hold portfolios

| Monthly Rebalancing (Overlapping) for winner/loser portfolio |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Time Jan-00 Feb-00 | Mar-00 | Apr-00 | May-00 | Jun-00 | Jul-00 | Aug-00 | Sep-00 | Oct-00 Nov-00 |
| P1 P1 | P1 | P4 | P4 | P4 | P7 | P7 | P7 |  |
| P2 | P2 | P2 | P5 | P5 | P5 | P8 | P8 | P8 |
|  | P3 | P3 | P3 | P6 | P6 | P6 | P9 | P9 |
|  | $\vee$ | $\vee$ | $\downarrow$ | $\downarrow$ | $\downarrow$ | $\downarrow$ | $\downarrow$ |  |
| Monthly return for winner/loser | Average return at Mar-00 | Average return at Apr-00 | Average return at May-00 | Average return at Jun-00 | Average return at Jul-00 | Average return at Aug-00 | Average return at Sep-00 | $\ldots$ |

## Chart 10.3. $3 x 3$ momentum constructions with one-month gap

Formation period (3 months)

| Jan-00 | Feb-00 | Har-00 |  | Apr-00 period ( 3 months) |  |
| :--- | :--- | :--- | :--- | :--- | :--- |

1-Month Gap

## Appendix 3. Momentum results on raw, net and risk-adjusted returns (Investing around $\mathbf{3 2 \%}$ of the universe)

## Table 5.1. Monthly raw returns of time-series momentum strategy under different implementations

This table reports the average monthly returns for $16(\mathrm{~J} \times \mathrm{H})$ time-series momentum strategies across the 24 stock markets along with an indication of significant level based on the Newey-West adjusted t-statistics. At the end of each month if using monthly rebalancing or at the end of each holding period if using buy-and-hold portfolio construction, stocks in each market are selected into winner (loser) portfolio if average stock return over past $\mathbf{J}(\mathbf{J}=3,6,9$ and 12 months) is above pre-determined symmetric upper (lower) level. The pre-defined upper and lower cut-offs for each market are reported in the appendix. All stocks in the winner and loser portfolios are equally weighted in Panel A, market value weighted in Panel B and inversed volatility weighted in Panel C. Following Moskowitz et al. (2012), inversed volatility weighting scheme is given lower proportion to higher volatile stocks in the portfolio; that is the weight of the stock in portfolio is estimated by an inverse proportion of its ex-ante volatility from daily returns over $J(J=3,6,9$ and 12 months). The proportions of stocks in the portfolios remain same during the $H(H=3,6,9$ and 12 months) holding period. We implement portfolio constructions as in Jegadeesh and Titman (1993) for buy-and-hold and monthly-rebalancing. For buy-and-hold (BHAR), the procedure is rolling forward at the end of each H holding period to generate a new winner and loser portfolios. For monthly-rebalancing (CAR), the procedure is rolling forward at the end of each month to produce an overlapping winner (loser) portfolio which contains of winner (loser) portfolio of the past J month. The return of the winner (loser) portfolio is then the simple average return of the H numbers of winner (loser) portfolios. CAR (1) and BHAR (1) indicates one-month gap between the formation and the holding periods to avoid the bid-ask bounce, whereas CAR ( 0 ) and BHAR ( 0 ) indicates no gap between the formation and the holding periods. The return on momentum portfolio is then estimated as return difference return between winner and loser portfolio at each month.

Panel A. The time-series momentum using equal-weighted return

| EW | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=3$ | 9 |  | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.24\% | 0.28\% | 0.25\% | 0.17\% | 0.62\% | 0.45\% | 0.36\% | 0.14\% | 0.71\% | 0.57\% | 0.36\% | 0.09\% | 0.56\% | 0.26\% | 0.07\% | -0.13\% |
|  | 0.8154 | 1.2369 | 1.4465 | 1.0918 | 2.0125 | 1.7526 | 1.6725 | 0.7216 | 2.3626 | 2.0984 | 1.5041 | 0.4128 | 1.5427 | 0.8610 | 0.2552 | -0.5527 |
| CAR (1) | 0.77\% | 0.53\% | 0.40\% | 0.21\% | 0.82\% | 0.57\% | 0.32\% | 0.09\% | 0.88\% | 0.56\% | 0.27\% | -0.01\% | 0.40\% | 0.17\% | -0.08\% | -0.24\% |
|  | 3.0025 | 2.7361 | 2.5452 | 1.3711 | 2.9689 | 2.5340 | 1.6176 | 0.4559 | 3.1108 | 2.2150 | 1.1741 | -0.0465 | 1.1410 | 0.5824 | -0.3148 | -1.0490 |
| BHAR (0) | 0.36\% | 0.28\% | 0.16\% | 0.09\% | 0.60\% | 0.45\% | 0.05\% | -0.16\% | 0.65\% | 0.48\% | 0.41\% | 0.27\% | 0.21\% | -0.06\% | -0.08\% | -0.08\% |
|  | 1.1560 | 1.0552 | 0.6231 | 0.3255 | 1.7185 | 1.3592 | 0.1458 | -0.5214 | 1.9911 | 1.6839 | 1.6436 | 0.9343 | 0.4029 | -0.1271 | -0.1987 | -0.1653 |
| BHAR (1) | 0.84\% | 0.25\% | 0.05\% | 0.04\% | 0.85\% | 0.55\% | -0.11\% | -0.32\% | 0.64\% | 0.28\% | 0.41\% | 0.15\% | 0.15\% | 0.00\% | -0.40\% | -0.40\% |
|  | 3.1193 | 0.9752 | 0.1662 | 0.1405 | 2.6656 | 2.0362 | -0.3541 | -1.0437 | 1.8518 | 0.9162 | 1.6896 | 0.5004 | 0.3327 | -0.0063 | -1.0067 | -0.9590 |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.76\% | 0.85\% | 0.82\% | 0.80\% | 1.08\% | 1.10\% | 1.14\% | 0.96\% | 1.31\% | 1.30\% | 1.10\% | 0.87\% | 1.48\% | 1.23\% | 1.03\% | 0.71\% |
|  | 2.2292 | 2.8991 | 3.1324 | 3.5347 | 2.2714 | 2.7847 | 3.0976 | 2.8142 | 2.9492 | 3.1491 | 2.8086 | 2.4709 | 3.1785 | 2.9470 | 2.6453 | 2.0696 |
| CAR (1) | 1.37\% | 1.04\% | 0.95\% | 0.83\% | 1.23\% | 1.13\% | 1.12\% | 0.88\% | 1.56\% | 1.27\% | 1.05\% | 0.81\% | 1.37\% | 1.11\% | 0.86\% | 0.57\% |
|  | 3.6894 | 3.6097 | 3.6523 | 3.7079 | 2.5891 | 2.9100 | 3.0664 | 2.6563 | 3.6929 | 3.1015 | 2.7478 | 2.4191 | 2.9910 | 2.6652 | 2.3100 | 1.6870 |
| BHAR (0) | 1.15\% | 1.04\% | 1.07\% | 0.76\% | 1.41\% | 1.26\% | 1.11\% | 1.22\% | 1.42\% | 1.13\% | 1.06\% | 1.33\% | 1.33\% | 0.80\% | 1.07\% | 0.05\% |
|  | 2.8107 | 2.7249 | 2.2117 | 2.1139 | 2.5663 | 2.3782 | 2.2568 | 3.0622 | 2.9539 | 1.9837 | 2.3572 | 2.5334 | 2.5019 | 1.4581 | 2.0779 | 0.1109 |
| BHAR (1) | 1.94\% | 1.06\% | 1.28\% | 0.75\% | 1.57\% | 1.13\% | 1.01\% | 1.13\% | 1.14\% | 0.66\% | 1.09\% | 1.00\% | 1.11\% | 0.78\% | 0.59\% | 0.18\% |
|  | 4.4724 | 2.5926 | 2.7928 | 2.0701 | 2.8832 | 2.0585 | 2.1231 | 2.9034 | 2.3241 | 1.0621 | 2.3210 | 1.9382 | 2.0323 | 1.4288 | 1.1715 | 0.3858 |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.93\% | 1.00\% | 0.92\% | 0.89\% | 1.35\% | 1.21\% | 1.17\% | 0.99\% | 1.25\% | 1.32\% | 1.13\% | 0.98\% | 1.57\% | 1.41\% | 1.22\% | 1.05\% |
|  | 3.5012 | 4.3336 | 4.4346 | 4.4923 | 4.0533 | 3.7492 | 3.8600 | 3.6683 | 3.2819 | 3.7961 | 3.5007 | 3.2653 | 3.5639 | 3.6322 | 3.4081 | 3.1144 |
| CAR (1) | 1.31\% | 1.05\% | 1.02\% | 0.90\% | 1.46\% | 1.22\% | 1.12\% | 0.92\% | 1.40\% | 1.29\% | 1.09\% | 0.93\% | 1.71\% | 1.37\% | 1.18\% | 0.99\% |
|  | 5.1982 | 4.5885 | 4.8380 | 4.7297 | 4.4429 | 3.7105 | 3.7640 | 3.4907 | 3.5351 | 3.7526 | 3.4425 | 3.1484 | 4.1155 | 3.6944 | 3.3825 | 3.0125 |
| BHAR (0) | 1.10\% | 0.77\% | 0.71\% | 0.75\% | 1.27\% | 1.13\% | 0.86\% | 1.22\% | 1.25\% | 1.45\% | 1.27\% | 1.39\% | 1.58\% | 1.42\% | 1.15\% | 0.66\% |
|  | 3.4890 | 2.2841 | 2.5045 | 2.0530 | 3.2682 | 2.7709 | 2.3212 | 3.6865 | 3.0413 | 3.0905 | 2.8527 | 3.4047 | 3.6382 | 3.3929 | 3.1932 | 1.7845 |
| BHAR (1) | 1.08\% | 0.54\% | 0.66\% | 0.72\% | 1.53\% | 0.98\% | 0.73\% | 1.18\% | 1.26\% | 1.43\% | 1.23\% | 1.16\% | 1.42\% | 1.37\% | 0.97\% | 0.66\% |
|  | 3.3874 | 1.3155 | 2.3187 | 1.9379 | 4.1124 | 2.3020 | 1.8575 | 3.6467 | 2.8287 | 3.0860 | 3.0497 | 2.8006 | 3.5727 | 3.4034 | 2.7862 | 1.7422 |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.84\% | 0.78\% | 0.80\% | 0.79\% | 1.28\% | 1.18\% | 1.12\% | 0.84\% | 1.47\% | 1.29\% | 1.00\% | 0.65\% | 1.43\% | 1.06\% | 0.78\% | 0.44\% |
|  | 2.7039 | 3.1331 | 3.6091 | 4.2652 | 3.8282 | 3.9960 | 4.2777 | 3.5701 | 4.3567 | 4.0245 | 3.4163 | 2.4638 | 4.0719 | 3.3398 | 2.5865 | 1.6082 |
| CAR (1) | 1.17\% | 0.92\% | 0.94\% | 0.77\% | 1.50\% | 1.31\% | 1.12\% | 0.72\% | 1.57\% | 1.23\% | 0.87\% | 0.47\% | 1.29\% | 0.89\% | 0.60\% | 0.24\% |
|  | 4.0067 | 3.6301 | 4.4111 | 4.3609 | 4.4072 | 4.3843 | 4.3228 | 3.0738 | 4.4036 | 3.8803 | 3.0475 | 1.7965 | 3.7020 | 2.7982 | 2.0121 | 0.8797 |
| BHAR (0) | 0.89\% | 0.66\% | 0.82\% | $\mathbf{0 . 6 7 \%}$ | 1.15\% | 0.93\% | 1.02\% | 0.50\% | 1.59\% | 1.24\% | 0.92\% | 0.61\% | 1.45\% | 0.91\% | 0.76\% | 0.51\% |
|  | 2.3483 | 1.7577 | 2.3732 | 2.0669 | 3.0006 | 2.5548 | 2.6619 | 1.4813 | 4.4128 | 3.2597 | 2.6232 | 1.7332 | 3.7743 | 2.4517 | 2.0975 | 1.4681 |
| BHAR (1) | 1.08\% | 0.86\% | 1.02\% | 0.66\% | 1.44\% | 1.15\% | 1.03\% | 0.34\% | 1.75\% | 1.31\% | 0.84\% | 0.57\% | 1.30\% | 0.73\% | 0.59\% | 0.28\% |
|  | 3.0655 | 2.5016 | 3.4405 | 2.0716 | 3.7697 | 3.1552 | 2.7762 | 1.0060 | 4.7828 | 3.4954 | 2.4861 | 1.5751 | 3.4574 | 2.0229 | 1.6999 | 0.8863 |


| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| H = |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.22\% | 1.26\% | 1.21\% | 1.15\% | 1.70\% | 1.53\% | 1.51\% | 1.30\% | 1.71\% | 1.75\% | 1.51\% | 1.29\% | 1.73\% | 1.75\% | 1.57\% | 1.40\% |
|  |  | 4.4015 | 5.7916 | 6.7652 | 6.8585 | 5.2638 | 5.4690 | 5.8570 | 5.1471 | 4.5992 | 5.5172 | 5.0716 | 4.4361 | 4.7532 | 5.1274 | 4.6832 | 4.3795 |
| CAR (1) |  | 1.47\% | 1.35\% | 1.27\% | 1.12\% | 1.57\% | 1.52\% | 1.42\% | 1.16\% | 1.88\% | 1.75\% | 1.43\% | 1.20\% | 1.83\% | 1.72\% | 1.49\% | 1.30\% |
|  |  | 6.1293 | 6.3640 | 7.1262 | 6.4557 | 4.4874 | 5.3627 | 5.2364 | 4.3915 | 5.5532 | 5.8321 | 4.7452 | 4.1564 | 5.0496 | 5.0527 | 4.4619 | 4.1132 |
| BHAR (0) |  | 1.13\% | 1.03\% | 0.76\% | 0.89\% | 1.52\% | 1.58\% | 1.50\% | 1.67\% | 1.92\% | 1.49\% | 1.65\% | 1.30\% | 1.65\% | 1.66\% | 1.13\% | 1.10\% |
|  |  | 3.5218 | 3.1912 | 2.5554 | 2.0605 | 4.1989 | 4.7020 | 4.6749 | 5.5928 | 6.0431 | 3.5224 | 4.9273 | 4.0979 | 3.9179 | 4.0822 | 2.8136 | 2.6493 |
| BHAR (1) |  | 1.44\% | 1.29\% | 0.91\% | 1.06\% | 1.45\% | 1.67\% | 1.19\% | 1.54\% | 2.01\% | 1.71\% | 1.56\% | 1.25\% | 1.74\% | 1.79\% | 1.24\% | 1.08\% |
|  |  | 5.0214 | 4.0622 | 2.5512 | 2.5483 | 3.7160 | 4.9371 | 3.4312 | 5.4090 | 5.1648 | 4.0772 | 4.9684 | 3.9041 | 4.1496 | 4.9450 | 3.2636 | 2.7890 |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.87\% | 0.55\% | 0.65\% | 0.61\% | 1.26\% | 1.09\% | 1.06\% | 0.88\% | 1.41\% | 1.37\% | 1.06\% | 0.76\% | 1.50\% | 1.16\% | 0.81\% | 0.61\% |
|  |  | 2.1099 | 1.5496 | 1.9496 | 1.9865 | 3.1929 | 3.1021 | 3.0208 | 2.4838 | 3.2084 | 2.9015 | 2.2477 | 1.6706 | 2.6676 | 2.1504 | 1.5489 | 1.2366 |
| CAR (1) |  | 1.06\% | 0.71\% | 0.73\% | 0.66\% | 1.28\% | 1.25\% | 0.97\% | 0.87\% | 1.39\% | 1.25\% | 0.89\% | 0.63\% | 1.40\% | 0.95\% | 0.66\% | 0.51\% |
|  |  | 2.7072 | 1.9032 | 2.2527 | 2.1910 | 3.3958 | 3.5958 | 2.7138 | 2.4509 | 2.8007 | 2.4255 | 1.8007 | 1.3660 | 2.4132 | 1.7214 | 1.2516 | 1.0392 |
| BHAR (0) |  | 0.79\% | -0.10\% | 1.05\% | 0.84\% | 1.05\% | 1.13\% | 0.21\% | 0.69\% | 1.15\% | 0.99\% | 1.01\% | 0.34\% | 1.60\% | 1.88\% | 1.10\% | 1.05\% |
|  |  | 1.4413 | -0.1675 | 2.1249 | 1.2767 | 1.9782 | 1.9743 | 0.3525 | 1.2742 | 2.4666 | 1.5988 | 1.8170 | 0.6103 | 2.4378 | 3.1006 | 1.7024 | 1.9072 |
| BHAR (1) |  | 1.09\% | -0.14\% | 1.16\% | 0.98\% | 1.02\% | 1.32\% | 0.19\% | 0.59\% | 1.16\% | 1.06\% | 0.69\% | 0.43\% | 1.35\% | 1.49\% | 0.98\% | 1.04\% |
|  |  | 2.3092 | -0.2362 | 2.3803 | 1.5040 | 2.0346 | 2.1384 | 0.3060 | 1.1043 | 2.1740 | 1.7762 | 1.1757 | 0.7440 | 2.0855 | 2.3112 | 1.5219 | 1.9857 |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.14\% | 0.39\% | 0.44\% | 0.51\% | 0.46\% | 0.73\% | 0.82\% | 0.74\% | 0.67\% | 0.92\% | 0.85\% | 0.74\% | 0.86\% | 0.97\% | 0.85\% | 0.69\% |
|  |  | -0.5360 | 1.9417 | 2.5632 | 3.2875 | 1.6086 | 3.1693 | 4.0081 | 3.7193 | 2.4331 | 3.6074 | 3.4358 | 3.1721 | 2.8662 | 3.4555 | 3.2429 | 2.7334 |
| CAR (1) |  | 0.89\% | 0.77\% | 0.74\% | 0.67\% | 1.07\% | 1.03\% | 0.99\% | 0.80\% | 1.25\% | 1.12\% | 0.95\% | 0.77\% | 1.20\% | 1.06\% | 0.86\% | 0.68\% |
|  |  | 3.8516 | 4.1923 | 4.6690 | 4.5892 | 4.1935 | 4.8490 | 4.8803 | 4.1773 | 4.7657 | 4.4000 | 3.8322 | 3.3842 | 4.1443 | 3.8711 | 3.2972 | 2.7279 |
| BHAR (0) |  | -0.10\% | 0.23\% | 0.66\% | 0.16\% | 0.53\% | 0.68\% | 0.67\% | 0.52\% | 0.65\% | 0.90\% | 0.92\% | 0.80\% | 0.82\% | 0.86\% | 0.88\% | 0.61\% |
|  |  | -0.3128 | 0.8288 | 2.4788 | 0.5732 | 1.6797 | 2.6429 | 2.2047 | 2.0457 | 2.1582 | 2.9866 | 3.3085 | 2.9959 | 2.6900 | 2.8313 | 3.2195 | 2.4370 |
| BHAR (1) |  | 0.84\% | 0.64\% | 0.91\% | 0.45\% | 1.10\% | 0.96\% | 0.82\% | 0.56\% | 1.14\% | 1.04\% | 0.92\% | 0.58\% | 1.06\% | 0.83\% | 0.88\% | 0.60\% |
|  |  | 3.1635 | 2.4529 | 3.5733 | 1.7646 | 4.1890 | 3.8962 | 2.8237 | 2.3520 | 3.9037 | 3.4534 | 3.1616 | 2.0676 | 3.3768 | 2.8293 | 3.2442 | 2.3359 |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.05\% | 0.99\% | 0.88\% | 0.81\% | 1.21\% | 1.10\% | 1.07\% | 0.80\% | 1.42\% | 1.33\% | 1.09\% | 0.87\% | 1.63\% | 1.38\% | 1.15\% | 0.90\% |
|  |  | 3.3633 | 3.8751 | 4.2274 | 4.2885 | 3.3054 | 3.5550 | 3.9124 | 3.0907 | 4.0690 | 4.2785 | 3.6360 | 3.0240 | 4.5527 | 4.0251 | 3.6140 | 2.9838 |
| CAR (1) |  | 1.37\% | 1.12\% | 0.93\% | 0.81\% | 1.25\% | 1.17\% | 1.00\% | 0.71\% | 1.61\% | 1.32\% | 1.02\% | 0.80\% | 1.59\% | 1.31\% | 1.02\% | 0.78\% |
|  |  | 4.6033 | 4.7997 | 4.7597 | 4.4967 | 3.8041 | 4.1065 | 3.7820 | 2.7740 | 4.8937 | 4.2931 | 3.3999 | 2.7823 | 4.4425 | 3.8982 | 3.2524 | 2.5927 |
| BHAR (0) |  | 1.12\% | 1.04\% | 1.11\% | 0.58\% | 1.19\% | 1.35\% | 1.01\% | 0.95\% | 1.50\% | 1.20\% | 1.19\% | 1.01\% | 1.50\% | 1.10\% | 1.07\% | 0.81\% |
|  |  | 3.2176 | 3.0059 | 3.6581 | 1.6074 | 2.8936 | 4.0072 | 2.6765 | 2.8729 | 3.9891 | 3.0812 | 3.6066 | 2.7749 | 3.8990 | 3.1350 | 3.1584 | 2.5364 |
| BHAR (1) |  | 1.57\% | 1.11\% | 1.07\% | 0.68\% | 1.08\% | 1.35\% | 0.99\% | 0.67\% | 1.41\% | 1.00\% | 0.95\% | 0.91\% | 1.30\% | 0.87\% | 0.65\% | 0.65\% |
|  |  | 5.0271 | 3.3193 | 3.5821 | 1.8358 | 2.8282 | 4.3020 | 2.7295 | 2.0167 | 3.8717 | 2.5890 | 2.6858 | 2.3432 | 3.3336 | 2.5635 | 1.9267 | 2.0296 |




| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 12 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.78\% | 0.95\% | 0.86\% | 0.76\% | 0.90\% | 0.96\% | 0.78\% | 0.60\% | 1.09\% | 0.99\% | 0.71\% | 0.32\% | 1.22\% | 0.90\% | 0.56\% | 0.28\% |
|  |  | 1.6740 | 2.4887 | 2.9123 | 2.9340 | 1.6654 | 2.2445 | 2.2083 | 1.7964 | 2.2115 | 2.1788 | 1.6736 | 0.8128 | 2.2975 | 1.8178 | 1.2249 | 0.6678 |
| CAR (1) |  | 0.78\% | 0.97\% | 0.93\% | 0.71\% | 1.12\% | 1.07\% | 0.81\% | 0.42\% | 1.14\% | 0.83\% | 0.51\% | 0.09\% | 0.88\% | 0.61\% | 0.29\% | 0.04\% |
|  |  | 1.5302 | 2.6862 | 3.2123 | 2.7275 | 2.2956 | 2.8648 | 2.4341 | 1.2834 | 2.3260 | 1.8433 | 1.1842 | 0.2261 | 1.6533 | 1.2366 | 0.6441 | 0.0978 |
| BHAR (0) |  | 0.71\% | 1.12\% | 0.30\% | 0.38\% | 0.80\% | 0.70\% | 0.31\% | 1.09\% | 2.11\% | 1.40\% | 0.90\% | 0.74\% | 1.64\% | 1.58\% | 0.70\% | 0.94\% |
|  |  | 1.3519 | 2.0604 | 0.6867 | 0.8867 | 1.2619 | 1.0578 | 0.5351 | 2.3801 | 3.4745 | 2.3662 | 1.5186 | 1.2083 | 2.8226 | 2.5872 | 1.3060 | 1.6200 |
| BHAR (1) |  | 0.87\% | 1.38\% | 0.50\% | 0.29\% | 1.46\% | 0.88\% | 0.19\% | 0.69\% | 1.80\% | 1.10\% | 0.68\% | 0.38\% | 1.23\% | 1.20\% | 0.77\% | 0.65\% |
|  |  | 1.6212 | 2.7291 | 1.1598 | 0.6245 | 2.3335 | 1.5244 | 0.3434 | 1.5423 | 3.0430 | 1.7613 | 1.1510 | 0.6224 | 2.0174 | 1.9362 | 1.4549 | 1.0510 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.88\% | 0.01\% | 0.18\% | 0.12\% | -0.25\% | 0.15\% | 0.27\% | 0.20\% | -0.45\% | 0.10\% | 0.14\% | 0.11\% | -0.45\% | -0.16\% | 0.09\% | 0.06\% |
|  |  | -1.8036 | 0.0172 | 0.6085 | 0.4532 | -0.4617 | 0.3230 | 0.6430 | 0.5167 | -0.8826 | 0.1968 | 0.3122 | 0.2607 | -0.7729 | -0.3072 | 0.1916 | 0.1336 |
| CAR (1) |  | 0.24\% | 0.71\% | 0.44\% | 0.44\% | 0.52\% | 0.66\% | 0.48\% | 0.38\% | 0.26\% | 0.41\% | 0.30\% | 0.27\% | -0.04\% | 0.15\% | 0.24\% | 0.11\% |
|  |  | $0.4834$ | $2.0616$ | 1.5630 | 1.7292 | $1.0002$ | $1.4110$ | 1.1581 | 0.9707 | $0.5068$ | 0.7973 | $0.6749$ | $0.6221$ | -0.0734 | $0.2876$ | $0.5257$ | $0.2741$ |
| BHAR (0) |  | -0.38\% | 0.82\% | 0.73\% | 0.66\% | 0.15\% | 0.65\% | 0.93\% | 0.66\% | -0.79\% | -0.07\% | 0.09\% | 0.55\% | -0.63\% | -0.45\% | 0.19\% | -0.03\% |
|  |  | -0.6596 | 1.2563 | 1.1714 | 1.0275 | 0.2109 | 0.9793 | 1.4802 | 0.9957 | -1.4956 | -0.1128 | 0.1561 | 0.9761 | -1.0169 | -0.8086 | 0.3852 | -0.0571 |
| BHAR (1) |  | 0.09\% | 1.04\% | 0.98\% | 0.70\% | 1.10\% | $0.89 \%$ | $1.19 \%$ | 0.59\% | $0.12 \%$ | $0.57 \%$ | $0.31 \%$ | 0.62\% | $-0.24 \%$ | $-0.32 \%$ | $0.16 \%$ | -0.23\% |
|  |  | 0.1490 | 1.8053 | 1.6099 | 1.1769 | 1.8071 | $1.6463$ | $2.0418$ | 1.0373 | $0.2047$ | $0.9756$ | $0.6297$ | 1.0236 | $-0.4077$ | $-0.5965$ | $0.3228$ | -0.4398 |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.02\% | 1.23\% | 0.94\% | 0.76\% | 1.02\% | 1.09\% | 0.84\% | 0.64\% | 1.30\% | 1.07\% | 0.82\% | 0.62\% | 1.14\% | 0.99\% | 0.74\% | 0.53\% |
|  |  | 2.2404 | 3.6141 | 3.3014 | 2.8969 | 1.9832 | 2.7168 | 2.3331 | 2.0006 | 2.6233 | 2.2712 | 1.9527 | 1.6939 | 2.1324 | 2.0477 | 1.6753 | 1.4071 |
| CAR (1) |  | 1.27\% | 1.28\% | 0.93\% | 0.66\% | 1.27\% | 1.09\% | 0.77\% | 0.50\% | 1.07\% | 0.91\% | 0.69\% | 0.44\% | 1.00\% | 0.89\% | 0.62\% | 0.39\% |
|  |  | 2.8426 | 4.2342 | 3.3318 | 2.7247 | 2.9411 | 2.9087 | 2.1385 | 1.6638 | 2.1486 | 1.9459 | 1.6867 | 1.2623 | 1.9084 | 1.9038 | 1.5292 | 1.1213 |
| BHAR (0) |  | 0.85\% | 0.99\% | 0.83\% | 0.28\% | 1.22\% | 1.05\% | 0.65\% | 0.64\% | 1.34\% | 0.71\% | 0.49\% | 0.02\% | 1.11\% | 1.40\% | 1.25\% | 0.75\% |
|  |  | 1.5303 | 2.0230 | 2.3903 | 0.6953 | 1.8802 | 2.2933 | 1.1921 | 1.4064 | 2.3923 | 1.2404 | 1.0415 | 0.0404 | 2.0667 | 2.7902 | 2.6271 | 1.7047 |
| BHAR (1) |  | 1.14\% | 0.46\% | 0.96\% | 0.07\% | 0.77\% | 1.00\% | 1.05\% | 0.65\% | 0.67\% | 0.73\% | 0.63\% | -0.08\% | 0.89\% | 1.21\% | 0.77\% | 0.35\% |
|  |  | 2.4130 | 1.0962 | 2.6023 | 0.1621 | 1.3441 | 2.0846 | 1.8064 | 1.5393 | 1.1337 | 1.2237 | 1.4395 | -0.1535 | 1.5429 | 2.3012 | 1.6141 | 0.7940 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.13\% | 0.39\% | 0.51\% | 0.62\% | 0.16\% | 0.34\% | 0.65\% | 0.56\% | 0.24\% | 0.55\% | 0.70\% | 0.50\% | 1.04\% | 0.80\% | 0.77\% | 0.60\% |
|  |  | 0.4084 | 1.3744 | 2.0808 | 2.8605 | 0.4321 | 0.9579 | 2.1268 | 2.0359 | 0.5391 | 1.3046 | 2.0054 | 1.5132 | 2.3766 | 1.9774 | 2.0759 | $1.7066$ |
| CAR (1) |  | 0.21\% | 0.52\% | 0.61\% | 0.62\% | 0.22\% | 0.57\% | 0.72\% | 0.53\% | 0.52\% | 0.70\% | 0.63\% | 0.47\% | 0.67\% | 0.66\% | 0.62\% | 0.48\% |
|  |  | 0.5587 | 1.8369 | 2.5051 | 2.9053 | 0.5297 | 1.5873 | 2.3606 | 1.8815 | 1.1052 | 1.7432 | 1.7968 | 1.4312 | 1.5003 | 1.6522 | 1.6692 | 1.3515 |
| BHAR (0) |  | 0.29\% | -0.35\% | 0.40\% | 0.40\% | 0.02\% | 0.16\% | 0.37\% | -0.10\% | $0.50 \%$ | $0.55 \%$ | $1.03 \%$ | 0.26\% | 1.01\% | 1.29\% | 0.76\% | 0.49\% |
|  |  | 0.7907 | -0.8070 | 0.9752 | 0.9173 | 0.0371 | 0.2679 | 0.6505 | -0.2016 | $0.9927$ | $0.9967$ | 2.0315 | 0.4642 | 2.0702 | 2.7071 | 1.4610 | 0.9376 |
| BHAR (1) |  | 0.21\% | -0.18\% | 0.18\% | 0.32\% | 0.17\% | 0.55\% | 0.75\% | -0.18\% | 0.64\% | 0.44\% | 0.86\% | 0.20\% | 0.37\% | 0.93\% | 0.48\% | 0.42\% |
|  |  | 0.5016 | -0.4041 | 0.4247 | 0.7138 | 0.3348 | 1.0427 | 1.3893 | -0.3649 | 1.2683 | 0.7393 | 1.7633 | 0.3503 | 0.7053 | 1.8710 | 0.9658 | 0.7802 |


| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.02\% | 1.33\% | 1.07\% | 1.01\% | 1.85\% | 1.73\% | 1.49\% | 1.25\% | 2.13\% | 1.94\% | 1.50\% | 1.15\% | 2.34\% | 1.86\% | 1.47\% | 1.16\% |
|  |  | 2.3063 | 3.8089 | 3.6189 | 3.9845 | 3.6875 | 3.7575 | 3.7022 | 3.5571 | 4.0749 | 4.0667 | 3.5116 | 3.1299 | 4.7456 | 3.9392 | 3.4177 | 3.0182 |
| CAR (1) |  | 1.59\% | 1.47\% | 1.12\% | 0.97\% | 2.19\% | 1.80\% | 1.51\% | 1.16\% | 2.35\% | 1.71\% | 1.34\% | 0.97\% | 2.28\% | 1.67\% | 1.33\% | 1.03\% |
|  |  | 3.8979 | 4.6752 | 4.0399 | 3.8974 | 4.3648 | 4.0600 | 3.9453 | 3.5267 | 4.6170 | 3.7006 | 3.2669 | 2.7297 | 4.8592 | 3.6877 | 3.2668 | 2.7457 |
| BHAR (0) |  | 0.99\% | 1.23\% | 0.77\% | 0.88\% | 1.81\% | 1.68\% | 1.04\% | 0.96\% | 2.16\% | 2.03\% | 1.46\% | 0.81\% | 2.14\% | 1.79\% | 1.92\% | 1.64\% |
|  |  | 1.7221 | 2.7911 | 1.6812 | 1.9572 | 3.0110 | 3.2036 | 1.7198 | 1.9385 | 3.8352 | 3.5544 | 3.0240 | 1.7189 | 4.0865 | 3.5591 | 3.7493 | 3.1993 |
| BHAR (1) |  | 1.39\% | 1.43\% | 1.02\% | 0.91\% | 2.31\% | 1.91\% | 1.00\% | 0.82\% | 2.32\% | 1.89\% | 1.56\% | 0.70\% | 2.61\% | 1.94\% | 1.82\% | 1.90\% |
|  |  | 2.8110 | 3.4643 | 2.4621 | 1.9855 | 3.7789 | 3.5453 | 1.6451 | 1.6543 | 4.0259 | 3.5742 | 3.5112 | 1.4877 | 5.0139 | 3.7347 | 3.5148 | 3.6712 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.02\% | 1.07\% | 0.96\% | 0.90\% | 1.55\% | 1.50\% | 1.31\% | 1.04\% | 1.82\% | 1.69\% | 1.25\% | 0.95\% | 1.75\% | 1.36\% | 1.03\% | 0.75\% |
|  |  | 4.3862 | 4.9189 | 4.9702 | 5.3089 | 4.9750 | 5.3787 | 5.2435 | 4.5700 | 5.5335 | 5.9468 | 5.0144 | 4.1111 | 5.2722 | 4.4805 | 3.7979 | 3.0000 |
| CAR (1) |  | 1.26\% | 1.17\% | 0.98\% | 0.86\% | 1.68\% | 1.49\% | 1.19\% | 0.94\% | 1.73\% | 1.44\% | 1.02\% | 0.77\% | 1.52\% | 1.14\% | 0.83\% | 0.56\% |
|  |  | 5.3957 | 5.5023 | 5.2052 | 5.0722 | 5.3936 | 5.5964 | 4.9227 | 4.1927 | 5.3707 | 5.2561 | 4.2224 | 3.3613 | 4.6483 | 3.8874 | 3.1013 | 2.2515 |
| BHAR (0) |  | 0.85\% | 1.16\% | 0.78\% | 1.49\% | 1.44\% | 1.72\% | 0.95\% | 1.42\% | 1.74\% | 1.85\% | 1.56\% | 1.02\% | 1.72\% | 1.20\% | 0.92\% | 1.00\% |
|  |  | 3.0768 | 3.3950 | 2.2628 | 3.8869 | 4.0884 | 5.1215 | 3.1792 | 3.7521 | 4.3210 | 4.8297 | 4.6183 | 3.0485 | 4.7874 | 3.3062 | 2.7461 | 3.3122 |
| BHAR (1) |  | 1.16\% | 1.31\% | 0.61\% | 1.46\% | 1.70\% | 1.70\% | 0.95\% | 1.32\% | 1.79\% | 1.59\% | 1.33\% | 0.88\% | 1.60\% | 1.21\% | 0.48\% | 0.98\% |
|  |  | 4.3676 | 3.7322 | 1.7694 | 3.7143 | 4.9403 | 5.0691 | 3.2825 | 3.5369 | 4.6460 | 4.3596 | 3.9883 | 2.5355 | 4.7133 | 3.4315 | 1.5412 | 3.1191 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.34\% | 1.32\% | 1.12\% | 1.11\% | 1.87\% | 1.53\% | 1.42\% | 1.24\% | 1.80\% | 1.65\% | 1.41\% | 1.19\% | 1.95\% | 1.62\% | 1.33\% | 1.06\% |
|  |  | 5.3962 | 6.4377 | 6.7948 | 7.9464 | 7.0085 | 6.8658 | 7.7057 | 7.2642 | 6.9306 | 7.0827 | 6.5094 | 5.7281 | 7.2472 | 6.2482 | 5.4293 | 4.4073 |
| CAR (1) |  | 1.50\% | 1.27\% | 1.12\% | 1.05\% | 1.70\% | 1.42\% | 1.31\% | 1.10\% | 1.73\% | 1.49\% | 1.28\% | 1.01\% | 1.76\% | 1.44\% | 1.14\% | 0.90\% |
|  |  | 6.6516 | 6.7474 | 7.5270 | 8.0855 | 6.8528 | 6.8322 | 7.4283 | 6.5760 | 7.1990 | 6.5055 | 5.9385 | 4.8660 | 6.6156 | 5.5679 | 4.6473 | 3.7327 |
| BHAR (0) |  | 1.32\% | 1.47\% | 1.39\% | 1.08\% | 1.99\% | 1.76\% | 1.08\% | 1.35\% | 1.83\% | 1.57\% | 1.39\% | 1.15\% | 1.90\% | 1.72\% | 1.34\% | 1.01\% |
|  |  | 4.7737 | 5.3551 | 6.1606 | 3.9464 | 7.2805 | 8.1501 | 4.0484 | 6.1983 | 6.8108 | 5.6278 | 6.0232 | 4.7486 | 6.7712 | 6.6184 | 4.7769 | 4.0785 |
| BHAR (1) |  | 1.61\% | 1.46\% | 1.24\% | 1.04\% | 1.72\% | 1.57\% | 1.01\% | 1.12\% | 1.76\% | 1.39\% | 1.18\% | 0.87\% | 1.82\% | 1.43\% | 1.06\% | 0.79\% |
|  |  | 6.5079 | 5.7498 | 6.0713 | 3.8818 | 6.9042 | 8.3876 | 4.0635 | 5.3296 | 7.2089 | 5.2961 | 5.0851 | 3.6164 | 6.8360 | 5.6043 | 3.7145 | 3.3290 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.21\% | 0.30\% | 0.25\% | 0.19\% | 0.54\% | 0.49\% | 0.37\% | 0.19\% | 0.63\% | 0.52\% | 0.27\% | 0.06\% | 0.52\% | 0.30\% | 0.07\% | -0.12\% |
|  |  | 0.9257 | 1.5580 | 1.5031 | 1.2659 | 2.0435 | 2.0960 | 1.7812 | 0.9520 | 2.2587 | 1.9686 | 1.1059 | 0.2763 | 1.7582 | 1.0385 | 0.2678 | -0.4882 |
| CAR (1) |  | 0.36\% | 0.36\% | 0.30\% | 0.14\% | 0.62\% | 0.51\% | 0.32\% | 0.10\% | 0.69\% | 0.44\% | 0.19\% | -0.05\% | 0.40\% | 0.17\% | -0.06\% | -0.24\% |
|  |  | 1.6953 | 2.0421 | 1.9266 | 0.9770 | 2.5026 | 2.2799 | 1.5966 | 0.4954 | 2.5243 | 1.7286 | 0.7650 | -0.2415 | 1.3775 | 0.5934 | -0.2270 | -0.9875 |
| BHAR (0) |  | 0.21\% | 0.64\% | 0.32\% | 0.32\% | 0.47\% | 0.40\% | 0.21\% | 0.26\% | 0.67\% | 0.59\% | 0.38\% | 0.08\% | 0.57\% | $\mathbf{0 . 3 1 \%}$ | 0.15\% | -0.05\% |
|  |  | 0.8716 | 2.8520 | 1.2667 | 1.3064 | 1.5935 | 1.4071 | 0.6684 | 1.1406 | 2.2674 | 1.9615 | 1.5837 | 0.2912 | 1.8711 | 0.9831 | 0.4871 | -0.1787 |
| BHAR (1) |  | 0.50\% | 0.59\% | 0.34\% | 0.18\% | 0.59\% | 0.37\% | 0.10\% | -0.01\% | 0.71\% | 0.44\% | 0.14\% | -0.08\% | 0.31\% | 0.06\% | -0.06\% | -0.26\% |
|  |  | 2.3862 | 2.4958 | 1.4705 | 0.6504 | 2.2967 | 1.4857 | 0.3194 | -0.0414 | 2.5367 | 1.4622 | 0.5337 | -0.2733 | 1.0042 | 0.2006 | -0.2172 | -0.8963 |

Panel B. The time-series momentum using market-weighted return


| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 36 |  | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.29\% | 1.29\% | 1.15\% | 1.04\% | 1.70\% | 1.49\% | 1.47\% | 1.25\% | 1.65\% | 1.68\% | 1.42\% | 1.29\% | 1.52\% | 1.54\% | 1.41\% | 1.35\% |
|  |  | 3.1144 | 3.7580 | 4.0028 | 4.1703 | 3.7922 | 3.4927 | 3.7297 | 3.4584 | 2.9751 | 3.4580 | 3.2190 | 2.9982 | 2.7867 | 3.1233 | 2.9198 | 2.9044 |
| CAR (1) |  | 1.36\% | 1.17\% | 1.13\% | 0.95\% | 1.44\% | 1.51\% | 1.33\% | 1.11\% | 1.79\% | 1.72\% | 1.39\% | 1.25\% | 1.60\% | 1.56\% | 1.39\% | 1.36\% |
|  |  | 3.3940 | 3.5606 | 4.0988 | 3.8725 | 2.8490 | 3.3617 | 3.3116 | 2.9677 | 3.2629 | 3.6083 | 3.1140 | 2.9090 | 2.9436 | 3.1139 | 2.8770 | 2.8994 |
| BHAR (0) |  | 0.71\% | 0.91\% | 0.17\% | 0.93\% | 1.75\% | 1.03\% | 0.95\% | 1.46\% | 1.69\% | 1.44\% | 1.28\% | 0.94\% | 1.21\% | 1.24\% | 0.54\% | 1.18\% |
|  |  | 1.5367 | 1.6621 | 0.3373 | 1.3969 | 3.5842 | 2.0365 | 2.0419 | 3.3291 | 2.9872 | 2.2844 | 2.5544 | 1.8658 | 1.9330 | 2.1307 | 0.8602 | 1.8981 |
| BHAR (1) |  | 1.10\% | 1.06\% | 0.35\% | 1.06\% | 1.55\% | 1.42\% | 0.80\% | 1.25\% | 1.92\% | 1.88\% | 1.37\% | 0.95\% | 1.40\% | 1.72\% | $\mathbf{0 . 8 2 \%}$ | 1.47\% |
|  |  | 2.2419 | 1.9425 | 0.6073 | 1.6877 | 2.8475 | 2.8502 | 1.5738 | 2.9964 | 2.8732 | 3.1593 | 2.8544 | 1.8270 | 2.3545 | 3.2887 | 1.4689 | 2.5621 |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.94\% | 0.96\% | 1.29\% | 1.17\% | 1.55\% | 1.84\% | 1.94\% | 1.74\% | 1.74\% | 1.95\% | 1.79\% | 1.53\% | 2.12\% | 1.86\% | 1.63\% | 1.43\% |
|  |  | 1.5458 | 2.0768 | 2.8142 | 2.7912 | 2.5730 | 3.3336 | 3.6275 | 3.2312 | 2.5813 | 2.9628 | 2.7277 | 2.4412 | 2.8731 | 2.5144 | 2.2728 | 2.0842 |
| CAR (1) |  | 0.84\% | 1.27\% | 1.39\% | 1.25\% | 1.85\% | 2.12\% | 1.95\% | 1.78\% | 1.90\% | 1.90\% | 1.66\% | 1.44\% | 1.91\% | 1.73\% | 1.50\% | 1.38\% |
|  |  | 1.3508 | 2.5724 | 3.1213 | 2.8993 | 3.0338 | 3.8669 | 3.5484 | 3.2912 | 2.7096 | 2.7230 | 2.4858 | 2.2743 | 2.4163 | 2.2623 | 2.0489 | 2.0189 |
| BHAR (0) |  | 0.56\% | 0.19\% | 1.74\% | 1.73\% | 1.09\% | 1.87\% | 1.42\% | 1.43\% | 1.67\% | 1.41\% | 1.05\% | 0.26\% | 1.81\% | 2.85\% | 1.88\% | 2.32\% |
|  |  | 0.7156 | 0.2635 | 2.2140 | 1.9467 | 1.2633 | 2.2264 | 1.7411 | 1.7043 | 2.1239 | 1.5876 | 1.2466 | 0.2905 | 2.0413 | 3.4246 | 2.1699 | 2.9980 |
| BHAR (1) |  | 0.92\% | 0.71\% | 1.95\% | 1.92\% | 1.27\% | 1.93\% | 1.35\% | 1.26\% | 1.45\% | 1.68\% | 0.81\% | 0.35\% | 2.03\% | 2.53\% | 1.95\% | 2.44\% |
|  |  | 1.1991 | 0.9196 | 2.4777 | 2.1659 | 1.5311 | 2.2776 | 1.6805 | 1.5564 | 1.7819 | 1.9760 | 0.9924 | 0.3814 | 2.3896 | 3.0064 | 2.3134 | 3.3750 |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.42\% | 0.16\% | 0.16\% | 0.26\% | -0.09\% | 0.21\% | 0.35\% | 0.36\% | -0.01\% | 0.25\% | 0.31\% | 0.29\% | -0.05\% | 0.30\% | 0.34\% | 0.28\% |
|  |  | -0.9460 | 0.4983 | 0.5909 | 1.0518 | -0.1869 | 0.5488 | 1.0288 | 1.1452 | -0.0267 | 0.7132 | 0.8942 | 0.9230 | -0.1032 | 0.7170 | 0.8786 | 0.7658 |
| CAR (1) |  | 0.27\% | 0.37\% | 0.35\% | 0.33\% | 0.37\% | 0.42\% | 0.49\% | $\mathbf{0 . 4 2 \%}$ | 0.51\% | 0.44\% | 0.46\% | 0.35\% | 0.23\% | 0.42\% | 0.37\% | 0.29\% |
|  |  | 0.7133 | 1.3097 | 1.3647 | 1.4171 | 0.8897 | 1.1271 | 1.4375 | 1.3542 | 1.3642 | 1.2517 | 1.3311 | 1.1050 | 0.5210 | 1.0162 | 0.9685 | 0.8311 |
| BHAR (0) |  | -0.53\% | 0.08\% | 0.28\% | 0.09\% | 0.04\% | 0.10\% | -0.37\% | 0.25\% | 0.04\% | 0.11\% | 0.28\% | 0.85\% | -0.25\% | 0.37\% | 0.49\% | 0.18\% |
|  |  | -1.0111 | 0.1489 | 0.5260 | 0.1494 | 0.0692 | 0.1868 | -0.6638 | 0.4702 | 0.0939 | 0.2299 | 0.7535 | 1.9978 | -0.5007 | 0.7562 | 1.1591 | 0.4314 |
| BHAR (1) |  | 0.22\% | 0.24\% | 0.22\% | $\mathbf{0 . 5 9 \%}$ | 0.26\% | 0.18\% | -0.42\% | 0.17\% | 0.60\% | 0.20\% | 0.59\% | 0.64\% | -0.05\% | 0.20\% | 0.46\% | 0.10\% |
|  |  | 0.4349 | 0.4700 | 0.4532 | 0.9670 | 0.4996 | 0.3686 | -0.7299 | 0.3111 | 1.3803 | 0.3883 | 1.4687 | 1.3228 | -0.0916 | 0.3987 | 1.0546 | 0.2241 |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.45\% | 1.46\% | 1.47\% | 1.25\% | 1.53\% | 1.57\% | 1.48\% | 1.08\% | 1.61\% | 1.70\% | 1.22\% | 1.03\% | 1.64\% | 1.41\% | 1.24\% | 0.99\% |
|  |  | 3.2269 | 4.0987 | 4.7257 | 4.2750 | 2.9011 | 3.4794 | 3.5139 | 2.6709 | 2.8864 | 3.3514 | 2.4243 | 2.1080 | 2.7480 | 2.2771 | 2.0333 | 1.6867 |
| CAR (1) |  | 1.40\% | 1.59\% | 1.43\% | 1.15\% | 1.47\% | 1.61\% | 1.31\% | 0.99\% | 1.78\% | 1.62\% | 1.07\% | 0.91\% | 1.49\% | 1.33\% | 1.03\% | 0.80\% |
|  |  | 3.1934 | 4.6694 | 4.7329 | 3.9982 | 2.9776 | 3.7840 | 3.1455 | 2.5015 | 3.2679 | 3.1162 | 2.1133 | 1.8864 | 2.2465 | 2.0380 | 1.6372 | 1.3664 |
| BHAR (0) |  | 1.34\% | 1.52\% | 1.77\% | 0.63\% | 1.47\% | 1.68\% | 1.59\% | 1.43\% | 1.65\% | 1.74\% | 0.39\% | 1.46\% | 1.19\% | 1.09\% | 1.75\% | 0.52\% |
|  |  | 2.5493 | 2.8238 | 3.2201 | 1.1690 | 2.5010 | 2.8985 | 2.5195 | 2.7486 | 2.4780 | 2.6462 | 0.5824 | 2.4721 | 1.8748 | 1.5669 | 2.6599 | 0.8255 |
| BHAR (1) |  | 1.60\% | 1.61\% | 1.45\% | 0.68\% | 1.31\% | 1.64\% | 1.30\% | 1.10\% | 1.64\% | 1.59\% | 0.38\% | 1.30\% | 1.35\% | 0.97\% | 1.39\% | 0.38\% |
|  |  | 3.0700 | 3.0408 | 2.5480 | 1.2617 | 2.3533 | 2.9047 | 2.1133 | 2.0913 | 2.5072 | 2.4459 | 0.5406 | 2.1333 | 2.0680 | 1.3944 | 2.0357 | 0.5917 |


| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| H $=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.44\% | 0.05\% | -0.12\% | -0.13\% | 0.19\% | -0.02\% | 0.08\% | 0.04\% | -0.06\% | 0.01\% | 0.08\% | 0.11\% | 0.00\% | 0.12\% | 0.08\% | -0.05\% |
|  |  | 0.7194 | 0.0900 | -0.2534 | -0.3031 | 0.2592 | -0.0302 | 0.1338 | 0.0616 | -0.0755 | 0.0084 | 0.1157 | 0.1671 | -0.0048 | 0.1482 | 0.1097 | -0.0646 |
| CAR (1) |  | 0.26\% | 0.12\% | -0.05\% | -0.12\% | 0.22\% | -0.04\% | 0.18\% | -0.06\% | -0.20\% | 0.12\% | 0.09\% | 0.13\% | 0.25\% | 0.23\% | 0.05\% | 0.01\% |
|  |  | 0.3744 | 0.2327 | -0.1096 | -0.2640 | 0.3153 | -0.0622 | 0.3087 | -0.1016 | -0.2563 | 0.1672 | 0.1351 | 0.1838 | 0.3164 | 0.2716 | 0.0666 | 0.0154 |
| BHAR (0) |  | 0.53\% | 1.14\% | 0.93\% | 1.32\% | 0.47\% | 0.93\% | 0.21\% | 0.26\% | 0.57\% | 0.83\% | -0.35\% | 1.56\% | -0.11\% | -0.50\% | 0.57\% | -0.08\% |
|  |  | 0.6891 | 1.5257 | 1.0759 | 1.8133 | 0.6137 | 1.1149 | 0.2471 | 0.3110 | 0.6206 | 0.9736 | -0.3004 | 2.1323 | -0.1289 | -0.4599 | 0.6689 | -0.0837 |
| BHAR (1) |  | 0.89\% | 1.80\% | 1.16\% | 1.71\% | 1.22\% | 0.83\% | 0.72\% | -0.18\% | 0.76\% | 1.49\% | -0.15\% | 1.58\% | 0.80\% | -0.19\% | 0.78\% | -0.11\% |
|  |  | 1.0586 | 2.1901 | 1.2832 | 2.1623 | 1.4927 | 1.0096 | 0.7294 | -0.2054 | 0.8115 | 1.7894 | -0.1282 | 2.0832 | 0.8403 | -0.1866 | 0.9429 | -0.1167 |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.45\% | 1.37\% | 1.06\% | 0.94\% | 1.81\% | 1.43\% | 1.15\% | 0.87\% | 1.82\% | 1.44\% | 1.05\% | 0.81\% | 1.77\% | 1.21\% | 0.85\% | 0.67\% |
|  |  | 3.1686 | 3.6593 | 3.0577 | 3.0242 | 3.1644 | 2.5492 | 2.4234 | 2.0702 | 3.0663 | 2.6413 | 2.2702 | 1.9017 | 3.0453 | 2.3734 | 1.7946 | 1.6003 |
| CAR (1) |  | 1.53\% | 1.36\% | 1.08\% | 0.86\% | 1.78\% | 1.40\% | 0.96\% | 0.75\% | 1.97\% | 1.18\% | 0.93\% | 0.70\% | 1.33\% | 0.95\% | 0.68\% | 0.55\% |
|  |  | 3.6610 | 3.8024 | 3.3670 | 2.9235 | 2.9562 | 2.4706 | 2.1042 | 1.8533 | 3.3470 | 2.2554 | 2.1117 | 1.7276 | 2.3080 | 1.9483 | 1.4756 | 1.3508 |
| BHAR (0) |  | 0.87\% | 1.32\% | 0.35\% | 0.60\% | 2.21\% | 1.32\% | 1.00\% | 0.21\% | 1.48\% | 1.31\% | 1.35\% | 1.00\% | 1.44\% | 1.45\% | 1.03\% | 1.02\% |
|  |  | 1.4533 | 2.2214 | 0.4920 | 1.3641 | 3.5306 | 1.9461 | 1.4369 | 0.3362 | 1.8524 | 1.5776 | 2.1003 | 1.1145 | 2.1015 | 2.6918 | 1.6654 | 1.8920 |
| BHAR (1) |  | 0.95\% | 1.19\% | 0.17\% | $\mathbf{0 . 6 2 \%}$ | 1.38\% | 0.90\% | 0.91\% | -0.24\% | 1.33\% | 0.78\% | 1.18\% | 1.14\% | 0.83\% | 0.66\% | 0.28\% | 0.51\% |
|  |  | 1.7073 | 2.3613 | 0.2681 | 1.4805 | 2.0474 | 1.3156 | 1.3434 | -0.3774 | 1.7989 | 0.9261 | 1.9046 | 1.3744 | 1.4480 | 1.4074 | 0.5244 | 0.9618 |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.27\% | 1.12\% | 0.62\% | 0.60\% | 1.44\% | 1.35\% | 1.24\% | 1.15\% | 1.49\% | 1.28\% | 1.30\% | 1.29\% | 1.51\% | 1.15\% | 1.11\% | 0.98\% |
|  |  | 1.6266 | 1.7226 | 1.1302 | 1.2908 | 1.6662 | 1.8962 | 2.0073 | 2.0472 | 1.6198 | 1.6277 | 1.7437 | 1.8532 | 1.5957 | 1.4350 | 1.4835 | 1.4709 |
| CAR (1) |  | 1.34\% | 0.76\% | 0.53\% | 0.62\% | 1.47\% | 1.13\% | 1.18\% | 1.05\% | 1.03\% | 1.18\% | 1.23\% | 1.23\% | 1.56\% | 1.21\% | 1.21\% | 0.91\% |
|  |  | 1.8112 | 1.2745 | 1.0668 | 1.4219 | 1.9187 | 1.7203 | 2.0681 | 1.9495 | 1.2326 | 1.5484 | 1.6690 | 1.8254 | 1.8264 | 1.5237 | 1.6879 | 1.4536 |
| BHAR (0) |  | 1.43\% | -0.75\% | -0.65\% | -0.35\% | 1.02\% | 2.22\% | -0.80\% | 3.52\% | 1.22\% | 1.15\% | 2.09\% | 1.38\% | 1.91\% | 1.25\% | 1.75\% | 0.97\% |
|  |  | 1.5570 | -0.7137 | -0.6378 | -0.3208 | 0.9585 | 2.2105 | -0.8433 | 3.3624 | 1.1568 | 1.0524 | 2.0711 | 1.3139 | 1.9383 | 1.4720 | 1.7786 | 1.0635 |
| BHAR (1) |  | 0.65\% | -0.94\% | -1.38\% | -0.01\% | 1.44\% | 2.03\% | 0.24\% | 2.97\% | 0.71\% | 1.17\% | 1.91\% | 0.74\% | 1.64\% | 0.78\% | 1.68\% | 1.06\% |
|  |  | 0.7565 | -0.8941 | -1.3013 | -0.0113 | 1.6013 | 2.0762 | 0.2704 | 3.0723 | 0.7201 | 1.1238 | 1.9207 | 0.7612 | 1.9122 | 0.9807 | 1.6434 | 1.1642 |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.37\% | 0.41\% | 0.36\% | 0.29\% | 1.13\% | 1.05\% | 0.94\% | 0.76\% | 1.54\% | 1.28\% | 1.20\% | 0.88\% | 1.45\% | 1.41\% | 1.12\% | 0.72\% |
|  |  | 0.7608 | 0.9841 | 1.0460 | 0.9420 | 1.8954 | 2.1879 | 2.2492 | 1.8797 | 2.5469 | 2.2999 | 2.4158 | 1.8827 | 1.8984 | 2.0768 | 1.8587 | 1.3115 |
| CAR (1) |  | 0.28\% | 0.46\% | 0.43\% | 0.28\% | 1.24\% | 1.20\% | 0.91\% | 0.66\% | 1.42\% | 1.25\% | 1.09\% | 0.75\% | 1.65\% | 1.43\% | 1.00\% | 0.65\% |
|  |  | 0.5387 | 1.0824 | 1.2850 | 0.9133 | 2.1268 | 2.7192 | 2.1697 | 1.6334 | 2.3654 | 2.2671 | 2.2259 | 1.6384 | 2.1284 | 2.1775 | 1.6984 | 1.2333 |
| BHAR (0) |  | 0.10\% | -0.18\% | 0.38\% | 0.09\% | 1.68\% | 1.46\% | 0.68\% | 1.00\% | 2.00\% | 1.82\% | 1.23\% | 2.02\% | 1.55\% | 1.84\% | 1.27\% | 1.91\% |
|  |  | 0.1772 | -0.3316 | 0.5582 | 0.1775 | 2.5165 | 2.3728 | 1.2967 | 1.6291 | 3.4744 | 2.9989 | 1.8047 | 3.0968 | 1.9062 | 2.4052 | 1.7967 | 2.2219 |
| BHAR (1) |  | -0.35\% | -0.07\% | 0.84\% | 0.27\% | 1.21\% | 1.69\% | 0.52\% | 1.07\% | 1.80\% | 1.68\% | 1.18\% | 1.83\% | 2.17\% | 2.04\% | 1.16\% | 2.21\% |
|  |  | -0.5128 | -0.1260 | 1.2739 | 0.4925 | 1.7010 | 2.7860 | 0.9266 | 1.7667 | 2.6297 | 2.5310 | 1.7003 | 2.9344 | 2.4164 | 2.7282 | 1.6888 | 2.5816 |


| MW $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\overline{\mathrm{H}=}$ |  | 6 | 9 | 12 | 6 |  | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.55\% | 0.89\% | 0.86\% | 0.91\% | 1.45\% | 1.44\% | 1.17\% | 1.05\% | 1.42\% | 1.71\% | 1.59\% | 1.41\% | 1.92\% | 2.04\% | 1.74\% | 1.54\% |
|  | 1.2350 | 2.4420 | 2.8305 | 3.4159 | 2.8405 | 3.3859 | 3.0155 | 2.9912 | 3.2103 | 4.3463 | 4.0457 | 3.7821 | 3.7631 | 4.4045 | 3.9693 | 3.7651 |
| CAR (1) | 0.98\% | 1.08\% | 1.02\% | 0.94\% | 1.56\% | 1.43\% | 1.24\% | 0.97\% | 1.82\% | 1.87\% | 1.56\% | 1.35\% | 1.81\% | 1.94\% | 1.61\% | 1.36\% |
|  | 2.2702 | 2.9795 | 3.3820 | 3.4433 | 3.3425 | 3.3464 | 3.2878 | 2.7229 | 4.1170 | 4.4624 | 3.9150 | 3.5584 | 3.7866 | 4.0962 | 3.7526 | 3.3623 |
| BHAR (0) | 0.64\% | -0.05\% | 0.95\% | 0.45\% | 1.58\% | 1.10\% | 0.73\% | 0.45\% | 1.35\% | 0.93\% | 1.43\% | 0.85\% | 2.14\% | 2.26\% | 1.42\% | 2.01\% |
|  | 1.0214 | -0.0770 | 1.5966 | 0.8388 | 2.8734 | 1.8369 | 1.2637 | 0.8060 | 2.3458 | 1.6139 | 2.4326 | 1.5660 | 3.3429 | 3.6685 | 2.6569 | 3.1488 |
| BHAR (1) | 0.86\% | 0.23\% | 1.59\% | 0.95\% | 1.18\% | 0.89\% | 0.75\% | 0.25\% | 1.46\% | 1.34\% | 1.20\% | 1.09\% | 1.78\% | 2.04\% | 1.34\% | 1.88\% |
|  | 1.3623 | 0.3899 | 2.6457 | 1.8684 | 2.0411 | 1.4249 | 1.3041 | 0.4842 | 2.5633 | 2.2112 | 2.0311 | 2.0345 | 3.0235 | 3.4769 | 2.4614 | 2.9934 |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.35\% | 0.21\% | 0.25\% | 0.31\% | 0.45\% | 0.41\% | 0.49\% | 0.43\% | 0.34\% | 0.49\% | 0.44\% | 0.39\% | 0.47\% | 0.48\% | 0.45\% | 0.35\% |
|  | 1.0526 | 0.6939 | 0.9182 | 1.3291 | 1.0833 | 1.0486 | 1.4323 | 1.4424 | 0.7613 | 1.2093 | 1.1893 | 1.1416 | 1.0873 | 1.2013 | 1.1892 | 0.9967 |
| CAR (1) | 0.35\% | 0.24\% | 0.33\% | 0.29\% | 0.62\% | 0.55\% | 0.56\% | 0.43\% | 0.51\% | 0.52\% | 0.47\% | 0.35\% | 0.46\% | 0.46\% | 0.43\% | 0.30\% |
|  | 1.0737 | 0.7879 | 1.2371 | 1.2671 | 1.5529 | 1.4726 | 1.7372 | 1.4922 | 1.1961 | 1.3428 | 1.3149 | 1.1092 | 1.0767 | 1.1862 | 1.1882 | 0.8834 |
| BHAR (0) | 0.48\% | 0.50\% | 0.48\% | 1.09\% | 0.49\% | 0.64\% | 0.43\% | 0.81\% | 0.60\% | 0.77\% | 0.40\% | 0.59\% | 0.70\% | 0.71\% | 0.39\% | 0.42\% |
|  | 1.1232 | 1.2953 | 1.1795 | 2.9597 | 1.1218 | 1.3509 | 0.9540 | 2.0959 | 1.3036 | 1.8266 | 1.0053 | 1.4427 | 1.5189 | 1.5727 | 0.9136 | 1.1297 |
| BHAR (1) | 0.58\% | 0.24\% | 0.21\% | 1.07\% | 0.59\% | 0.79\% | 0.42\% | 0.68\% | 0.41\% | 0.58\% | 0.30\% | 0.35\% | 0.55\% | 0.56\% | 0.15\% | 0.31\% |
|  | 1.4413 | 0.5752 | 0.5005 | 3.0399 | 1.4644 | 1.8541 | 0.9722 | 1.8075 | 0.9633 | 1.4257 | 0.8112 | 0.9298 | 1.2325 | 1.3251 | 0.3572 | 0.7988 |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.58\% | 1.21\% | 1.03\% | 0.87\% | 0.87\% | 0.94\% | 0.86\% | 0.75\% | 1.29\% | 1.02\% | 0.98\% | 0.79\% | 1.35\% | 1.23\% | 1.01\% | 0.74\% |
|  | 3.7290 | 3.4583 | 3.3515 | 3.2625 | 1.8410 | 2.2828 | 2.2733 | 2.0107 | 2.7509 | 2.4378 | 2.4158 | 1.8809 | 2.6207 | 2.6997 | 2.2766 | 1.7519 |
| CAR (1) | 1.34\% | 1.06\% | 0.93\% | 0.81\% | 0.79\% | 1.00\% | 0.72\% | 0.60\% | 1.31\% | 0.96\% | 0.91\% | 0.69\% | 1.01\% | 1.05\% | 0.71\% | 0.58\% |
|  | 3.0088 | 2.9823 | 3.1212 | 2.9785 | 1.6528 | 2.2569 | 1.7918 | 1.4956 | 2.6606 | 2.1762 | 2.0510 | 1.5956 | 1.9973 | 2.2319 | 1.5468 | 1.3760 |
| BHAR (0) | 1.50\% | 0.77\% | 0.34\% | 1.37\% | 0.74\% | 0.71\% | 0.88\% | 2.12\% | 1.05\% | 1.56\% | 0.55\% | 1.29\% | 1.31\% | 1.47\% | 0.68\% | 0.29\% |
|  | 2.6682 | 1.4972 | 0.5049 | 2.2189 | 1.4011 | 1.2303 | 1.2361 | 4.0739 | 1.9481 | 2.8778 | 1.2584 | 2.5905 | 2.5771 | 2.7316 | 1.2037 | 0.5060 |
| BHAR (1) | 1.27\% | 0.51\% | 0.16\% | 1.75\% | 0.64\% | 0.66\% | 0.83\% | 1.75\% | 1.52\% | 1.49\% | 0.76\% | 1.15\% | 0.90\% | 0.95\% | 0.54\% | -0.25\% |
|  | 2.3240 | 0.9697 | 0.2380 | 2.5570 | 1.1253 | 1.1184 | 1.1318 | 3.3450 | 2.8517 | 2.7825 | 1.5235 | 2.0984 | 1.7040 | 1.7130 | 0.9324 | -0.4151 |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\overline{\mathrm{CAR}}$ (0) | 2.09\% | 1.56\% | 1.13\% | 0.93\% | 2.42\% | 1.68\% | 1.40\% | 1.15\% | 1.95\% | 1.85\% | 1.49\% | 1.28\% | 2.33\% | 1.72\% | 1.46\% | 1.24\% |
|  | 2.9977 | 3.4405 | 3.1544 | 3.1438 | 2.8085 | 2.6481 | 2.9908 | 3.0313 | 2.1676 | 2.9509 | 3.1785 | 3.1513 | 3.1623 | 3.2963 | 3.4436 | 3.2444 |
| CAR (1) | 1.64\% | 1.14\% | 0.96\% | 0.68\% | 1.91\% | 1.29\% | 1.15\% | 0.90\% | 1.76\% | 1.61\% | 1.31\% | 1.14\% | 1.91\% | 1.42\% | 1.28\% | 1.05\% |
|  | 2.9849 | 3.0169 | 3.1536 | 2.6208 | 2.5047 | 2.3871 | 2.8237 | 2.6595 | 2.3361 | 3.0977 | 3.2141 | 3.1392 | 3.0954 | 3.0862 | 3.2386 | 2.9326 |
| BHAR (0) | 2.03\% | 1.07\% | 1.10\% | -0.07\% | 1.95\% | 1.32\% | 0.71\% | 0.90\% | 1.51\% | 0.44\% | 1.42\% | 0.40\% | 2.84\% | 2.84\% | 1.97\% | 1.22\% |
|  | 2.9613 | 1.3118 | 1.4531 | -0.0933 | 2.4979 | 1.8434 | 1.1608 | 1.2661 | 1.7954 | 0.7810 | 3.0202 | 0.8153 | 3.4157 | 3.6648 | 2.5605 | 2.4344 |
| BHAR (1) | 1.46\% | 0.30\% | 0.46\% | -0.20\% | 1.26\% | 0.41\% | 0.49\% | 0.25\% | 1.27\% | 0.61\% | 1.35\% | 0.40\% | 2.39\% | 1.93\% | 1.57\% | 1.00\% |
|  | 2.3379 | 0.3749 | 0.7758 | -0.2702 | 1.8691 | 0.6936 | 0.8122 | 0.4384 | 1.8183 | 1.0457 | 2.6676 | 0.7729 | 3.5625 | 3.1075 | 2.5371 | 1.9400 |



| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| H |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.02\% | 1.21\% | 1.04\% | 0.97\% | 1.86\% | 1.72\% | 1.57\% | 1.39\% | 1.97\% | 1.79\% | 1.51\% | 1.16\% | 1.77\% | 1.59\% | 1.36\% | 1.13\% |
|  |  | 1.7772 | 2.7066 | 2.4948 | 2.5389 | 3.1317 | 3.0041 | 2.9476 | 2.7589 | 3.0263 | 2.8453 | 2.5290 | 2.0002 | 2.5125 | 2.3940 | 2.0452 | 1.7267 |
| CAR (1) |  | 1.16\% | 1.20\% | 1.10\% | 0.90\% | 2.13\% | 1.87\% | 1.63\% | 1.37\% | 2.01\% | 1.53\% | 1.24\% | 1.00\% | 1.72\% | 1.55\% | 1.23\% | 1.08\% |
|  |  | 2.1351 | 2.7760 | 2.7671 | 2.3592 | 3.3759 | 3.2358 | 2.9952 | 2.6886 | 2.9512 | 2.4326 | 2.0813 | 1.7374 | 2.4887 | 2.2677 | 1.8260 | 1.6563 |
| BHAR (0) |  | 0.68\% | 0.64\% | 0.49\% | 0.33\% | 1.58\% | 1.36\% | 1.18\% | 1.12\% | 1.71\% | 1.45\% | 1.23\% | 0.32\% | 1.14\% | 1.17\% | 1.31\% | 1.93\% |
|  |  | 0.7513 | 0.6691 | 0.5237 | 0.3426 | 2.3474 | 1.9531 | 1.3237 | 1.5731 | 2.4806 | 1.8589 | 1.9142 | 0.4164 | 1.4825 | 1.4699 | 1.7630 | 2.3846 |
| BHAR (1) |  | 0.85\% | 1.15\% | 0.88\% | 0.33\% | 1.95\% | 1.62\% | 1.07\% | 1.04\% | 1.47\% | 1.15\% | 1.28\% | 0.34\% | 1.67\% | 1.30\% | 1.38\% | 2.43\% |
|  |  | 1.0473 | 1.3514 | 1.0109 | 0.3428 | 2.6023 | 2.1981 | 1.1914 | 1.3769 | 1.9061 | 1.5333 | 1.9696 | 0.4456 | 2.0747 | 1.4596 | 1.7304 | 2.7677 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.30\% | 0.61\% | 0.55\% | 0.58\% | 0.81\% | 0.88\% | 0.77\% | 0.65\% | 0.98\% | 0.98\% | 0.70\% | 0.53\% | 1.31\% | 1.06\% | 0.86\% | 0.61\% |
|  |  | 1.1285 | 2.6453 | 2.5794 | 3.0069 | 2.5183 | 2.9107 | 3.0136 | 2.6016 | 2.6516 | 2.9929 | 2.3315 | 1.8415 | 3.3409 | 2.8212 | 2.4615 | 1.8685 |
| CAR (1) |  | 0.79\% | 0.73\% | 0.72\% | 0.58\% | 1.04\% | 0.96\% | 0.72\% | 0.58\% | 1.10\% | 0.86\% | 0.58\% | 0.42\% | 1.28\% | 0.95\% | 0.74\% | 0.46\% |
|  |  | 2.7850 | 3.0731 | 3.2311 | 2.9338 | 2.8181 | 3.1318 | 2.7368 | 2.3244 | 2.8139 | 2.6151 | 1.9627 | 1.4731 | 3.0821 | 2.5504 | 2.1132 | 1.4442 |
| BHAR (0) |  | 0.05\% | 0.70\% | 0.24\% | 1.18\% | 0.59\% | 1.09\% | 0.09\% | 0.78\% | 0.84\% | 1.19\% | 0.60\% | 0.82\% | 1.59\% | 1.25\% | 0.72\% | 1.01\% |
|  |  | 0.1500 | 1.8823 | 0.6459 | 2.9031 | 1.6096 | 2.9768 | 0.2383 | 1.6679 | 1.8922 | 2.5907 | 1.2351 | 1.8225 | 3.7341 | 2.6867 | 1.6074 | 2.2825 |
| BHAR (1) |  | 0.47\% | 1.09\% | 0.33\% | 1.21\% | 1.05\% | 1.11\% | -0.05\% | 0.69\% | 0.87\% | 1.15\% | 0.26\% | 0.65\% | 1.59\% | 1.36\% | 0.39\% | 0.93\% |
|  |  | 1.4073 | 2.5770 | 0.9009 | 2.9241 | 2.9650 | 3.0672 | -0.1337 | 1.4480 | 1.9549 | 2.4738 | 0.5504 | 1.3545 | 3.5307 | 3.1188 | 0.9507 | 2.1542 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.33\% | 0.70\% | 0.72\% | 0.92\% | 0.80\% | 0.86\% | 1.20\% | 1.07\% | 0.83\% | 1.36\% | 1.33\% | 1.12\% | 0.99\% | 1.27\% | 1.18\% | 0.97\% |
|  |  | 0.9191 | 2.2267 | 2.5595 | 3.7703 | 1.8992 | 2.2429 | 3.6596 | 3.4978 | 1.8682 | 3.4155 | 3.6230 | 3.1591 | 2.2441 | 2.9632 | 2.8839 | 2.4672 |
| CAR (1) |  | 0.70\% | 0.81\% | 0.93\% | 0.96\% | 1.01\% | 1.17\% | 1.34\% | 1.07\% | 1.33\% | 1.52\% | 1.41\% | 1.05\% | 1.14\% | 1.33\% | 1.14\% | 0.90\% |
|  |  | 2.0557 | 2.6219 | 3.4463 | 4.1518 | 2.4832 | 3.1680 | 4.1939 | 3.5658 | 3.3088 | 3.9330 | 3.8487 | 2.9860 | 2.6096 | 3.0952 | 2.8335 | 2.3168 |
| BHAR (0) |  | 0.31\% | 1.08\% | 0.56\% | 0.88\% | 0.97\% | 0.86\% | 1.16\% | 1.19\% | 1.09\% | 1.77\% | 1.68\% | 1.38\% | 0.96\% | 0.99\% | 1.05\% | 0.67\% |
|  |  | 0.6629 | 2.2638 | 1.2624 | 1.9097 | 2.0845 | 1.8841 | 2.4335 | 2.7611 | 2.2741 | 3.7291 | 3.5979 | 2.8979 | 2.0279 | 2.0684 | 2.1821 | 1.4510 |
| BHAR (1) |  | 0.91\% | 1.10\% | 0.58\% | 1.07\% | 1.15\% | 1.11\% | 1.03\% | 0.95\% | 1.57\% | 2.08\% | 1.56\% | 1.14\% | 1.56\% | 0.96\% | 1.02\% | 0.41\% |
|  |  | 2.0496 | 2.2712 | 1.3797 | 2.4349 | 2.6484 | 2.5877 | 2.2954 | 2.1477 | 3.6635 | 4.8009 | 3.4634 | 2.7223 | 3.1765 | 1.9578 | 2.0228 | 0.8722 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.13\% | 0.37\% | 0.39\% | 0.42\% | 0.53\% | 0.70\% | 0.67\% | 0.57\% | 0.56\% | 0.71\% | 0.56\% | 0.45\% | 0.61\% | 0.62\% | 0.49\% | 0.38\% |
|  |  | 0.4455 | 1.4883 | 1.7783 | 1.9793 | 1.5353 | 2.2448 | 2.2580 | 2.0540 | 1.5462 | 2.0173 | 1.6861 | 1.4030 | 1.5523 | 1.6505 | 1.3419 | 1.0868 |
| CAR (1) |  | 0.48\% | 0.50\% | 0.51\% | 0.42\% | 0.86\% | 0.82\% | 0.72\% | 0.56\% | 0.87\% | 0.78\% | 0.60\% | 0.41\% | 0.67\% | 0.64\% | 0.48\% | 0.34\% |
|  |  | 1.6632 | 2.1045 | 2.2704 | 2.0221 | 2.5437 | 2.5975 | 2.4587 | 1.9823 | 2.3207 | 2.2089 | 1.7861 | 1.2884 | 1.7257 | 1.7107 | 1.3155 | 0.9878 |
| BHAR (0) |  | 0.02\% | 0.89\% | -0.03\% | 0.48\% | 0.40\% | 0.31\% | 0.53\% | 0.42\% | 0.62\% | 0.76\% | 0.62\% | 0.46\% | 0.57\% | 0.49\% | 0.60\% | 0.57\% |
|  |  | 0.0551 | 2.5458 | -0.0809 | 1.4324 | 1.0671 | 0.8493 | 1.2722 | 1.3837 | 1.6439 | 2.0154 | 1.8094 | 1.3128 | 1.3374 | 1.1610 | 1.5808 | 1.2653 |
| BHAR (1) |  | 0.44\% | 0.62\% | 0.00\% | 0.34\% | 0.67\% | 0.44\% | 0.45\% | 0.25\% | 0.87\% | 0.76\% | 0.54\% | 0.37\% | 0.42\% | 0.27\% | 0.46\% | 0.32\% |
|  |  | 1.4177 | 1.5852 | -0.0017 | 0.9039 | 1.8255 | 1.2499 | 1.0123 | 0.7997 | 2.2452 | 1.7876 | 1.4638 | 0.9655 | 0.9269 | 0.6029 | 1.1862 | 0.6971 |

Panel C. The time-series momentum using inversed-volatility weighted return



| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.54\% | 0.47\% | 0.18\% | 0.04\% | 0.84\% | 0.61\% | 0.37\% | 0.09\% | 0.77\% | 0.46\% | 0.14\% | -0.05\% | 0.49\% | 0.04\% | -0.28\% | -0.43\% |
|  |  | 0.9663 | 1.0944 | 0.4917 | 0.1304 | 1.1402 | 0.9676 | 0.7249 | 0.2001 | 0.9802 | 0.6805 | 0.2307 | -0.0991 | 0.6284 | 0.0484 | -0.4385 | -0.7263 |
| CAR (1) |  | 0.46\% | 0.42\% | 0.16\% | -0.03\% | 1.00\% | 0.52\% | 0.35\% | -0.04\% | 0.44\% | 0.30\% | -0.05\% | -0.19\% | 0.41\% | -0.10\% | -0.45\% | -0.48\% |
|  |  | 0.9029 | 1.0627 | 0.4371 | -0.0793 | 1.4459 | 0.9183 | 0.7075 | -0.0922 | 0.5893 | 0.4673 | -0.0946 | -0.3423 | 0.5181 | -0.1335 | -0.7196 | -0.8151 |
| BHAR (0) |  | 0.54\% | 1.33\% | 0.67\% | 1.08\% | 1.28\% | 1.21\% | 0.32\% | 0.16\% | 1.68\% | 1.06\% | -0.27\% | 1.22\% | 0.63\% | -0.51\% | 0.37\% | -0.66\% |
|  |  | 0.7548 | 2.0216 | 0.7943 | 1.6890 | 1.6350 | 1.6854 | 0.4173 | 0.2206 | 1.7043 | 1.1638 | -0.3237 | 1.6621 | 0.7188 | -0.5924 | 0.4654 | -0.8450 |
| BHAR (1) |  | 1.04\% | 1.68\% | 0.78\% | 1.53\% | 1.45\% | 1.10\% | 0.53\% | -0.22\% | 1.73\% | 1.39\% | -0.01\% | 1.10\% | 1.01\% | -0.50\% | 0.29\% | -0.66\% |
|  |  | 1.4280 | 2.4234 | 0.9343 | 2.3875 | 1.8779 | 1.5999 | 0.7177 | -0.3084 | 1.8654 | 1.5665 | -0.0135 | 1.4664 | 1.0937 | -0.6021 | 0.3705 | -0.8920 |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.90\% | 0.73\% | 0.47\% | 0.33\% | 1.24\% | 0.96\% | 0.64\% | 0.47\% | 1.25\% | 0.79\% | 0.53\% | 0.31\% | 1.00\% | 0.53\% | 0.21\% | 0.03\% |
|  |  | 3.1721 | 2.7257 | 1.8482 | 1.5258 | 2.9352 | 2.2188 | 1.8040 | 1.5795 | 2.6274 | 1.9331 | 1.6563 | 1.0404 | 2.4999 | 1.4673 | 0.6321 | 0.0936 |
| CAR (1) |  | 0.88\% | 0.71\% | 0.47\% | 0.23\% | 1.24\% | 0.92\% | 0.53\% | 0.35\% | 1.16\% | 0.60\% | 0.36\% | 0.14\% | 0.54\% | 0.24\% | 0.00\% | -0.13\% |
|  |  | 3.5654 | 2.6273 | 1.9372 | 1.0972 | 2.6324 | 2.1901 | 1.5611 | 1.1834 | 2.7602 | 1.6311 | 1.1931 | 0.4882 | 1.3485 | 0.6731 | -0.0130 | -0.4300 |
| BHAR (0) |  | 0.42\% | 0.23\% | 0.06\% | 0.14\% | 1.59\% | 1.32\% | 0.68\% | 0.63\% | 1.00\% | 0.69\% | 0.57\% | 0.38\% | 0.78\% | 0.70\% | 0.55\% | -0.02\% |
|  |  | 1.1444 | 0.5376 | 0.1258 | 0.4062 | 3.3422 | 2.8538 | 1.5415 | 1.5747 | 1.5992 | 1.0599 | 1.2299 | 0.5424 | 1.5295 | 1.5164 | 1.2793 | -0.0533 |
| BHAR (1) |  | 0.31\% | -0.04\% | 0.24\% | 0.03\% | 1.26\% | 1.18\% | 0.50\% | 0.32\% | 0.80\% | 0.18\% | 0.52\% | 0.25\% | 0.20\% | 0.31\% | 0.16\% | -0.19\% |
|  |  | 0.9166 | -0.0894 | 0.5570 | 0.0759 | 2.4334 | 2.6083 | 1.1741 | 0.7595 | 1.3837 | 0.2782 | 1.1349 | 0.3758 | 0.4518 | 0.7704 | 0.4146 | -0.4633 |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.50\% | 0.35\% | 0.33\% | 0.48\% | 0.34\% | 0.47\% | 0.55\% | 0.52\% | 1.24\% | 1.08\% | 1.02\% | 1.03\% | 1.36\% | 1.15\% | 1.02\% | 0.80\% |
|  |  | 1.1357 | 0.8006 | 0.8990 | 1.4952 | 0.6011 | 0.9265 | 1.1881 | 1.2325 | 2.0707 | 1.9480 | 1.9305 | 2.1744 | 1.9653 | 1.8580 | 1.7392 | 1.5364 |
| CAR (1) |  | 0.46\% | 0.15\% | 0.29\% | 0.45\% | 0.42\% | 0.50\% | 0.63\% | 0.51\% | 1.02\% | 1.05\% | 1.02\% | 0.92\% | 1.43\% | 1.10\% | 0.93\% | 0.73\% |
|  |  | 0.9477 | 0.3356 | 0.8234 | 1.3457 | 0.8083 | 1.0462 | 1.3677 | 1.2459 | 1.6705 | 1.8624 | 1.9477 | 1.9414 | 2.1128 | 1.7448 | 1.6281 | 1.4330 |
| BHAR (0) |  | 0.89\% | -1.23\% | -0.51\% | 0.27\% | -0.05\% | 0.79\% | -0.78\% | 1.61\% | 1.08\% | 1.01\% | 1.25\% | $\mathbf{0 . 8 2 \%}$ | 1.67\% | 1.33\% | 0.98\% | 0.51\% |
|  |  | 1.3804 | -1.4936 | -0.6936 | 0.3731 | -0.0747 | 1.2459 | -1.0816 | 2.5325 | 1.4916 | 1.2960 | 1.9657 | 1.1439 | 2.2783 | 1.9994 | 1.3854 | 0.6634 |
| BHAR (1) |  | 0.24\% | -1.13\% | -0.73\% | 0.61\% | 0.08\% | 0.60\% | -0.52\% | 1.36\% | 0.85\% | 1.05\% | 1.07\% | 0.43\% | 1.58\% | 0.83\% | 0.72\% | 0.40\% |
|  |  | 0.3926 | -1.4987 | -1.0375 | 0.9259 | 0.1384 | 0.9565 | -0.7630 | 2.3238 | 1.1634 | 1.5478 | 1.7689 | 0.6348 | 2.3843 | 1.2904 | 1.0122 | 0.4968 |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.19\% | -0.16\% | -0.33\% | -0.31\% | 0.21\% | -0.04\% | -0.12\% | -0.10\% | 0.35\% | 0.20\% | 0.19\% | 0.06\% | 0.52\% | 0.55\% | 0.39\% | 0.11\% |
|  |  | -0.7405 | -0.7418 | -1.6549 | -1.6957 | 0.7000 | -0.1474 | -0.4440 | -0.3993 | 1.1405 | 0.6117 | 0.6421 | 0.2252 | 1.2276 | 1.4852 | 1.1523 | 0.3461 |
| CAR (1) |  | 0.06\% | -0.06\% | -0.27\% | -0.25\% | 0.42\% | 0.05\% | -0.11\% | -0.13\% | 0.30\% | 0.18\% | 0.09\% | -0.03\% | 0.82\% | 0.62\% | 0.37\% | 0.08\% |
|  |  | 0.2036 | -0.2437 | -1.2251 | -1.2292 | 1.2415 | 0.1816 | -0.4098 | -0.5315 | 0.9175 | 0.5420 | 0.2876 | -0.1223 | 2.0942 | 1.8104 | 1.1291 | 0.2670 |
| BHAR (0) |  | -0.13\% | -0.54\% | -0.39\% | -0.31\% | 0.31\% | 0.02\% | -0.22\% | 0.21\% | 0.41\% | 0.35\% | 0.23\% | $\mathbf{0 . 6 2 \%}$ | 0.75\% | 1.03\% | 0.46\% | 0.75\% |
|  |  | -0.3799 | -1.1353 | -0.9916 | -0.6339 | 0.7657 | 0.0508 | -0.6057 | 0.6686 | 1.2351 | 1.0796 | 0.6238 | 1.9439 | 1.7136 | 2.6275 | 1.1217 | 1.5420 |
| BHAR (1) |  | -0.01\% | -0.32\% | -0.53\% | -0.26\% | 0.35\% | 0.16\% | -0.21\% | -0.09\% | 0.21\% | 0.16\% | 0.12\% | $\mathbf{0 . 6 2 \%}$ | 1.48\% | 1.23\% | 0.29\% | 0.82\% |
|  |  | -0.0312 | -0.8475 | -1.1941 | -0.5796 | 0.8354 | 0.4395 | -0.5811 | -0.2441 | 0.5441 | 0.4617 | 0.2787 | 1.9314 | 3.0695 | 3.0687 | 0.7106 | 1.6322 |




| IVOL $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\overline{\mathrm{H}=}$ |  | 9 |  | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.08\% | 1.28\% | 1.08\% | 1.01\% | 1.96\% | 1.80\% | 1.60\% | 1.35\% | 2.42\% | 2.18\% | 1.71\% | 1.37\% | 2.48\% | 2.05\% | 1.66\% | 1.34\% |
|  | 2.5855 | 3.9181 | 3.8859 | 4.2126 | 4.1452 | 4.0861 | 4.0808 | 3.8508 | 4.7711 | 4.7164 | 4.0463 | 3.7675 | 5.0403 | 4.4214 | 3.9327 | 3.5266 |
| CAR (1) | 1.42\% | 1.34\% | 1.10\% | 0.96\% | 2.17\% | 1.84\% | 1.57\% | 1.24\% | 2.56\% | 1.91\% | 1.51\% | 1.17\% | 2.48\% | 1.90\% | 1.52\% | 1.20\% |
|  | 3.6670 | 4.5030 | 4.1046 | 3.9190 | 4.5162 | 4.2054 | 4.1144 | 3.7005 | 5.2013 | 4.2640 | 3.7282 | 3.3680 | 5.4547 | 4.3092 | 3.8395 | 3.2637 |
| BHAR (0) | 1.04\% | 1.36\% | 1.02\% | 1.00\% | 2.01\% | 1.59\% | 1.23\% | 1.26\% | 2.43\% | 2.26\% | 1.76\% | 1.08\% | 2.33\% | 2.11\% | 2.02\% | 1.97\% |
|  | 1.7981 | 3.2158 | 2.2508 | 2.1946 | 3.5050 | 3.0127 | 1.9912 | 2.4106 | 4.5237 | 3.9159 | 3.9173 | 2.2649 | 4.2698 | 4.0076 | 3.9614 | 3.7109 |
| BHAR (1) | 1.29\% | 1.36\% | 1.18\% | 1.42\% | 2.22\% | 1.84\% | 1.26\% | 1.01\% | 2.53\% | 2.12\% | 1.84\% | 0.98\% | 2.81\% | 2.21\% | 1.90\% | 2.18\% |
|  | 2.5004 | 3.2704 | 2.9288 | 2.9679 | 3.7826 | 3.3988 | 2.0032 | 1.9699 | 4.5767 | 4.0525 | 4.4022 | 2.1127 | 5.3410 | 4.2316 | 3.7685 | 4.1416 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.77\% | 0.87\% | 0.85\% | 0.84\% | 1.39\% | 1.40\% | 1.25\% | 0.98\% | 1.66\% | 1.59\% | 1.15\% | 0.87\% | 1.55\% | 1.19\% | 0.92\% | 0.70\% |
|  | 3.6372 | 4.1792 | 4.7265 | 5.3880 | 4.8542 | 5.4637 | 5.4496 | 4.5932 | 5.4397 | 5.9105 | 5.0319 | 4.1741 | 5.0248 | 4.4030 | 3.8803 | 3.1874 |
| CAR (1) | 0.94\% | 0.97\% | 0.89\% | 0.76\% | 1.43\% | 1.35\% | 1.10\% | 0.86\% | 1.58\% | 1.33\% | 0.92\% | 0.70\% | 1.30\% | 1.01\% | 0.75\% | 0.55\% |
|  | 4.2508 | 4.6161 | 5.0169 | 4.8130 | 4.9802 | 5.4056 | 4.8535 | 4.0720 | 5.3160 | 5.2001 | 4.2896 | 3.4251 | 4.3863 | 3.8855 | 3.2150 | 2.4913 |
| BHAR (0) | 0.64\% | 0.98\% | 0.59\% | 1.35\% | 1.17\% | 1.56\% | 1.04\% | 1.35\% | 1.51\% | 1.70\% | 1.47\% | 0.88\% | 1.54\% | 1.07\% | 0.89\% | 0.87\% |
|  | 2.4853 | 2.9980 | 1.8019 | 3.5789 | 3.4857 | 4.7143 | 3.6919 | 3.5150 | 3.8749 | 4.7589 | 4.4846 | 2.8092 | 4.5602 | 3.2598 | 2.8119 | 3.3025 |
| BHAR (1) | 0.86\% | 1.05\% | 0.44\% | 1.19\% | 1.55\% | 1.55\% | 1.04\% | 1.26\% | 1.52\% | 1.31\% | 1.20\% | 0.76\% | 1.40\% | 1.03\% | 0.50\% | 0.88\% |
|  | 3.4006 | 3.0222 | 1.4527 | 3.0459 | 4.5492 | 4.6770 | 3.7535 | 3.2931 | 4.0845 | 3.8819 | 3.8342 | 2.2928 | 4.4744 | 3.3154 | 1.6645 | 3.3328 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.36\% | 1.36\% | 1.18\% | 1.22\% | 1.93\% | 1.59\% | 1.49\% | 1.32\% | 1.99\% | 1.82\% | 1.56\% | 1.32\% | 2.15\% | 1.79\% | 1.48\% | 1.20\% |
|  | 6.8351 | 7.5733 | 7.9172 | 9.5194 | 8.3646 | 7.9229 | 8.5905 | 7.9816 | 8.8409 | 8.4680 | 7.7107 | 6.7527 | 8.8272 | 7.3952 | 6.4598 | 5.2986 |
| CAR (1) | 1.43\% | 1.28\% | 1.15\% | 1.12\% | 1.71\% | 1.46\% | 1.36\% | 1.17\% | 1.91\% | 1.67\% | 1.43\% | 1.15\% | 1.94\% | 1.59\% | 1.29\% | 1.04\% |
|  | 7.5199 | 7.4863 | 8.1657 | 8.8679 | 7.8344 | 7.6719 | 8.1677 | 7.3429 | 9.0902 | 7.8595 | 7.0729 | 5.8558 | 7.9967 | 6.6171 | 5.6410 | 4.5974 |
| BHAR (0) | 1.43\% | 1.51\% | 1.54\% | 1.35\% | 2.03\% | 1.80\% | 1.20\% | 1.43\% | 2.03\% | 1.81\% | 1.54\% | 1.26\% | 2.13\% | 1.91\% | 1.53\% | 1.13\% |
|  | 6.4762 | 6.1000 | 7.1353 | 5.3656 | 8.5886 | 8.5740 | 4.6356 | 6.4526 | 8.7722 | 6.8311 | 7.0078 | 5.1711 | 8.3378 | 7.6437 | 5.5532 | 4.4310 |
| BHAR (1) | 1.73\% | 1.42\% | 1.46\% | 1.25\% | 1.82\% | 1.67\% | 1.14\% | 1.25\% | 2.02\% | 1.69\% | 1.45\% | 1.00\% | 2.06\% | 1.61\% | 1.23\% | 0.96\% |
|  | 7.2980 | 5.8763 | 6.2738 | 5.2763 | 8.1812 | 8.9173 | 4.8690 | 6.1113 | 9.3427 | 6.2569 | 5.8958 | 4.1459 | 8.5110 | 6.6887 | 4.5695 | 3.9961 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.03\% | 0.19\% | 0.21\% | 0.20\% | 0.35\% | 0.45\% | 0.41\% | 0.27\% | 0.55\% | 0.55\% | 0.38\% | 0.20\% | 0.51\% | 0.39\% | 0.22\% | 0.06\% |
|  | 0.1600 | 1.0563 | 1.2849 | 1.3244 | 1.4858 | 2.0704 | 2.0346 | 1.4144 | 2.1219 | 2.2076 | 1.5868 | 0.9167 | 1.8468 | 1.4237 | 0.8643 | 0.2476 |
| CAR (1) | 0.29\% | 0.32\% | 0.31\% | 0.20\% | 0.51\% | 0.51\% | 0.40\% | 0.21\% | 0.70\% | 0.54\% | 0.33\% | 0.12\% | 0.48\% | 0.32\% | 0.13\% | -0.02\% |
|  | 1.5047 | 1.9260 | 2.0604 | 1.4182 | 2.1911 | 2.3852 | 1.9776 | 1.1261 | 2.7432 | 2.1781 | 1.4113 | 0.5499 | 1.7523 | 1.1861 | 0.5332 | -0.0988 |
| BHAR (0) | 0.08\% | 0.60\% | 0.21\% | 0.32\% | 0.36\% | 0.36\% | 0.28\% | 0.32\% | 0.61\% | 0.63\% | 0.48\% | 0.22\% | 0.58\% | 0.42\% | 0.36\% | 0.12\% |
|  | 0.3453 | 2.9054 | 0.7343 | 1.4075 | 1.3314 | 1.3483 | 0.9660 | 1.4755 | 2.2164 | 2.2736 | 2.0338 | 0.9068 | 2.0516 | 1.3844 | 1.2491 | 0.4294 |
| BHAR (1) | 0.35\% | 0.52\% | 0.21\% | 0.26\% | 0.51\% | 0.38\% | 0.20\% | 0.10\% | 0.67\% | 0.52\% | 0.29\% | 0.09\% | 0.38\% | 0.22\% | 0.16\% | -0.07\% |
|  | 1.6978 | 2.4922 | 0.8007 | 1.0466 | 2.1566 | 1.5865 | 0.6796 | 0.4740 | 2.4972 | 1.8190 | 1.1190 | 0.3317 | 1.2917 | 0.7262 | 0.5709 | -0.2418 |

## Table 5.6. Monthly raw returns of cross-sectional momentum strategy under different implementations

This table reports the average monthly returns for $16(\mathrm{JxH})$ cross-sectional momentum strategies across the 24 stock markets along with an indication of significant levels based on the Newey-West adjusted t-statistics. At the end of each month if using monthly rebalancing or at the end of each holding period if using buy-and-hold, all stocks are ranked based on their average returns over past $\mathrm{J}(\mathrm{J}=3,6,9$ and 12 months). The Winner (loser) portfolio contains top (bottom) $16 \%$ stocks. All stocks in the winner and loser portfolios are equally weighted in Panel A, market value weighted in Panel B and inversed volatility weighted in Panel C. Following Moskowitz et al. (2012), inversed volatility weighting scheme is given lower proportion to higher volatile stocks in the portfolio; that is the weight of the stock in portfolio is estimated by an inverse proportion of its ex ante volatility from daily returns over $\mathrm{J}(\mathrm{J}=3,6,9$ and 12 months). The proportions of stocks in the portfolios remain same during the $\mathrm{H}(\mathrm{H}=3,6,9$ and 12 months) holding period. We implement portfolio constructions as in (Jegadeesh \& Titman, 1993) for buy-and-hold and monthly-rebalancing. For buy-and-hold (BHAR), the procedure is rolling forward at the end of each H holding period to generate a new winner and loser portfolios. For monthly-rebalancing (CAR), the procedure is rolling forward at the end of each month to produce an overlapping winner (loser) portfolio which contains of winner (loser) portfolio of the past J month. The return of the winner (loser) portfolio is then the simple average return of the H winner (loser) portfolios. CAR (1) and BHAR (1) indicates one-month gap between the formation and the holding periods to avoid the bid-ask bounce, whereas CAR ( 0 ) and BHAR ( 0 ) indicates no gap between the formation and the holding periods. The return on momentum portfolio is then estimated as return difference return between winner and loser portfolio at each month.

Panel A. The cross-sectional momentum using equal-weighted return


| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.11\% | 1.13\% | 1.05\% | 1.02\% | 1.54\% | 1.49\% | 1.40\% | 1.22\% | 1.72\% | 1.66\% | 1.43\% | 1.16\% | 1.90\% | 1.63\% | 1.34\% | 1.07\% |
|  |  | 5.0562 | 6.0649 | 6.0734 | 6.5468 | 6.4193 | 6.3051 | 6.3275 | 5.7775 | 6.2593 | 6.2993 | 5.4681 | 4.6577 | 6.6647 | 5.8052 | 4.8082 | 4.0901 |
| CAR (1) |  | 1.25\% | 1.14\% | 1.08\% | 0.98\% | 1.62\% | 1.49\% | 1.36\% | $\mathbf{1 . 1 1 \%}$ | 1.78\% | 1.59\% | 1.30\% | $\mathbf{1 . 0 2 \%}$ | 1.77\% | 1.43\% | 1.16\% | 0.90\% |
|  |  | 5.9124 | 6.2181 | 6.2773 | 6.1581 | 6.7613 | 6.1888 | 6.1051 | 5.1942 | 6.5002 | 5.9077 | 4.9535 | 4.0899 | 6.2079 | 5.1131 | 4.1926 | 3.5059 |
| BHAR (0) |  | 1.14\% | 1.00\% | 0.74\% | 1.03\% | 1.48\% | 1.29\% | 1.19\% | 1.44\% | 1.67\% | 1.33\% | 1.49\% | 0.96\% | 1.93\% | 1.64\% | 1.35\% | 0.87\% |
|  |  | 4.8144 | 4.0656 | 2.9604 | 4.2180 | 5.5769 | 4.3377 | 4.1190 | 5.5442 | 5.8397 | 4.5778 | 4.9217 | 3.3648 | 6.2712 | 5.3550 | 4.4981 | 2.9310 |
| BHAR (1) |  | 1.14\% | 0.97\% | 0.94\% | 0.99\% | 1.64\% | 1.31\% | 1.22\% | 1.32\% | 1.70\% | 1.44\% | 1.37\% | $\mathbf{0 . 8 0 \%}$ | 1.71\% | 1.34\% | 1.18\% | 0.62\% |
|  |  | 4.9485 | 4.0635 | 3.5838 | 4.2304 | 6.3810 | 4.2985 | 4.1560 | 5.3330 | 5.9433 | 4.9024 | 4.7538 | 2.7022 | 5.8001 | 4.4373 | 3.8402 | 2.1189 |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.74\% | 0.70\% | 0.78\% | 0.67\% | 1.13\% | 1.09\% | 1.06\% | 0.81\% | 1.23\% | 1.11\% | 0.89\% | 0.63\% | 1.04\% | 0.81\% | 0.64\% | 0.45\% |
|  |  | 2.2437 | 2.6675 | 3.4937 | 3.1867 | 3.1126 | 3.3157 | 3.6424 | 2.8111 | 3.2536 | 3.0981 | 2.4617 | 1.7403 | 2.5003 | 1.9469 | 1.5592 | 1.1311 |
| CAR (1) |  | 1.00\% | 0.81\% | 0.82\% | 0.65\% | 1.21\% | 1.14\% | 0.99\% | 0.69\% | 1.24\% | 1.01\% | 0.77\% | 0.48\% | 1.00\% | 0.69\% | 0.53\% | 0.37\% |
|  |  | $3.2478$ | $3.3575$ | $3.8828$ | 3.0738 | $3.4482$ | 3.6927 | 3.3956 | 2.3555 | 3.3033 | $2.7143$ | 2.0294 | 1.3077 | $2.3154$ | $1.6189$ | $1.2733$ | $0.9154$ |
| BHAR (0) |  | 0.42\% | 0.29\% | 0.86\% | 0.44\% | 1.01\% | 1.08\% | 0.81\% | 1.30\% | 1.12\% | 0.83\% | 0.71\% | 0.43\% | 0.92\% | 0.97\% | $\mathbf{0 . 8 1 \%}$ | 0.69\% |
|  |  | 0.9254 | 0.6323 | 2.1162 | 0.9044 | 2.3798 | 2.8241 | 2.3131 | 3.5703 | 2.7448 | 1.8944 | 1.8083 | 1.0375 | 2.0941 | 2.3407 | 1.7376 | 1.7394 |
| BHAR (1) |  | 1.07\% | 0.36\% | 1.02\% | 0.45\% | 1.22\% | 1.20\% | 0.74\% | 1.04\% | 1.20\% | 0.68\% | 0.51\% | 0.35\% | $0.91 \%$ | $0.76 \%$ | 0.48\% | 0.53\% |
|  |  | 2.9980 | 0.8775 | 2.6711 | 0.9324 | 3.3116 | 3.5110 | 2.0956 | 2.8882 | 2.9830 | 1.4995 | 1.2328 | 0.8106 | $2.0849$ | $1.9001$ | 1.0264 | $1.4046$ |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.08\% | 0.37\% | 0.45\% | 0.53\% | 0.49\% | 0.71\% | 0.76\% | 0.68\% | 0.66\% | 0.87\% | 0.79\% | 0.64\% | 0.84\% | 0.82\% | 0.69\% | 0.54\% |
|  |  | -0.2662 | 1.5148 | 2.1830 | 2.9253 | 1.4982 | 2.4874 | 3.0510 | 2.9243 | 1.9584 | 2.8490 | 2.7264 | 2.3945 | 2.4450 | 2.5243 | 2.2333 | 1.8642 |
| CAR (1) |  | 0.68\% | 0.72\% | 0.71\% | 0.64\% | 1.01\% | 0.96\% | 0.89\% | 0.71\% | 1.09\% | 1.01\% | 0.84\% | 0.62\% | 1.05\% | 0.86\% | 0.68\% | 0.52\% |
|  |  | 2.4487 | 3.2074 | 3.7566 | 3.7374 | 3.3278 | 3.6174 | 3.6438 | 3.1457 | 3.3925 | 3.3857 | 2.9379 | 2.3702 | 3.2354 | 2.7263 | 2.2577 | 1.8350 |
| BHAR (0) |  | -0.15\% | -0.03\% | 0.55\% | -0.10\% | 0.48\% | 0.74\% | 0.40\% | 0.52\% | 0.57\% | 0.63\% | 0.86\% | 0.60\% | 0.79\% | 0.85\% | 0.87\% | 0.51\% |
|  |  | -0.4339 | -0.0825 | 1.7987 | -0.3126 | 1.3210 | 2.3188 | 1.0699 | 2.0320 | 1.5975 | 1.8080 | 2.9094 | 1.9524 | 2.2501 | 2.4359 | 2.6496 | 1.5962 |
| BHAR (1) |  | 0.52\% | 0.21\% | 0.73\% | 0.05\% | 0.96\% | 0.92\% | 0.55\% | 0.50\% | 0.93\% | 0.69\% | 0.90\% | 0.37\% | 0.95\% | 0.87\% | 0.76\% | 0.54\% |
|  |  | 1.7038 | 0.7335 | 2.5627 | 0.1702 | 3.0212 | 3.0659 | 1.5454 | 2.1070 | 2.7287 | 1.9489 | 2.9711 | 1.1232 | 2.7970 | 2.6889 | 2.3236 | 1.7213 |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.77\% | 0.78\% | 0.77\% | 0.75\% | 1.10\% | 1.06\% | 1.03\% | 0.83\% | 1.23\% | 1.13\% | 0.95\% | 0.74\% | 1.32\% | 1.05\% | 0.84\% | 0.68\% |
|  |  | 2.7167 | 3.3605 | 3.6755 | 3.9789 | 3.5239 | 3.8071 | 3.9735 | 3.4233 | 3.7090 | 3.6249 | 3.1228 | 2.6670 | 3.9055 | 3.2107 | 2.7358 | $2.3662$ |
| CAR (1) |  | 1.14\% | 0.91\% | 0.86\% | 0.75\% | 1.26\% | 1.12\% | 1.00\% | 0.76\% | 1.34\% | 1.10\% | 0.86\% | 0.66\% | 1.31\% | 0.95\% | 0.76\% | 0.61\% |
|  |  | 4.2739 | 4.1483 | 4.2861 | 4.1240 | 4.3514 | 4.0885 | 3.8414 | 3.1929 | 4.0993 | 3.5057 | 2.8696 | 2.4167 | 3.9944 | 2.9666 | 2.5309 | 2.1724 |
| BHAR (0) |  | $0.72 \%$ | 0.60\% | 0.78\% | 0.31\% | 1.14\% | $1.21 \%$ | 1.02\% | 0.94\% | 1.23\% | 1.08\% | 0.99\% | 0.65\% | 1.36\% | 1.15\% | 0.85\% | 0.60\% |
|  |  | 2.1948 | 1.8760 | 2.6449 | 0.8247 | 3.2782 | 3.9221 | 2.7154 | 2.8748 | 3.4042 | 2.9862 | 3.3050 | 1.7578 | 4.0344 | 3.6009 | 2.5709 | 1.9882 |
| BHAR (1) |  | 1.18\% | 0.56\% | 0.86\% | 0.24\% | 1.18\% | 1.16\% | 0.98\% | 0.74\% | 1.28\% | 0.97\% | 0.79\% | 0.45\% | 1.21\% | 0.92\% | 0.64\% | 0.56\% |
|  |  | 3.8457 | 1.8698 | 2.9679 | 0.5888 | 3.8410 | 3.6825 | 2.6509 | 2.2667 | 3.8461 | 2.6873 | 2.5617 | 1.1986 | 3.6739 | 3.0667 | 2.0598 | 1.8599 |




| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 1 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.61\% | 0.68\% | 0.71\% | 0.65\% | 0.88\% | 0.92\% | 0.96\% | 0.71\% | 1.24\% | 1.14\% | 0.88\% | 0.57\% | 1.27\% | 0.88\% | 0.64\% | 0.35\% |
|  |  | 1.6660 | 2.5561 | 2.9431 | 2.7615 | 2.1973 | 2.7025 | 2.9556 | 2.2663 | 3.1686 | 2.9552 | 2.3399 | 1.5979 | 2.9820 | 2.1365 | 1.6039 | 0.9104 |
| CAR (1) |  | 0.59\% | 0.75\% | 0.75\% | 0.55\% | 1.01\% | 1.04\% | 0.94\% | $\mathbf{0 . 5 9 \%}$ | 1.22\% | 1.04\% | 0.72\% | 0.38\% | 0.97\% | 0.69\% | 0.44\% | 0.18\% |
|  |  | 1.7719 | 2.9950 | 3.0768 | 2.3045 | 2.8135 | 3.1487 | 2.9100 | 1.8962 | 3.0995 | 2.6749 | 1.8939 | 1.0782 | 2.2369 | 1.6511 | 1.0907 | 0.4748 |
| BHAR (0) |  | 0.66\% | 0.76\% | 0.60\% | 0.75\% | 0.85\% | 0.96\% | 0.73\% | 1.31\% | 1.39\% | 1.25\% | 1.00\% | 1.01\% | 1.15\% | 0.92\% | 0.78\% | 0.28\% |
|  |  | 1.5163 | 1.8290 | 1.6863 | 2.0827 | 1.9815 | 2.2573 | 1.7530 | 3.7027 | 3.3265 | 2.9547 | 2.3338 | 2.3419 | 2.4739 | 2.1005 | 1.7836 | 0.6225 |
| BHAR (1) |  | 0.64\% | 0.85\% | 0.79\% | 0.69\% | 1.04\% | 1.05\% | 0.68\% | 0.98\% | 1.38\% | 1.19\% | 0.85\% | 0.90\% | 1.01\% | 0.60\% | 0.83\% | 0.10\% |
|  |  | 1.6418 | 2.4770 | 2.3694 | 1.8455 | 2.7978 | 2.5900 | 1.7862 | 2.7321 | 3.4618 | 2.9488 | 2.0907 | 2.1896 | 2.2597 | 1.3765 | 2.0387 | 0.2300 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.63\% | -0.07\% | 0.17\% | 0.20\% | -0.25\% | 0.15\% | 0.27\% | 0.29\% | 0.09\% | 0.26\% | 0.34\% | 0.29\% | 0.04\% | 0.20\% | 0.26\% | 0.24\% |
|  |  | -1.8131 | -0.2259 | 0.6426 | 0.8437 | -0.5695 | 0.3940 | 0.7668 | 0.8723 | 0.1915 | 0.6135 | 0.8210 | 0.7402 | 0.0753 | 0.4302 | 0.5926 | 0.5690 |
| CAR (1) |  | -0.02\% | $0.39 \%$ | $\mathbf{0 . 4 1 \%}$ | $0.40 \%$ | $0.43 \%$ | 0.54\% | 0.50\% | 0.45\% | 0.48\% | 0.50\% | 0.42\% | 0.36\% | 0.44\% | 0.42\% | $0.40 \%$ | $0.33 \%$ |
|  |  | -0.0523 | $1.3078$ | $1.5684$ | $1.6573$ | $0.9450$ | $1.3710$ | $1.4146$ | $1.3685$ | $1.0527$ | $1.1330$ | $1.0230$ | $0.9263$ | $0.8846$ | $0.8966$ | $0.8971$ | $0.7768$ |
| BHAR (0) |  | -0.55\% | 0.34\% | 0.24\% | $\mathbf{0 . 3 1 \%}$ | -0.19\% | 0.25\% | 0.41\% | 0.36\% | 0.16\% | 0.61\% | 0.43\% | 0.99\% | 0.11\% | 0.10\% | 0.21\% | 0.20\% |
|  |  | -1.1348 | 0.7371 | 0.5058 | 0.6350 | -0.3915 | 0.5330 | 0.9372 | 0.8328 | 0.3047 | 1.1009 | 0.8268 | 2.0752 | 0.2198 | 0.1988 | 0.4265 | 0.4012 |
| BHAR (1) |  | -0.25\% | 0.68\% | 0.45\% | $\mathbf{0 . 5 1 \%}$ | 0.06\% | 0.44\% | 0.59\% | 0.45\% | 0.39\% | 0.39\% | 0.35\% | 0.88\% | $\mathbf{0 . 3 1 \%}$ | 0.40\% | 0.41\% | 0.13\% |
|  |  | -0.5239 | 1.6525 | 0.9688 | 1.0828 | 0.1355 | 1.0205 | 1.3649 | 1.0555 | 0.8180 | 0.7781 | 0.7464 | 1.8423 | $0.5900$ | 0.7892 | 0.8140 | $0.2609$ |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.37\% | 0.59\% | 0.47\% | 0.32\% | 0.76\% | 0.67\% | 0.45\% | 0.25\% | 0.61\% | 0.47\% | 0.26\% | 0.06\% | 0.38\% | 0.23\% | 0.02\% | -0.12\% |
|  |  | 0.9449 | 2.0395 | 1.8165 | 1.3642 | 1.9668 | 1.9279 | 1.3863 | 0.8692 | 1.4097 | 1.1870 | 0.7262 | 0.1918 | 0.8663 | 0.5686 | 0.0610 | -0.3527 |
| CAR (1) |  | 0.61\% | 0.69\% | 0.48\% | 0.31\% | 0.95\% | 0.69\% | 0.39\% | 0.20\% | 0.62\% | 0.40\% | 0.15\% | -0.02\% | 0.36\% | 0.14\% | -0.08\% | -0.15\% |
|  |  | 1.6060 | 2.6738 | 1.9115 | 1.3750 | 2.6758 | 2.0114 | 1.2330 | 0.7313 | 1.4529 | 1.0469 | 0.4284 | -0.0705 | 0.8547 | 0.3633 | -0.2225 | -0.4900 |
| BHAR (0) |  | 0.31\% | 0.28\% | 0.59\% | 0.42\% | 0.84\% | 0.73\% | 0.37\% | 0.59\% | 0.71\% | 0.40\% | 0.42\% | -0.08\% | 0.56\% | 0.54\% | 0.26\% | 0.04\% |
|  |  | 0.7140 | 0.6709 | 1.8212 | 1.5725 | 1.7325 | 1.8348 | 0.8832 | 1.9096 | 1.4798 | 0.8865 | 1.3000 | -0.1914 | 1.1696 | 1.3544 | 0.6850 | 0.1019 |
| BHAR (1) |  | 0.57\% | 0.22\% | 0.64\% | 0.29\% | 0.96\% | 0.76\% | 0.23\% | 0.49\% | 0.66\% | 0.40\% | 0.45\% | -0.07\% | 0.51\% | 0.44\% | -0.04\% | 0.04\% |
|  |  | 1.4797 | 0.6672 | 2.0651 | 1.1462 | 2.4911 | 2.0653 | 0.5612 | 1.6575 | 1.4885 | 1.0134 | 1.5268 | -0.1778 | 1.1961 | 1.2045 | -0.0939 | 0.1158 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.40\% | 0.44\% | 0.53\% | 0.54\% | 0.66\% | 0.70\% | 0.76\% | 0.68\% | 0.94\% | 0.97\% | 0.89\% | 0.77\% | 1.00\% | 0.90\% | 0.82\% | 0.69\% |
|  |  | 1.8108 | 2.3124 | 2.9051 | 3.1847 | 2.4785 | 2.6512 | 2.9900 | 2.8888 | 2.9750 | 3.2132 | 3.0429 | 2.8003 | 3.0102 | 2.8172 | 2.6140 | 2.2775 |
| CAR (1) |  | 0.59\% | 0.55\% | 0.61\% | 0.54\% | 0.75\% | 0.81\% | 0.74\% | $\mathbf{0 . 6 2 \%}$ | 1.01\% | 0.96\% | 0.86\% | 0.69\% | 0.98\% | 0.87\% | 0.76\% | 0.62\% |
|  |  | 2.8857 | 2.9144 | 3.2663 | 3.2290 | 2.8038 | 2.8860 | 2.8485 | 2.6598 | 3.1402 | 3.0920 | 2.9471 | 2.5219 | 2.9198 | 2.6533 | 2.4356 | 2.0589 |
| BHAR (0) |  | $0.27 \%$ | 0.16\% | 0.74\% | 0.64\% | $0.52 \%$ | 0.87\% | 0.77\% | 0.65\% | 1.04\% | 1.10\% | 0.99\% | 0.54\% | 1.01\% | 1.00\% | $0.97 \%$ | 0.56\% |
|  |  | 1.0065 | 0.5846 | 2.3035 | 2.1691 | 1.7865 | 2.5709 | 2.0132 | 2.3339 | 2.9985 | 3.2126 | 2.9780 | 1.7863 | 2.9189 | 2.9540 | 2.8383 | 1.5682 |
| BHAR (1) |  | 0.60\% | 0.16\% | 0.68\% | 0.64\% | 0.60\% | 0.87\% | 0.71\% | 0.52\% | 0.89\% | 0.90\% | 0.68\% | 0.31\% | 0.92\% | 0.90\% | 0.90\% | 0.50\% |
|  |  | 2.2109 | 0.5067 | 2.0624 | 2.1463 | 2.0352 | 2.6984 | 1.9203 | 1.9658 | 2.5193 | 2.5182 | 2.0352 | 0.9698 | 2.7532 | 2.5990 | 2.6676 | 1.3976 |


| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.96\% | 1.12\% | 0.85\% | 0.82\% | 1.39\% | 1.26\% | 1.06\% | 0.86\% | 1.41\% | 1.31\% | 0.99\% | 0.74\% | 1.44\% | 1.13\% | 0.78\% | 0.58\% |
|  |  | 2.5028 | 3.4417 | 3.0703 | 3.4640 | 3.0657 | 3.2225 | 3.1370 | 2.8101 | 3.2302 | 3.2610 | 2.6378 | 2.1498 | 3.1590 | 2.5792 | 1.9204 | 1.5400 |
| CAR (1) |  | 1.42\% | 1.20\% | 0.94\% | 0.82\% | 1.56\% | 1.28\% | 1.02\% | 0.77\% | 1.54\% | 1.23\% | 0.87\% | 0.62\% | 1.29\% | 0.94\% | 0.61\% | 0.47\% |
|  |  | 3.8647 | 3.9553 | 3.7146 | 3.7038 | 3.7086 | 3.4911 | 3.1450 | 2.5975 | 3.6189 | 3.1383 | 2.3239 | 1.8526 | 2.8475 | 2.1798 | 1.5375 | 1.2685 |
| BHAR (0) |  | 1.21\% | 0.98\% | 0.91\% | 0.45\% | 1.52\% | 1.45\% | 1.05\% | 0.74\% | 1.50\% | 1.16\% | 1.00\% | 0.58\% | 1.41\% | 1.23\% | 0.75\% | 0.73\% |
|  |  | 2.9831 | 2.6751 | 2.6247 | 1.1075 | 3.1253 | 3.6512 | 2.1654 | 1.9449 | 3.2376 | 2.3646 | 2.2621 | 1.3218 | 3.0048 | 2.9164 | 1.7525 | 2.0304 |
| BHAR (1) |  | 1.47\% | 1.03\% | 0.94\% | 0.57\% | 1.65\% | 1.40\% | 1.03\% | 0.70\% | 1.47\% | 1.16\% | 0.96\% | 0.44\% | 1.39\% | 1.10\% | 0.59\% | 0.68\% |
|  |  | 3.8040 | 2.8816 | 3.0311 | 1.4872 | 3.6735 | 3.8671 | 2.2052 | 1.9097 | 3.3494 | 2.6016 | 2.2442 | 0.9986 | 2.9833 | 2.6370 | 1.3850 | 1.8171 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.02\% | 0.90\% | 0.77\% | 0.77\% | 1.24\% | 1.06\% | 0.99\% | 0.85\% | 1.21\% | 1.12\% | 0.95\% | 0.75\% | 1.32\% | 1.08\% | 0.84\% | 0.64\% |
|  |  | 4.4631 | 4.4003 | 3.8617 | 4.2654 | 4.4775 | 3.7709 | 3.7816 | 3.6146 | 3.7123 | 3.5282 | 3.2061 | 2.7770 | 3.8830 | 3.3300 | 2.7575 | 2.2623 |
| CAR (1) |  | 1.04\% | 0.87\% | 0.77\% | 0.71\% | 1.17\% | 1.02\% | 0.92\% | 0.72\% | 1.20\% | 1.06\% | 0.85\% | 0.62\% | 1.22\% | 0.95\% | 0.71\% | 0.50\% |
|  |  | 4.8599 | 4.1849 | 3.8202 | 4.0222 | 4.1561 | 3.5506 | 3.5473 | 3.1596 | 3.6575 | 3.3599 | 2.9196 | 2.3611 | 3.6885 | 2.9663 | 2.3656 | 1.8266 |
| BHAR (0) |  | 0.97\% | 0.85\% | 0.70\% | 0.74\% | 1.26\% | 1.23\% | 0.81\% | 1.20\% | 1.21\% | 0.96\% | 1.06\% | 0.80\% | 1.34\% | 1.33\% | 0.98\% | 0.79\% |
|  |  | 3.7223 | 2.7700 | 2.3116 | 2.1294 | 4.1631 | 3.9720 | 2.5417 | 4.3403 | 3.5350 | 2.5896 | 3.5617 | 2.6646 | 3.8847 | 4.0298 | 2.9302 | 2.4947 |
| BHAR (1) |  | 0.98\% | 0.69\% | 0.68\% | 0.70\% | 1.13\% | 1.12\% | 0.72\% | 1.04\% | 1.08\% | 0.83\% | 0.95\% | 0.57\% | 1.16\% | 1.16\% | 0.75\% | 0.71\% |
|  |  | 3.9231 | 2.2542 | 2.2701 | 2.0727 | 3.5988 | 3.5228 | 2.2832 | 3.8522 | 3.1744 | 2.3384 | 3.2213 | 1.7596 | 3.5101 | 3.6519 | 2.3921 | 2.2949 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.22\% | 1.19\% | 1.00\% | 0.98\% | 1.64\% | 1.40\% | 1.28\% | 1.10\% | 1.61\% | 1.46\% | 1.21\% | 0.96\% | 1.72\% | 1.40\% | 1.07\% | 0.81\% |
|  |  | 4.4085 | 4.8581 | 4.8809 | 5.5055 | 4.9876 | 4.8505 | 5.2478 | 4.9755 | 4.8759 | 4.9501 | 4.4351 | 3.7899 | 5.1929 | 4.4333 | 3.6380 | 2.9248 |
| CAR (1) |  | 1.29\% | 1.14\% | 0.98\% | 0.90\% | 1.54\% | 1.31\% | 1.16\% | 0.95\% | 1.51\% | 1.31\% | 1.05\% | 0.78\% | 1.53\% | 1.19\% | 0.88\% | 0.64\% |
|  |  | 4.7357 | 4.9148 | 5.1379 | 5.2652 | 4.9067 | 4.9426 | 5.0357 | 4.4632 | 4.8122 | 4.5944 | 3.8865 | 3.1472 | 4.8211 | 3.8589 | 3.0486 | 2.3679 |
| BHAR (0) |  | 1.07\% | 0.97\% | 0.98\% | 0.63\% | 1.61\% | 1.34\% | 1.00\% | 1.27\% | 1.58\% | 1.34\% | 1.25\% | 0.98\% | 1.60\% | 1.38\% | 1.06\% | 0.71\% |
|  |  | 3.3126 | 3.1821 | 3.2676 | 2.0019 | 4.6385 | 4.1849 | 3.0828 | 5.8367 | 4.4178 | 3.9901 | 4.5282 | 3.3494 | 4.6311 | 4.4447 | 3.1843 | 2.3907 |
| BHAR (1) |  | 1.20\% | 0.91\% | 0.86\% | 0.56\% | 1.47\% | 1.21\% | 0.94\% | 1.04\% | 1.49\% | 1.16\% | 1.02\% | 0.76\% | 1.40\% | 1.10\% | 0.73\% | 0.47\% |
|  |  | 4.0494 | 3.2362 | 3.1647 | 1.7904 | 4.7452 | 4.2905 | 3.1493 | 5.1033 | 4.5898 | 3.7275 | 3.6758 | 2.5807 | 4.3746 | 3.7548 | 2.2508 | 1.6262 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.04\% | 0.09\% | 0.13\% | 0.06\% | 0.19\% | 0.27\% | 0.19\% | 0.01\% | 0.31\% | 0.24\% | 0.05\% | -0.15\% | 0.17\% | 0.00\% | -0.19\% | -0.34\% |
|  |  | -0.1477 | 0.4014 | 0.6959 | 0.3844 | 0.6154 | 0.9793 | 0.7958 | 0.0413 | 0.9549 | 0.7832 | 0.1726 | -0.5726 | 0.5063 | 0.0046 | -0.5994 | -1.2097 |
| CAR (1) |  | 0.07\% | 0.20\% | 0.19\% | 0.02\% | 0.35\% | 0.35\% | 0.16\% | -0.06\% | 0.38\% | 0.19\% | -0.04\% | -0.26\% | 0.08\% | -0.10\% | -0.30\% | -0.43\% |
|  |  | 0.3065 | 0.9603 | 1.0783 | 0.1285 | 1.2204 | 1.3785 | 0.6913 | -0.2908 | 1.2099 | 0.6277 | -0.1229 | -0.9806 | 0.2333 | -0.2965 | -0.9977 | $-1.5893$ |
| BHAR (0) |  | -0.13\% | 0.14\% | 0.04\% | 0.07\% | 0.15\% | 0.31\% | -0.24\% | 0.33\% | 0.32\% | 0.11\% | 0.20\% | -0.13\% | 0.22\% | 0.19\% | -0.06\% | -0.29\% |
|  |  | -0.4669 | 0.5601 | 0.1369 | 0.2689 | 0.4384 | 0.9619 | -0.6522 | 1.4573 | 0.8898 | 0.3187 | 0.7618 | -0.4480 | 0.6074 | 0.5711 | -0.1890 | -0.8715 |
| BHAR (1) |  | 0.11\% | 0.08\% | 0.02\% | -0.03\% | 0.28\% | 0.31\% | -0.27\% | 0.03\% | 0.30\% | -0.04\% | -0.07\% | -0.33\% | -0.02\% | -0.06\% | -0.30\% | -0.46\% |
|  |  | 0.4249 | 0.3181 | 0.0538 | -0.1039 | 0.9283 | 1.1070 | -0.7907 | 0.1402 | 0.9014 | -0.1173 | -0.2368 | -1.1186 | -0.0660 | -0.1880 | -0.9435 | -1.3854 |

Panel B. The cross-sectional momentum using market-weighted return





| MW | J | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.09\% | 0.25\% | 0.48\% | 0.52\% | 0.46\% | 0.90\% | 1.08\% | 0.88\% | 1.01\% | 1.23\% | 1.09\% | 0.84\% | 1.15\% | 1.06\% | 0.99\% | 0.74\% |
|  |  | 0.2441 | 0.8723 | 1.7863 | 2.0585 | 1.0075 | 2.1645 | 2.9347 | 2.5484 | 2.2625 | 2.9182 | 2.6627 | 2.2154 | 2.4339 | 2.3458 | 2.3159 | 1.7971 |
| CAR (1) |  | 0.12\% | 0.40\% | 0.64\% | 0.50\% | 0.79\% | 1.14\% | 1.10\% | 0.81\% | 1.20\% | 1.22\% | 1.02\% | 0.71\% | 0.93\% | 0.96\% | 0.86\% | 0.59\% |
|  |  | 0.3168 | 1.3312 | 2.3663 | 1.9175 | 1.7892 | 2.8087 | 2.9680 | 2.3344 | 2.7255 | 2.9291 | 2.4380 | 1.8502 | 1.8734 | 2.1102 | 2.0024 | 1.3993 |
| BHAR (0) |  | 0.12\% | 0.20\% | 0.48\% | 0.75\% | 0.37\% | 1.20\% | 1.43\% | 1.65\% | 1.36\% | 1.46\% | 0.65\% | 1.65\% | 1.09\% | 1.01\% | 0.80\% | 0.78\% |
|  |  | 0.2440 | 0.4028 | 0.9495 | 1.4522 | 0.6942 | 2.3795 | 3.0748 | 3.6658 | 2.7103 | 2.7897 | 1.3961 | 3.2808 | 1.9403 | 2.1088 | 1.5079 | 1.3228 |
| BHAR (1) |  | 0.17\% | 0.43\% | 0.70\% | 1.00\% | 0.91\% | 1.30\% | 1.47\% | 1.42\% | 1.41\% | 1.63\% | 0.65\% | 1.61\% | 0.93\% | 0.75\% | 0.90\% | 0.80\% |
|  |  | 0.3442 | 0.9192 | 1.5963 | 1.9865 | 1.8580 | 2.7127 | 3.2850 | 3.1070 | 2.9420 | 3.3115 | 1.3204 | 3.1342 | 1.6758 | 1.5582 | 1.8993 | 1.5199 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.94\% | 0.77\% | 0.79\% | 0.62\% | 0.56\% | 0.45\% | 0.47\% | 0.39\% | 0.83\% | 0.67\% | 0.65\% | 0.45\% | 0.58\% | 0.46\% | 0.42\% | 0.38\% |
|  |  | 1.5847 | 1.5865 | 2.0260 | 1.7433 | 0.8219 | 0.8040 | 0.9987 | 0.9212 | 1.2316 | 1.0934 | 1.2335 | 0.9344 | 0.8330 | 0.7723 | 0.7834 | 0.7541 |
| CAR (1) |  | 1.20\% | 0.85\% | 0.84\% | 0.66\% | 0.51\% | 0.53\% | 0.47\% | 0.41\% | 0.74\% | 0.62\% | 0.55\% | 0.40\% | 0.43\% | 0.43\% | 0.38\% | 0.35\% |
|  |  | 2.1442 | 1.8899 | 2.1535 | 1.8856 | 0.7619 | 0.9771 | 1.0454 | 1.0172 | 1.1010 | 1.0924 | 1.1131 | 0.8741 | 0.6369 | 0.7541 | 0.7328 | 0.7232 |
| BHAR (0) |  | 0.97\% | 0.63\% | 0.18\% | 0.76\% | 0.76\% | 0.71\% | 0.41\% | 0.95\% | 0.58\% | 0.75\% | 1.27\% | 0.87\% | 0.44\% | 0.32\% | -0.17\% | 0.44\% |
|  |  | 1.3470 | 0.8398 | 0.3112 | 1.0485 | 1.1213 | 0.9942 | 0.7164 | 1.5842 | 0.8357 | 0.9588 | 1.8260 | 1.3968 | 0.6146 | 0.4530 | -0.2359 | 0.6400 |
| BHAR (1) |  | 1.76\% | 1.06\% | 0.11\% | 0.85\% | 0.32\% | $0.89 \%$ | 0.65\% | 0.78\% | $0.62 \%$ | 0.59\% | $1.23 \%$ | 0.62\% | $0.39 \%$ | $0.26 \%$ | $-0.03 \%$ | 0.54\% |
|  |  | 3.0755 | 1.6494 | 0.1921 | 1.2450 | 0.4618 | $1.3249$ | 1.1164 | 1.3364 | $0.9047$ | $0.7734$ | $1.7971$ | 1.0114 | $0.5418$ | $0.3812$ | $-0.0361$ | 0.8087 |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.42\% | 0.31\% | 0.22\% | 0.13\% | 0.46\% | 0.29\% | 0.23\% | 0.05\% | 0.24\% | 0.13\% | 0.05\% | -0.04\% | 0.34\% | 0.18\% | 0.10\% | 0.06\% |
|  |  | 0.9664 | 0.9631 | 0.7698 | 0.5157 | 0.9562 | 0.7057 | 0.6118 | 0.1470 | 0.4735 | 0.2865 | 0.1274 | -0.1093 | 0.7263 | 0.3989 | 0.2453 | 0.1767 |
| CAR (1) |  | -0.06\% | 0.23\% | 0.14\% | 0.06\% | 0.42\% | 0.34\% | 0.17\% | 0.00\% | 0.20\% | 0.17\% | 0.00\% | -0.08\% | 0.34\% | 0.12\% | 0.06\% | 0.07\% |
|  |  | -0.1174 | 0.7439 | 0.4971 | 0.2493 | 0.9127 | 0.8363 | 0.4687 | -0.0013 | 0.3867 | 0.3841 | 0.0022 | -0.2205 | 0.7248 | 0.2691 | 0.1655 | 0.2152 |
| BHAR (0) |  | 0.27\% | 0.21\% | 0.70\% | 0.26\% | $0.69 \%$ | 0.12\% | 0.18\% | 0.28\% | 0.49\% | $\mathbf{0 . 0 1 \%}$ | 0.41\% | -0.39\% | 0.46\% | 0.47\% | 0.33\% | 0.38\% |
|  |  | 0.5559 | 0.4303 | 1.7045 | 0.5767 | 1.3011 | 0.2435 | 0.4155 | 0.6633 | 0.8265 | 0.0099 | 0.8889 | -0.6987 | 0.8746 | 0.9979 | 0.6862 | 0.9361 |
| BHAR (1) |  | -0.12\% | -0.29\% | 0.72\% | $\mathbf{0 . 1 1 \%}$ | 0.51\% | 0.03\% | 0.00\% | 0.31\% | 0.15\% | 0.16\% | 0.51\% | -0.42\% | 0.49\% | 0.28\% | -0.10\% | 0.44\% |
|  |  | -0.2340 | -0.5743 | 1.7275 | 0.2392 | 1.0513 | 0.0609 | -0.0025 | 0.7533 | 0.2566 | 0.2979 | 1.1249 | -0.8089 | 0.9823 | 0.6070 | -0.2173 | 1.1359 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.04\% | 0.02\% | 0.23\% | 0.37\% | 0.09\% | 0.13\% | 0.40\% | 0.54\% | 0.35\% | 0.43\% | 0.65\% | 0.73\% | 0.54\% | 0.76\% | 0.84\% | 0.84\% |
|  |  | 0.1130 | 0.0557 | 0.7926 | 1.5124 | 0.2063 | 0.2818 | 1.0366 | 1.6356 | 0.6356 | 0.9215 | 1.5688 | 1.9581 | 1.0554 | 1.6635 | 1.8780 | 2.0001 |
| CAR (1) |  | 0.00\% | 0.13\% | 0.38\% | $\mathbf{0 . 4 1 \%}$ | 0.14\% | 0.21\% | 0.52\% | 0.51\% | 0.31\% | 0.60\% | 0.77\% | 0.72\% | 0.77\% | 0.89\% | 0.96\% | 0.87\% |
|  |  | -0.0078 | 0.3836 | 1.2214 | 1.6619 | 0.3060 | 0.4480 | 1.3459 | 1.5261 | 0.5718 | 1.3171 | 1.9293 | 1.9315 | 1.6234 | 1.9371 | 2.1583 | 2.0681 |
| BHAR (0) |  | -0.48\% | -0.79\% | -0.13\% | -0.44\% | -0.63\% | 0.04\% | 0.18\% | 0.54\% | 0.14\% | 0.16\% | 0.30\% | 0.30\% | 0.72\% | 1.16\% | 1.07\% | 1.03\% |
|  |  | -1.0224 | -1.6218 | -0.2505 | -0.9189 | -1.1699 | 0.0787 | 0.2822 | 1.0238 | 0.2390 | 0.3047 | 0.6412 | 0.5399 | 1.4172 | 2.2667 | 2.1524 | 2.0245 |
| BHAR (1) |  | 0.12\% | -0.57\% | 0.16\% | -0.12\% | -0.01\% | 0.40\% | 0.38\% | 0.52\% | 0.00\% | 0.17\% | 0.12\% | 0.04\% | 0.90\% | 1.10\% | 1.20\% | 0.93\% |
|  |  | 0.2445 | -1.1162 | 0.3205 | -0.2649 | -0.0175 | 0.7838 | 0.6040 | 0.9628 | 0.0061 | 0.2893 | 0.2268 | 0.0739 | 1.7803 | 2.1142 | 2.4614 | 1.8628 |


| MW | J H | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\mathrm{H}=$ | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.41\% | 0.97\% | 0.60\% | 0.52\% | 1.12\% | 0.79\% | 0.59\% | 0.48\% | 0.69\% | 0.50\% | 0.32\% | 0.10\% | 0.34\% | 0.19\% | -0.06\% | -0.21\% |
|  |  | 2.6970 | 2.2103 | 1.5679 | 1.4870 | 2.1001 | 1.6771 | 1.3033 | 1.0691 | 1.2402 | 0.8586 | 0.5442 | 0.1780 | 0.4802 | 0.2638 | -0.0946 | -0.3137 |
| CAR (1) |  | 1.18\% | 0.75\% | 0.51\% | 0.34\% | 1.03\% | 0.72\% | 0.51\% | 0.36\% | 0.79\% | 0.46\% | 0.20\% | -0.02\% | 0.15\% | 0.01\% | -0.25\% | -0.24\% |
|  |  | 2.3244 | 1.8006 | 1.4178 | 1.0019 | 2.2020 | 1.5322 | 1.1141 | 0.7905 | 1.3786 | 0.7929 | 0.3519 | -0.0370 | 0.2052 | 0.0212 | -0.3785 | -0.3830 |
| BHAR (0) |  | 1.45\% | 0.20\% | 1.05\% | -0.46\% | 1.12\% | 1.25\% | 0.89\% | 0.35\% | 0.81\% | 0.23\% | 0.22\% | -0.25\% | 0.15\% | 0.08\% | -0.43\% | 0.09\% |
|  |  | 2.2734 | 0.3250 | 1.7945 | -0.8269 | 1.9014 | 2.4626 | 1.3667 | 0.5884 | 1.3412 | 0.3409 | 0.3401 | -0.3973 | 0.2027 | 0.1137 | -0.6058 | 0.1264 |
| BHAR (1) |  | 1.31\% | 0.12\% | 1.01\% | -0.29\% | 0.94\% | 1.01\% | 0.78\% | 0.14\% | 0.61\% | 0.24\% | -0.04\% | -0.35\% | -0.01\% | -0.20\% | -0.58\% | 0.10\% |
|  |  | 2.3118 | 0.1994 | 1.8430 | -0.5315 | 1.8230 | 2.0090 | 1.2267 | 0.2271 | 1.0102 | 0.3650 | -0.0636 | -0.5625 | -0.0197 | -0.2631 | -0.7816 | 0.1353 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.32\% | 0.53\% | 0.52\% | 0.60\% | 0.57\% | 0.59\% | 0.66\% | 0.53\% | 0.69\% | 0.76\% | 0.63\% | 0.47\% | 0.89\% | 0.80\% | 0.59\% | 0.48\% |
|  |  | 1.0945 | 2.1230 | 2.2489 | 3.0958 | 1.6698 | 1.7903 | 2.1477 | 1.9402 | 1.8066 | 2.0654 | 1.8562 | 1.4642 | 2.3409 | 2.2110 | 1.6858 | 1.4526 |
| CAR (1) |  | 0.58\% | 0.63\% | 0.64\% | 0.60\% | 0.59\% | 0.72\% | 0.64\% | 0.44\% | 0.84\% | 0.77\% | $\mathbf{0 . 6 1 \%}$ | 0.37\% | 0.72\% | 0.67\% | 0.50\% | 0.40\% |
|  |  | 1.9830 | 2.4592 | 2.7582 | 3.1631 | 1.6698 | 2.1057 | 2.1176 | 1.6108 | 2.1708 | 2.0700 | 1.7912 | 1.1566 | 1.9396 | 1.8304 | 1.4511 | 1.2112 |
| BHAR (0) |  | 0.09\% | 0.15\% | 0.07\% | 0.15\% | 0.35\% | 0.73\% | 0.44\% | 0.99\% | 0.65\% | 0.55\% | 0.73\% | 0.52\% | 0.85\% | 1.27\% | 0.83\% | 0.64\% |
|  |  | 0.2605 | 0.4285 | 0.2166 | 0.4286 | 0.8854 | 1.8742 | 1.0746 | 2.8950 | 1.5080 | 1.2363 | 2.0226 | 1.4661 | 2.0422 | 3.0520 | 1.8941 | 1.6310 |
| BHAR (1) |  | 0.27\% | 0.03\% | 0.16\% | 0.21\% | 0.61\% | 0.87\% | 0.26\% | 0.86\% | 0.58\% | $0.50 \%$ | $0.52 \%$ | 0.17\% | $0.59 \%$ | $0.92 \%$ | 0.79\% | 0.48\% |
|  |  | 0.7664 | 0.0778 | 0.4735 | 0.5964 | 1.4706 | 2.2039 | 0.6243 | 2.4714 | 1.3553 | $1.1350$ | $1.4163$ | 0.4079 | $1.3957$ | $2.3015$ | 1.8988 | $1.2771$ |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.14\% | 0.36\% | 0.42\% | 0.58\% | 0.32\% | 0.50\% | 0.73\% | 0.65\% | 0.54\% | 0.77\% | 0.79\% | 0.54\% | 0.57\% | 0.75\% | 0.63\% | 0.42\% |
|  |  | 0.3426 | 0.9693 | 1.2623 | 1.9790 | 0.6558 | 1.1082 | 1.8752 | 1.8188 | 1.0005 | 1.5106 | 1.6738 | 1.2636 | 0.9952 | 1.3955 | 1.2601 | 0.8992 |
| CAR (1) |  | 0.14\% | 0.44\% | 0.52\% | 0.57\% | 0.50\% | 0.69\% | 0.79\% | 0.58\% | 0.71\% | 0.88\% | 0.75\% | 0.41\% | 0.68\% | 0.79\% | 0.56\% | 0.30\% |
|  |  | 0.3180 | 1.1761 | 1.5456 | 1.9821 | 1.0566 | 1.5781 | 2.0664 | 1.6666 | 1.2565 | 1.7254 | 1.6223 | 0.9775 | 1.2430 | 1.5270 | 1.1611 | 0.6612 |
| BHAR (0) |  | $-\mathbf{0 . 1 0 \%}$ | 0.05\% | 0.13\% | $\mathbf{0 . 0 1 \%}$ | $0.40 \%$ | $0.41 \%$ | $\mathbf{0 . 4 8 \%}$ | $0.97 \%$ | $0.62 \%$ | $\mathbf{0 . 8 7 \%}$ | 0.80\% | 0.68\% | 0.51\% | 0.64\% | 0.73\% | 0.36\% |
|  |  | -0.1962 | 0.1032 | 0.2856 | 0.0251 | 0.7844 | 0.8143 | 0.9209 | 2.6182 | 1.0183 | 1.4701 | 1.4987 | 1.3799 | 0.8183 | 1.1329 | 1.3145 | 0.6500 |
| BHAR (1) |  | -0.15\% | 0.04\% | 0.12\% | 0.25\% | 0.45\% | 0.47\% | 0.60\% | 0.72\% | 0.86\% | 0.94\% | 0.70\% | 0.39\% | 0.62\% | 0.52\% | 0.33\% | 0.08\% |
|  |  | -0.3130 | 0.0845 | 0.2604 | 0.5700 | 0.9257 | 0.9838 | 1.2470 | 1.8616 | 1.4665 | 1.7592 | 1.3404 | 0.8098 | 1.0814 | 0.9111 | 0.5701 | 0.1372 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.22\% | -0.01\% | 0.19\% | 0.20\% | 0.05\% | 0.31\% | 0.41\% | 0.31\% | 0.41\% | 0.51\% | 0.41\% | 0.26\% | 0.35\% | 0.31\% | 0.22\% | 0.16\% |
|  |  | -0.7446 | -0.0529 | 0.8439 | 0.9437 | 0.1135 | 0.8836 | 1.2772 | 1.0542 | 0.9768 | 1.2952 | 1.1247 | 0.7687 | 0.7967 | 0.7372 | 0.5587 | 0.4254 |
| CAR (1) |  | -0.10\% | 0.15\% | 0.31\% | 0.19\% | 0.32\% | 0.54\% | 0.47\% | 0.30\% | 0.64\% | 0.58\% | 0.42\% | 0.23\% | 0.35\% | 0.31\% | 0.19\% | 0.11\% |
|  |  | -0.3364 | 0.5677 | 1.3125 | 0.9068 | 0.8252 | 1.5780 | 1.4791 | 1.0268 | 1.5217 | 1.5106 | 1.1419 | 0.6615 | 0.8172 | 0.7829 | 0.4981 | 0.3044 |
| BHAR (0) |  | -0.48\% | -0.04\% | -0.29\% | 0.22\% | 0.06\% | 0.24\% | -0.10\% | 0.70\% | 0.44\% | 0.41\% | 0.56\% | 0.25\% | 0.41\% | 0.55\% | 0.26\% | $\mathbf{0 . 2 9 \%}$ |
|  |  | -1.2075 | -0.1141 | -0.6665 | 0.6066 | 0.1392 | 0.5742 | -0.2226 | 2.2296 | 0.9389 | 0.9118 | 1.4197 | 0.6144 | 0.8816 | 1.2697 | 0.6071 | 0.6328 |
| BHAR (1) |  | -0.12\% | -0.32\% | -0.27\% | 0.18\% | 0.21\% | 0.40\% | -0.08\% | 0.48\% | 0.60\% | 0.38\% | 0.40\% | 0.05\% | 0.19\% | 0.30\% | 0.09\% | 0.09\% |
|  |  | -0.3364 | -0.7457 | -0.6441 | 0.4594 | 0.5125 | 1.0807 | -0.1901 | 1.4878 | 1.2587 | 0.7660 | 0.9135 | 0.1197 | 0.3737 | 0.7257 | 0.2111 | 0.1903 |

Panel C. The cross-sectional momentum using inversed-volatility weighted return



| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.43\% | 0.49\% | 0.30\% | 0.20\% | 0.56\% | 0.47\% | 0.36\% | 0.15\% | 0.48\% | 0.40\% | 0.08\% | -0.13\% | 0.29\% | 0.05\% | -0.17\% | -0.30\% |
|  |  | 1.0092 | 1.3148 | 0.9413 | 0.6790 | 1.1525 | 1.0536 | 0.8756 | 0.4003 | 0.9653 | 0.8361 | 0.1746 | -0.3158 | 0.5440 | 0.0959 | -0.3433 | -0.6438 |
| CAR (1) |  | 0.44\% | 0.45\% | 0.29\% | 0.16\% | 0.64\% | 0.50\% | 0.31\% | 0.09\% | 0.61\% | 0.34\% | 0.01\% | -0.21\% | 0.27\% | -0.05\% | -0.25\% | -0.38\% |
|  |  | 1.0035 | 1.2335 | 0.9142 | 0.5329 | 1.3586 | 1.1704 | 0.7768 | 0.2302 | 1.2389 | 0.7083 | 0.0181 | -0.4868 | 0.5199 | -0.0902 | -0.5129 | -0.8010 |
| BHAR (0) |  | 0.20\% | 0.78\% | 0.22\% | 0.87\% | 0.66\% | 0.70\% | 0.28\% | 0.46\% | 0.61\% | 0.45\% | -0.13\% | -0.04\% | 0.27\% | -0.23\% | -0.13\% | -0.97\% |
|  |  | 0.3939 | 1.7348 | 0.4327 | 1.9865 | 1.2546 | 1.3454 | 0.5608 | 0.9301 | 1.1645 | 0.8838 | -0.2276 | -0.0839 | 0.4783 | -0.3912 | -0.2671 | -1.5181 |
| BHAR (1) |  | 0.70\% | 0.89\% | 0.25\% | 1.03\% | 0.64\% | 0.48\% | 0.18\% | 0.27\% | 0.70\% | 0.36\% | 0.02\% | -0.30\% | 0.36\% | -0.30\% | -0.33\% | -0.82\% |
|  |  | 1.3527 | 1.7280 | 0.4978 | 2.1428 | 1.3162 | 1.0249 | 0.3434 | 0.5918 | 1.3174 | 0.7060 | 0.0304 | -0.6070 | 0.6587 | -0.5179 | -0.7311 | -1.3877 |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.48\% | 0.45\% | 0.28\% | 0.09\% | 0.62\% | 0.48\% | 0.16\% | -0.11\% | 0.42\% | 0.10\% | -0.11\% | -0.40\% | 0.04\% | -0.16\% | -0.47\% | -0.63\% |
|  |  | 1.3869 | 1.6396 | 1.1165 | 0.3724 | 1.6105 | 1.3222 | 0.4913 | -0.3587 | 0.9580 | 0.2529 | -0.2960 | -1.1540 | 0.0844 | -0.3987 | -1.2252 | -1.8049 |
| CAR (1) |  | 0.42\% | 0.48\% | 0.20\% | -0.02\% | 0.77\% | 0.45\% | 0.04\% | -0.25\% | 0.28\% | -0.02\% | -0.29\% | -0.54\% | -0.11\% | -0.33\% | -0.63\% | -0.74\% |
|  |  | 1.3260 | 1.7715 | 0.7773 | -0.0871 | 2.0909 | 1.2730 | 0.1275 | -0.8434 | 0.6383 | -0.0481 | -0.7645 | -1.6194 | -0.2564 | -0.8093 | -1.6682 | -2.1976 |
| BHAR (0) |  | 0.46\% | 0.14\% | -0.17\% | 0.01\% | 0.59\% | 0.53\% | 0.04\% | -0.02\% | 0.41\% | $\mathbf{0 . 0 2 \%}$ | -0.09\% | -0.40\% | -0.10\% | -0.04\% | -0.53\% | -0.42\% |
|  |  | 1.1423 | 0.3099 | -0.4097 | 0.0236 | 1.2900 | 1.3051 | 0.0877 | -0.0726 | 0.8571 | 0.0424 | -0.2102 | -0.9436 | -0.2014 | -0.0968 | -1.1925 | -1.0957 |
| BHAR (1) |  | 0.25\% | -0.07\% | -0.17\% | -0.26\% | 0.43\% | 0.38\% | -0.02\% | -0.27\% | 0.07\% | -0.19\% | -0.27\% | -0.54\% | -0.37\% | -0.18\% | -0.63\% | -0.52\% |
|  |  | 0.6299 | -0.1627 | -0.4603 | -0.6654 | 1.0066 | 0.9924 | -0.0539 | -0.8145 | 0.1517 | -0.4072 | -0.6827 | -1.3852 | -0.8072 | -0.4787 | -1.4560 | -1.4655 |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.71\% | 0.60\% | 0.50\% | 0.53\% | 0.99\% | 0.78\% | 0.78\% | 0.69\% | 0.81\% | 0.79\% | 0.67\% | 0.59\% | 1.02\% | 0.82\% | 0.67\% | 0.50\% |
|  |  | 2.1600 | 1.7332 | 1.6282 | 2.1922 | 2.2456 | 1.7488 | 2.0037 | 1.9890 | 1.7296 | 1.7564 | 1.5129 | 1.4180 | 1.9813 | 1.5759 | 1.3389 | 1.0630 |
| CAR (1) |  | 0.77\% | 0.49\% | 0.48\% | 0.42\% | 0.91\% | 0.75\% | 0.68\% | 0.53\% | 0.78\% | 0.67\% | 0.63\% | 0.47\% | 0.89\% | 0.72\% | 0.53\% | 0.34\% |
|  |  | 2.0185 | 1.3466 | 1.6113 | 1.6231 | 1.8962 | 1.6777 | 1.7596 | 1.5444 | 1.7075 | 1.4471 | 1.3991 | 1.1029 | 1.6749 | 1.3687 | 1.0543 | 0.7296 |
| BHAR (0) |  | 0.79\% | -0.25\% | -0.47\% | 0.10\% | 0.80\% | 0.95\% | 0.11\% | 1.49\% | 1.06\% | 0.95\% | 0.98\% | 1.30\% | 1.12\% | 1.21\% | 1.21\% | 0.27\% |
|  |  | 1.7716 | -0.4814 | -0.8278 | 0.2083 | 1.5705 | 1.6912 | 0.1888 | 2.9209 | 2.1425 | 1.8553 | 1.8055 | 2.7853 | 2.0068 | 2.1994 | 2.1936 | 0.5175 |
| BHAR (1) |  | 0.46\% | -0.22\% | -0.44\% | 0.37\% | 0.76\% | 0.83\% | 0.19\% | 1.19\% | 0.49\% | 0.86\% | 0.63\% | 0.74\% | 0.75\% | 0.95\% | 0.77\% | 0.03\% |
|  |  | 0.9022 | -0.4916 | -0.8158 | 0.8126 | 1.6085 | 1.4213 | 0.3637 | 2.3228 | 1.0213 | 1.7669 | 1.1465 | 1.5895 | 1.4242 | 1.7527 | 1.3189 | 0.0579 |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.03\% | -0.04\% | -0.10\% | -0.14\% | 0.27\% | 0.21\% | 0.01\% | -0.14\% | 0.29\% | 0.14\% | -0.02\% | -0.15\% | 0.37\% | 0.23\% | 0.08\% | -0.09\% |
|  |  | 0.1539 | -0.1931 | -0.5098 | -0.8140 | 0.9517 | 0.7537 | 0.0357 | -0.6376 | 0.9309 | 0.4463 | -0.0613 | -0.5795 | 1.0914 | 0.6740 | 0.2726 | -0.3189 |
| CAR (1) |  | 0.08\% | 0.03\% | -0.11\% | -0.21\% | 0.45\% | 0.24\% | -0.05\% | -0.22\% | 0.37\% | 0.09\% | -0.12\% | -0.27\% | 0.30\% | 0.15\% | -0.03\% | -0.20\% |
|  |  | 0.3307 | 0.1554 | -0.5371 | -1.1779 | 1.5432 | 0.8435 | -0.1879 | -0.9709 | 1.1773 | 0.2561 | -0.3839 | -1.0199 | 0.8778 | 0.4479 | -0.0986 | -0.7424 |
| BHAR (0) |  | 0.08\% | -0.30\% | -0.37\% | -0.31\% | 0.05\% | 0.01\% | -0.25\% | 0.25\% | 0.31\% | 0.14\% | 0.12\% | 0.36\% | 0.36\% | 0.25\% | 0.00\% | -0.22\% |
|  |  | 0.2640 | -0.7415 | -1.0139 | -0.8058 | 0.1409 | 0.0305 | -0.6562 | 1.1213 | 0.8884 | 0.3682 | 0.4480 | 1.1099 | 1.0166 | 0.7721 | 0.0136 | -0.6900 |
| BHAR (1) |  | 0.24\% | -0.14\% | -0.46\% | -0.42\% | 0.56\% | 0.33\% | 0.00\% | 0.24\% | 0.22\% | 0.01\% | -0.07\% | 0.10\% | 0.33\% | 0.17\% | -0.05\% | -0.45\% |
|  |  | 0.9276 | -0.4479 | -1.2062 | -1.0888 | 1.9174 | 1.0416 | 0.0061 | 0.8549 | 0.6388 | 0.0207 | -0.2269 | 0.3197 | 0.9449 | 0.5495 | -0.1509 | -1.2688 |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.78\% | 0.75\% | 0.83\% | 0.80\% | 0.99\% | 1.08\% | 1.08\% | 0.94\% | 1.32\% | 1.26\% | 1.09\% | 0.90\% | 1.32\% | 1.18\% | 0.99\% | 0.81\% |
|  |  | 3.1711 | 3.4025 | 4.6202 | 4.6733 | 3.2375 | 4.0656 | 4.4936 | 4.1367 | 4.4340 | 4.3890 | 4.0106 | 3.4780 | 4.2853 | 4.0228 | 3.5357 | 2.9725 |
| CAR (1) |  | 0.78\% | 0.79\% | 0.81\% | 0.75\% | 1.09\% | 1.12\% | 1.04\% | 0.87\% | 1.37\% | 1.19\% | 0.98\% | 0.78\% | 1.30\% | 1.09\% | 0.88\% | 0.71\% |
|  |  | 3.3939 | 3.7883 | 4.5430 | 4.4867 | 4.0381 | 4.4676 | 4.5147 | 3.9482 | 4.6878 | 4.2499 | 3.6038 | 3.0458 | 4.3725 | 3.7752 | 3.1726 | 2.6533 |
| BHAR (0) |  | 0.72\% | 0.72\% | 0.90\% | 0.75\% | 0.92\% | 1.07\% | 0.96\% | 0.79\% | 1.25\% | 1.18\% | 1.19\% | 0.73\% | 1.17\% | 1.01\% | 1.08\% | 0.66\% |
|  |  | 2.3882 | 2.4940 | 2.8969 | 2.5658 | 2.6397 | 3.1719 | 2.9573 | 2.8938 | 3.7564 | 3.5239 | 3.7554 | 2.2817 | 3.6116 | 3.4133 | 3.5666 | 2.1857 |
| BHAR (1) |  | 0.72\% | 0.72\% | 1.09\% | 0.80\% | 1.02\% | 1.07\% | 0.98\% | 0.70\% | 1.33\% | 1.06\% | 0.98\% | 0.44\% | 1.18\% | 0.99\% | 0.97\% | 0.68\% |
|  |  | 2.7018 | 2.4911 | 3.4126 | 2.6858 | 3.4103 | 3.2612 | 3.1277 | 2.6848 | 4.0088 | 3.1981 | 3.2391 | 1.2850 | 3.7547 | 3.3531 | 3.0601 | 2.3390 |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.10\% | -0.21\% | -0.15\% | -0.04\% | -0.32\% | -0.28\% | -0.10\% | -0.14\% | -0.29\% | -0.15\% | -0.17\% | -0.24\% | -0.10\% | -0.23\% | -0.29\% | -0.34\% |
|  |  | -0.4209 | -0.9408 | -0.7659 | -0.2093 | -1.0257 | -0.9932 | -0.3999 | -0.6092 | -0.8639 | -0.4802 | -0.5789 | -0.9526 | -0.2899 | -0.7132 | -0.9906 | -1.2895 |
| CAR (1) |  | -0.01\% | -0.15\% | -0.03\% | -0.03\% | -0.20\% | -0.13\% | -0.02\% | -0.16\% | -0.04\% | -0.04\% | -0.14\% | -0.26\% | -0.05\% | -0.25\% | -0.31\% | -0.36\% |
|  |  | -0.0365 | -0.7227 | -0.1682 | -0.1630 | -0.6730 | -0.4681 | -0.0906 | -0.7353 | -0.1269 | -0.1399 | -0.4969 | -1.0659 | -0.1502 | -0.8270 | -1.1123 | -1.4203 |
| BHAR (0) |  | -0.22\% | 0.05\% | -0.08\% | 0.15\% | -0.25\% | -0.27\% | -0.16\% | 0.21\% | -0.20\% | -0.06\% | 0.09\% | -0.08\% | -0.05\% | -0.17\% | -0.26\% | -0.34\% |
|  |  | -0.8049 | 0.1798 | -0.2671 | 0.5250 | -0.7169 | -0.7854 | -0.5006 | 0.7521 | -0.5702 | -0.1752 | 0.3099 | -0.3102 | -0.1573 | -0.5007 | -0.8498 | -1.1421 |
| BHAR (1) |  | -0.12\% | 0.04\% | -0.11\% | 0.18\% | -0.32\% | -0.52\% | -0.10\% | 0.03\% | -0.20\% | 0.03\% | -0.02\% | -0.20\% | -0.13\% | -0.40\% | -0.46\% | -0.43\% |
|  |  | -0.4703 | 0.1591 | -0.4061 | 0.7005 | -0.9965 | -1.6015 | -0.3649 | 0.1246 | -0.6069 | 0.1025 | -0.0891 | -0.8027 | -0.3993 | -1.2593 | -1.5687 | $-1.4617$ |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.89\% | 0.85\% | 0.83\% | 0.80\% | 1.24\% | 1.17\% | 1.16\% | 1.00\% | 1.32\% | 1.34\% | 1.17\% | 1.01\% | 1.50\% | 1.26\% | 1.12\% | 0.97\% |
|  |  | 3.1263 | 3.8854 | 4.2143 | 4.1258 | 4.2981 | 4.4866 | 4.5035 | 3.9367 | 4.1606 | 4.3672 | 3.8083 | 3.3643 | 4.1946 | 3.6061 | 3.2259 | 2.8517 |
| CAR (1) |  | 0.85\% | 0.86\% | 0.83\% | 0.71\% | 1.21\% | 1.22\% | 1.08\% | 0.89\% | 1.42\% | 1.30\% | 1.10\% | 0.91\% | 1.42\% | 1.16\% | 1.01\% | 0.90\% |
|  |  | 3.4052 | 4.0873 | 4.2605 | 3.6852 | 4.3709 | 4.6872 | 4.0716 | 3.4461 | 4.5253 | 4.1144 | 3.4717 | 3.0197 | 3.9422 | 3.2868 | 2.9055 | 2.6480 |
| BHAR (0) |  | 0.96\% | 0.85\% | 0.84\% | 0.42\% | 1.33\% | 1.33\% | 1.05\% | 1.42\% | 1.31\% | 1.12\% | 1.38\% | 1.22\% | 1.35\% | 1.21\% | 1.13\% | 1.01\% |
|  |  | 2.7743 | 2.5384 | 2.6471 | 1.1331 | 4.0223 | 4.1521 | 2.6725 | 5.0848 | 3.8085 | 2.9594 | 4.2318 | 3.2768 | 3.4300 | 3.3997 | 2.9527 | 2.7490 |
| BHAR (1) |  | 0.95\% | 0.75\% | 0.65\% | 0.35\% | 1.12\% | 1.22\% | 0.99\% | 1.13\% | 1.42\% | 1.01\% | 1.34\% | 1.00\% | 1.22\% | 1.04\% | 1.03\% | 0.96\% |
|  |  | 2.8492 | 2.3937 | 1.9045 | 1.0484 | 3.5150 | 3.8210 | 2.7001 | 3.9673 | 4.3468 | 2.6887 | 4.0052 | 2.5502 | 3.0235 | 2.8600 | 2.8458 | 2.6807 |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.93\% | 1.65\% | 1.26\% | 1.15\% | 1.85\% | 1.57\% | 1.36\% | 1.15\% | 1.68\% | 1.48\% | 1.23\% | 1.04\% | 1.72\% | 1.40\% | 1.13\% | 0.90\% |
|  |  | 3.3776 | 4.2781 | 4.3278 | 4.8573 | 5.5510 | 5.4695 | 5.2663 | 5.1041 | 5.2726 | 5.1136 | 4.5430 | 4.2815 | 5.1002 | 4.3474 | 3.9328 | 3.5461 |
| CAR (1) |  | 1.84\% | 1.47\% | 1.18\% | 1.01\% | 1.77\% | 1.49\% | 1.27\% | 0.99\% | 1.63\% | 1.39\% | 1.12\% | 0.89\% | 1.55\% | 1.26\% | 1.00\% | 0.75\% |
|  |  | 3.4106 | 4.0916 | 4.3696 | 4.5737 | 5.5939 | 5.4553 | 5.0807 | 4.5654 | 5.5341 | 4.9193 | 4.2352 | 3.7522 | 4.7375 | 4.0895 | 3.6278 | 3.0629 |
| BHAR (0) |  | 1.82\% | 1.31\% | 1.14\% | 0.39\% | 2.02\% | 1.71\% | 1.23\% | 1.15\% | 1.96\% | 1.54\% | 1.44\% | 1.29\% | 1.73\% | 1.49\% | 1.02\% | 1.00\% |
|  |  | 2.9350 | 4.0673 | 1.8118 | 1.2628 | 5.3834 | 4.8178 | 3.3939 | 3.9331 | 5.5214 | 4.4116 | 4.4786 | 4.4068 | 4.9700 | 4.5066 | 3.5801 | 2.7007 |
| BHAR (1) |  | 1.88\% | 1.14\% | 0.84\% | 0.42\% | 2.02\% | 1.45\% | 1.09\% | 0.88\% | 1.91\% | 1.50\% | 1.35\% | 1.20\% | 1.67\% | 1.21\% | 0.88\% | 1.02\% |
|  |  | 3.9524 | 3.6015 | 1.7134 | 1.4409 | 5.5779 | 4.1456 | 3.4343 | 2.8781 | 5.2524 | 4.4610 | 4.1660 | 4.3684 | 4.7138 | 3.5640 | 3.1595 | 2.7823 |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.75\% | 0.68\% | 0.74\% | 0.68\% | 0.99\% | 0.93\% | 0.98\% | 0.74\% | 1.34\% | 1.21\% | 0.92\% | 0.60\% | 1.36\% | 0.92\% | 0.64\% | 0.37\% |
|  |  | 2.1446 | 2.6470 | 3.0493 | 2.8976 | 2.6838 | 2.6196 | 2.9261 | 2.3253 | 3.2621 | 2.9865 | 2.3147 | 1.6052 | 3.1975 | 2.1976 | 1.5667 | 0.9378 |
| CAR (1) |  | 0.60\% | 0.67\% | 0.70\% | 0.54\% | 1.05\% | 1.05\% | 0.95\% | 0.60\% | 1.39\% | 1.13\% | 0.76\% | 0.42\% | 1.06\% | 0.67\% | 0.44\% | 0.20\% |
|  |  | 1.9693 | 2.6354 | 2.8295 | 2.2786 | 2.9294 | 2.9758 | 2.8110 | 1.8956 | 3.3283 | 2.7089 | 1.8991 | 1.1222 | 2.4160 | 1.5791 | 1.0699 | 0.4991 |
| BHAR (0) |  | 0.82\% | 0.76\% | 0.89\% | 0.80\% | 0.95\% | 1.06\% | 0.90\% | 1.36\% | 1.57\% | 1.22\% | 0.94\% | 0.99\% | 1.30\% | 1.00\% | 0.77\% | 0.29\% |
|  |  | 1.8600 | 1.8334 | 2.4872 | 2.0065 | 2.2523 | 2.5105 | 2.0607 | 3.8384 | 3.4499 | 2.6016 | 2.0891 | 2.1914 | 2.7301 | 2.2907 | 1.7268 | 0.6257 |
| BHAR (1) |  | 0.56\% | 0.70\% | 0.76\% | 0.50\% | 1.04\% | 1.07\% | 0.84\% | 1.00\% | 1.53\% | 1.20\% | 0.88\% | 0.92\% | 1.13\% | 0.71\% | 0.78\% | 0.15\% |
|  |  | 1.5399 | 2.1090 | 2.3626 | 1.3387 | 2.7553 | 2.5038 | 2.1604 | 2.8290 | 3.6551 | 2.7583 | 2.0463 | 2.2024 | 2.5253 | 1.6215 | 1.8445 | 0.3426 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.22\% | 0.54\% | 0.57\% | 0.46\% | 0.85\% | 0.88\% | 0.83\% | 0.67\% | 1.07\% | 0.89\% | 0.71\% | 0.51\% | 0.98\% | 0.69\% | 0.54\% | 0.42\% |
|  |  | 0.5632 | 1.6201 | 1.8681 | 1.6722 | 2.0024 | 2.2957 | 2.3408 | 2.0556 | 2.5037 | 2.0462 | 1.7613 | 1.3415 | 2.1576 | 1.5897 | 1.2932 | 1.0693 |
| CAR (1) |  | 0.28\% | 0.52\% | 0.58\% | 0.44\% | 0.89\% | 0.89\% | 0.75\% | 0.56\% | 1.02\% | 0.79\% | 0.61\% | 0.40\% | 0.89\% | 0.64\% | 0.48\% | 0.33\% |
|  |  | 0.6639 | 1.4773 | 1.6588 | 1.4771 | 2.0359 | 2.2452 | 2.0720 | 1.7198 | 2.3185 | 1.8218 | 1.5015 | 1.0753 | 1.9620 | 1.4731 | 1.1587 | 0.8437 |
| BHAR (0) |  | 0.00\% | 0.73\% | 0.46\% | 0.56\% | 0.78\% | 0.60\% | 0.81\% | 0.58\% | 0.78\% | 1.13\% | 0.83\% | 0.74\% | 1.04\% | 0.77\% | 0.48\% | 0.08\% |
|  |  | 0.0039 | 1.1738 | 0.7621 | 0.8410 | 1.5103 | 1.2356 | 1.2885 | 1.2381 | 1.5064 | 1.9484 | 1.6232 | 1.4582 | 2.0619 | 1.6617 | 1.0542 | 0.1749 |
| BHAR (1) |  | 0.25\% | 1.20\% | 0.90\% | 0.95\% | 0.53\% | 1.03\% | 0.90\% | 0.47\% | 0.89\% | 0.85\% | 0.54\% | 0.38\% | 0.71\% | 0.64\% | 0.54\% | 0.09\% |
|  |  | 0.4296 | 2.2123 | 1.2422 | 1.4792 | 0.9999 | 1.8105 | 1.2755 | 0.9732 | 1.9394 | 1.7128 | 1.0883 | 0.7183 | 1.5455 | 1.4185 | 1.1031 | 0.1947 |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.59\% | 0.71\% | 0.57\% | 0.37\% | 0.83\% | 0.75\% | 0.54\% | 0.30\% | 0.77\% | 0.58\% | 0.36\% | 0.15\% | 0.55\% | 0.35\% | 0.16\% | 0.00\% |
|  |  | 1.4739 | 2.4245 | 2.1093 | 1.4191 | 2.0833 | 2.0090 | 1.5345 | 0.9527 | 1.7610 | 1.3990 | 0.9492 | 0.4443 | 1.2112 | 0.8411 | 0.4062 | 0.0039 |
| CAR (1) |  | 0.61\% | 0.69\% | 0.50\% | 0.32\% | 0.87\% | 0.69\% | 0.43\% | 0.23\% | 0.71\% | 0.48\% | 0.22\% | 0.04\% | 0.43\% | 0.22\% | 0.01\% | -0.06\% |
|  |  | 1.5823 | 2.5697 | 1.8793 | 1.3044 | 2.2976 | 1.8738 | 1.2724 | 0.7639 | 1.6369 | 1.1810 | 0.5828 | 0.1229 | 0.9946 | 0.5490 | 0.0402 | -0.1746 |
| BHAR (0) |  | 0.43\% | 0.08\% | 0.61\% | 0.33\% | 0.97\% | 0.82\% | 0.35\% | 0.54\% | 0.87\% | 0.51\% | 0.64\% | 0.09\% | 0.68\% | 0.64\% | 0.35\% | 0.16\% |
|  |  | 0.9146 | 0.1744 | 1.7962 | 1.1492 | 2.0144 | 1.8980 | 0.7740 | 1.3587 | 1.7954 | 1.0946 | 1.9577 | 0.2126 | 1.4111 | 1.5276 | 0.8577 | 0.4174 |
| BHAR (1) |  | 0.58\% | 0.13\% | 0.67\% | 0.26\% | 1.00\% | 0.90\% | 0.28\% | 0.66\% | 0.74\% | 0.41\% | 0.62\% | 0.05\% | 0.57\% | 0.58\% | 0.04\% | 0.17\% |
|  |  | 1.4880 | 0.3923 | 2.1046 | 0.9757 | 2.5411 | 2.3803 | 0.6296 | 2.1017 | 1.6536 | 0.9671 | 2.0779 | 0.1197 | 1.3375 | 1.5338 | 0.0965 | 0.4605 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.55\% | 0.45\% | 0.58\% | 0.58\% | 0.74\% | 0.79\% | 0.83\% | 0.69\% | 1.11\% | 1.08\% | 0.98\% | 0.83\% | 1.18\% | 1.00\% | 0.92\% | 0.78\% |
|  |  | 2.4865 | 2.3475 | 3.0093 | 3.3123 | 2.7796 | 2.9109 | 3.1321 | 2.8291 | 3.3947 | 3.4391 | 3.1902 | 2.9047 | 3.3505 | 2.9450 | 2.7495 | 2.4141 |
| CAR (1) |  | 0.53\% | 0.49\% | 0.59\% | 0.55\% | 0.81\% | 0.84\% | 0.75\% | 0.62\% | 1.17\% | 1.08\% | 0.95\% | 0.75\% | 1.12\% | 0.94\% | 0.83\% | 0.70\% |
|  |  | 2.5672 | 2.4662 | 3.1196 | 3.2533 | 2.9251 | 2.9021 | 2.7863 | 2.5848 | 3.4142 | 3.3199 | 3.0991 | 2.6179 | 3.2135 | 2.7739 | 2.5086 | 2.1850 |
| BHAR (0) |  | 0.48\% | 0.15\% | 0.59\% | $\mathbf{0 . 6 2 \%}$ | 0.56\% | 0.90\% | 1.06\% | 0.62\% | 1.19\% | 1.19\% | 1.13\% | 0.70\% | 1.17\% | 1.03\% | 1.10\% | 0.66\% |
|  |  | 1.7866 | 0.4629 | 1.6401 | 1.8221 | 1.9480 | 2.6327 | 2.5702 | 2.1106 | 3.1856 | 3.2482 | 3.1541 | 2.1747 | 3.2557 | 2.6623 | 3.1626 | 1.7062 |
| BHAR (1) |  | 0.37\% | 0.16\% | 0.57\% | 0.41\% | 0.65\% | 0.99\% | 0.76\% | 0.46\% | 1.04\% | 1.05\% | 0.84\% | 0.36\% | 1.01\% | 0.84\% | 1.04\% | 0.52\% |
|  |  | 1.2444 | 0.4241 | 1.6374 | 1.2420 | 2.0783 | 3.1206 | 1.9952 | 1.5288 | 2.7731 | 2.7686 | 2.3725 | 1.0971 | 2.8149 | 2.2202 | 2.9910 | 1.3310 |



## Table 7.1. Monthly after-transaction cost return of time-series momentum strategy under different implementations

This table reports the average monthly returns after accounting for the transaction costs for 16 ( $\mathrm{J} \times \mathrm{H}$ ) time-series momentum strategies across the 24 stock markets along with an indication of significant level based on the Newey-West adjusted t-statistics. The results all relate to an implementation in which the cut-offs for selecting the stocks to be included in the cross-sectional momentum portfolios were set at $16 \%$.

At the end of each month if using monthly rebalancing or at the end of each holding period if using buy-and-hold portfolio construction, stocks in each market are selected into winner (loser) portfolio if average stock return over past $\mathbf{J}(\mathbf{J}=3,6,9$ and 12 months) is above pre-determined symmetric upper (lower) level. The pre-defined upper and lower cut-offs for each market are reported in the appendix. All stocks in the winner and loser portfolios are equally weighted in Panel A, market value weighted in Panel B and inversed volatility weighted in Panel C. Following Moskowitz et al. (2012), inversed volatility weighting scheme is given lower proportion to higher volatile stocks in the portfolio; that is the weight of the stock in portfolio is estimated by an inverse proportion of its ex-ante volatility from daily returns over J ( $\mathrm{J}=3,6,9$ and 12 months). The proportions of stocks in the portfolios remain same during the $\mathrm{H}(\mathrm{H}=3,6,9$ and 12 months) holding period. We implement portfolio constructions as in Jegadeesh and Titman (1993) for buy-and-hold and monthly-rebalancing. For buy-and-hold (BHAR), the procedure is rolling forward at the end of each H holding period to generate a new winner and loser portfolios. For monthly-rebalancing (CAR), the procedure is rolling forward at the end of each month to produce an overlapping winner (loser) portfolio which contains of winner (loser) portfolio of the past J month. The return of the winner (loser) portfolio is then the simple average return of the H numbers of winner (loser) portfolios. CAR (1) and BHAR (1) indicates one-month gap between the formation and the holding periods to avoid the bid-ask bounce, whereas CAR ( 0 ) and BHAR ( 0 ) indicates no gap between the formation and the holding periods. The return on momentum portfolio is then estimated as return difference return between winner and loser portfolio at each month.

The monthly transaction cost of each stock is inferred from the LOT - Y split model (Goyenko et al., 2009). The transaction costs of winner and loser portfolios are then estimated by Cost of portfolio ${ }_{t}=\sum_{i=1}^{i=m} \mid \Delta$ weight $(t, t-H)_{i} \mid \times \operatorname{cost}_{i, t}$, the sum product of absolute proportion changes $\left(\Delta w e i g h t(t, t-H)_{i}\right)$ for each stock in the portfolio and its transaction cost (cost ${ }_{i, t}$ ) at month $t$ from one holding period $(\mathrm{H})$ to another. After-transaction cost time-series momentum return is calculated by subtracting the transaction costs of winner and loser portfolios from the momentum return at each month

Panel A. The time-series momentum using equal-weighted return



| EW | J | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 6 |  | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.03\% | -0.38\% | -0.40\% | -0.39\% | -0.68\% | -0.32\% | -0.31\% | -0.44\% | -0.87\% | -0.49\% | -0.50\% | -0.52\% | -0.92\% | -0.70\% | -0.77\% | -0.76\% |
|  |  | -1.6714 | -0.8259 | -1.0448 | -1.1814 | -0.8389 | -0.4789 | -0.5679 | -0.9010 | -1.0419 | -0.6928 | -0.8155 | -0.9278 | -1.1060 | -0.9109 | -1.1860 | -1.2874 |
| CAR (1) |  | -1.04\% | -0.40\% | -0.38\% | $\mathbf{- 0 . 4 0 \%}$ | -0.49\% | -0.43\% | -0.33\% | -0.54\% | -1.04\% | -0.57\% | -0.63\% | -0.59\% | -0.79\% | -0.70\% | -0.84\% | -0.73\% |
|  |  | -1.8097 | -0.9683 | -1.0358 | -1.2271 | -0.6405 | -0.6883 | -0.6304 | -1.1145 | -1.3223 | -0.8600 | -1.0764 | -1.0660 | -0.9506 | -0.9241 | -1.3184 | -1.2299 |
| BHAR (0) |  | -0.95\% | 0.44\% | 0.28\% | 0.94\% | -0.13\% | 0.35\% | -0.37\% | -0.45\% | -0.02\% | 0.33\% | -0.95\% | 0.72\% | -0.74\% | -1.29\% | -0.03\% | -1.10\% |
|  |  | -1.1858 | 0.5956 | 0.3131 | 1.4127 | -0.1480 | 0.4575 | -0.5125 | -0.5787 | -0.0226 | 0.3535 | -1.1430 | 0.9604 | -0.8231 | -1.4209 | -0.0400 | -1.4205 |
| BHAR (1) |  | -0.47\% | 0.73\% | 0.38\% | 1.20\% | 0.01\% | 0.20\% | -0.24\% | -0.59\% | 0.21\% | 0.65\% | -0.69\% | $\mathbf{0 . 6 4 \%}$ | -0.36\% | -1.27\% | 0.08\% | -1.32\% |
|  |  | -0.5991 | 0.9853 | 0.4298 | 1.8258 | 0.0112 | 0.2619 | -0.3257 | -0.7788 | 0.2285 | 0.7049 | -0.8421 | 0.8117 | -0.3874 | -1.4415 | 0.0922 | -1.7533 |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.79\% | -0.54\% | -0.38\% | -0.29\% | -1.14\% | -0.49\% | -0.36\% | -0.31\% | -0.82\% | -0.52\% | -0.44\% | -0.45\% | -0.94\% | -0.71\% | -0.72\% | -0.74\% |
|  |  | -5.2563 | -1.9815 | -1.4792 | -1.3345 | -2.4545 | -1.1024 | -0.9772 | -1.0056 | $-1.5333$ | -1.1597 | -1.2618 | -1.4501 | -2.1208 | -1.8576 | -2.0984 | -2.3797 |
| CAR (1) |  | -1.83\% | -0.64\% | -0.46\% | -0.46\% | -1.17\% | -0.55\% | -0.47\% | -0.45\% | -0.99\% | -0.73\% | -0.62\% | -0.62\% | -1.38\% | -0.99\% | -0.93\% | -0.90\% |
|  |  | -5.9107 | -2.3248 | -1.8519 | -2.1117 | -2.2255 | -1.2280 | $-1.3218$ | -1.4746 | -2.0213 | -1.7726 | -1.8759 | -2.0527 | -3.1442 | -2.6095 | -2.7329 | -2.9151 |
| BHAR (0) |  | -2.36\% | -0.99\% | -0.84\% | -0.49\% | -0.85\% | -0.33\% | -0.34\% | -0.10\% | -1.11\% | -0.61\% | -0.43\% | -0.53\% | -1.09\% | -0.68\% | -0.52\% | -1.09\% |
|  |  | -5.6120 | -2.2189 | -1.7509 | -1.2723 | -1.5710 | -0.6581 | -0.7094 | -0.2433 | -1.6397 | -0.9134 | -0.8697 | -0.7538 | -1.9154 | -1.3734 | -1.1316 | -2.4220 |
| BHAR (1) |  | -2.55\% | -1.31\% | -0.88\% | -0.63\% | -1.30\% | -0.51\% | -0.52\% | -0.47\% | -1.42\% | -1.19\% | -0.55\% | -0.68\% | -1.90\% | -1.19\% | -1.00\% | -1.30\% |
|  |  | -6.2060 | -3.1204 | -1.8605 | -1.6178 | -2.1975 | -1.0145 | -1.1008 | -1.1117 | -2.2220 | -1.7558 | -1.1970 | -0.9755 | -3.6495 | -2.6561 | -2.2390 | -2.7615 |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.44\% | -0.67\% | -0.35\% | -0.06\% | -0.90\% | -0.35\% | 0.00\% | 0.18\% | -0.20\% | 0.16\% | 0.39\% | 0.54\% | 0.32\% | 0.45\% | 0.44\% | 0.33\% |
|  |  | -2.8832 | -1.3942 | -0.8767 | -0.1651 | -1.4158 | -0.6408 | -0.0077 | 0.4118 | -0.2873 | 0.2734 | 0.6888 | 1.0528 | 0.4576 | 0.7144 | 0.7328 | 0.6137 |
| CAR (1) |  | -1.00\% | -0.51\% | -0.18\% | 0.10\% | -0.81\% | -0.30\% | 0.08\% | 0.15\% | -0.27\% | 0.23\% | 0.48\% | 0.52\% | 0.57\% | 0.46\% | 0.41\% | 0.27\% |
|  |  | -1.8055 | -1.0745 | -0.4897 | 0.3074 | -1.3586 | -0.5654 | 0.1686 | 0.3520 | -0.4073 | 0.3835 | 0.8619 | 1.0055 | 0.8086 | 0.7182 | 0.6777 | 0.5058 |
| BHAR (0) |  | -0.98\% | -1.86\% | -1.17\% | -0.12\% | -1.14\% | -0.19\% | -1.40\% | 1.60\% | -0.25\% | 0.26\% | 0.87\% | $\mathbf{0 . 5 4 \%}$ | 0.56\% | 0.54\% | 0.30\% | 0.11\% |
|  |  | -1.3647 | -2.2151 | -1.5233 | -0.1680 | -1.4996 | -0.2725 | -1.9261 | 2.5589 | $-0.3198$ | 0.3201 | 1.3261 | 0.7297 | 0.7256 | 0.7933 | 0.3980 | 0.1382 |
| BHAR (1) |  | -1.37\% | -1.71\% | -1.33\% | 0.35\% | -1.20\% | -0.17\% | -0.97\% | 1.21\% | -0.46\% | 0.44\% | 0.68\% | 0.30\% | 0.72\% | 0.21\% | 0.42\% | 0.18\% |
|  |  | -1.9786 | -2.1066 | $-1.7084$ | 0.5058 | -1.7861 | -0.2325 | -1.4013 | 2.1221 | -0.5714 | 0.5976 | 0.9983 | 0.4293 | 1.0199 | 0.3195 | 0.5405 | 0.2299 |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -2.32\% | -1.18\% | -0.93\% | -0.72\% | -1.56\% | -1.02\% | -0.76\% | -0.58\% | -1.27\% | -0.73\% | -0.44\% | -0.39\% | -0.83\% | -0.33\% | -0.24\% | -0.36\% |
|  |  | -7.8787 | -5.1397 | -4.7676 | -4.0890 | -4.8738 | -3.6712 | -2.9675 | -2.3402 | -4.0066 | -2.2744 | -1.4484 | -1.3928 | -2.1253 | -0.9390 | -0.7236 | -1.2040 |
| CAR (1) |  | -1.97\% | -1.01\% | -0.77\% | -0.61\% | -1.24\% | -0.82\% | -0.64\% | -0.50\% | -1.24\% | -0.66\% | -0.45\% | -0.44\% | -0.52\% | -0.23\% | -0.26\% | -0.38\% |
|  |  | -6.2791 | -4.4394 | -4.0875 | -3.4785 | -3.6294 | -2.9690 | -2.4443 | -2.0553 | -3.6085 | -1.9427 | -1.4926 | -1.5480 | -1.3129 | -0.6678 | -0.8181 | -1.3070 |
| BHAR (0) |  | -2.13\% | -1.31\% | -0.93\% | -0.99\% | -1.38\% | -0.89\% | -0.89\% | -0.27\% | -1.24\% | -0.62\% | -0.61\% | 0.13\% | -0.61\% | 0.07\% | -0.19\% | 0.13\% |
|  |  | -6.6504 | -3.7218 | -2.3976 | -2.5168 | -3.6741 | -2.5699 | -2.7191 | -0.8286 | -3.7651 | -1.8319 | $-1.5492$ | 0.3820 | -1.4162 | 0.1862 | -0.4723 | 0.2651 |
| BHAR (1) |  | -2.25\% | -1.31\% | -0.91\% | -0.85\% | -1.49\% | -0.91\% | -0.83\% | -0.32\% | -1.36\% | -0.67\% | -0.66\% | 0.16\% | -0.10\% | 0.23\% | -0.36\% | 0.29\% |
|  |  | -5.5770 | -3.6212 | -2.2378 | -1.9861 | -3.5604 | -2.5306 | -2.6044 | -0.9790 | -3.3230 | $-1.7400$ | $-1.4662$ | 0.4523 | -0.2012 | 0.5511 | -0.8043 | 0.5540 |





Panel B. The time-series momentum using market-weighted return


| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.08\% | 0.68\% | 0.75\% | 0.75\% | 0.63\% | 0.86\% | 1.05\% | 0.95\% | 0.69\% | 1.11\% | 1.01\% | 0.99\% | 0.66\% | 1.01\% | 1.03\% | 1.06\% |
|  |  | 0.1829 | 1.9919 | 2.6051 | 3.0308 | 1.3854 | 2.0026 | 2.6845 | 2.6369 | 1.2187 | 2.2634 | 2.2898 | 2.3078 | 1.1826 | 2.0355 | 2.1345 | 2.2791 |
| CAR (1) |  | 0.16\% | 0.57\% | 0.73\% | 0.66\% | 0.37\% | 0.89\% | 0.92\% | 0.80\% | 0.83\% | 1.14\% | 0.99\% | 0.95\% | 0.75\% | 1.05\% | 1.01\% | 1.07\% |
|  |  | 0.3963 | 1.7166 | 2.6538 | 2.7400 | 0.7261 | 1.9591 | 2.2986 | 2.1603 | 1.4862 | 2.3848 | 2.2025 | 2.2175 | 1.3612 | 2.0727 | 2.0918 | 2.2864 |
| BHAR (0) |  | -0.53\% | 0.29\% | -0.23\% | 0.63\% | 0.66\% | 0.37\% | 0.55\% | 1.16\% | 0.79\% | 0.89\% | 0.88\% | 0.63\% | 0.33\% | 0.68\% | 0.12\% | 0.84\% |
|  |  | -1.1242 | 0.5239 | -0.4427 | 0.9282 | 1.3145 | 0.7074 | 1.1693 | 2.6342 | 1.3642 | 1.3953 | 1.7302 | 1.2288 | 0.5131 | 1.1582 | 0.1814 | 1.3314 |
| BHAR (1) |  | -0.13\% | 0.43\% | -0.05\% | 0.76\% | 0.48\% | 0.76\% | 0.40\% | 0.94\% | 1.02\% | 1.32\% | 0.96\% | 0.63\% | 0.52\% | 1.16\% | 0.40\% | 1.13\% |
|  |  | -0.2682 | 0.7692 | -0.0829 | 1.1847 | 0.8558 | 1.4907 | 0.7754 | 2.2556 | 1.5017 | 2.1994 | 1.9702 | 1.2138 | 0.8605 | 2.1842 | 0.6993 | 1.9402 |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.28\% | 0.37\% | 0.89\% | 0.86\% | 0.54\% | 1.27\% | 1.55\% | 1.46\% | 0.87\% | 1.44\% | 1.42\% | 1.26\% | 1.33\% | 1.39\% | 1.30\% | 1.17\% |
|  |  | -0.4585 | 0.7971 | 1.9496 | 2.0599 | 0.9010 | 2.3005 | 2.8893 | 2.7117 | 1.2919 | 2.1863 | 2.1563 | 1.9991 | 1.7770 | 1.8590 | 1.7949 | 1.6895 |
| CAR (1) |  | -0.37\% | 0.68\% | 1.00\% | 0.95\% | 0.83\% | 1.54\% | 1.57\% | 1.50\% | 1.02\% | 1.40\% | 1.31\% | 1.17\% | 1.11\% | 1.25\% | 1.16\% | 1.12\% |
|  |  | -0.5881 | 1.3728 | 2.2263 | 2.2028 | 1.3502 | 2.8037 | 2.8464 | 2.7700 | 1.4554 | 1.9935 | 1.9424 | 1.8430 | 1.3906 | 1.6196 | 1.5697 | 1.6251 |
| BHAR (0) |  | -0.73\% | -0.42\% | 1.33\% | 1.42\% | 0.07\% | 1.28\% | 1.08\% | 1.12\% | 0.77\% | 0.87\% | 0.67\% | -0.05\% | 0.99\% | 2.38\% | 1.52\% | 2.04\% |
|  |  | -0.9111 | -0.5645 | 1.6725 | 1.5782 | 0.0855 | 1.5127 | 1.3053 | 1.3470 | 0.9814 | 0.9689 | 0.7842 | -0.0547 | 1.0897 | 2.8739 | 1.7482 | 2.6202 |
| BHAR (1) |  | -0.32\% | 0.11\% | 1.54\% | $\mathbf{1 . 6 1 \%}$ | 0.27\% | 1.33\% | 1.01\% | 0.95\% | 0.58\% | 1.15\% | 0.44\% | 0.06\% | 1.23\% | 2.07\% | 1.60\% | 2.16\% |
|  |  | -0.4109 | 0.1437 | 1.9521 | 1.8066 | 0.3209 | 1.5564 | 1.2355 | 1.1728 | 0.7071 | 1.3458 | 0.5377 | 0.0596 | 1.4358 | 2.4568 | 1.8911 | 2.9845 |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.74\% | -0.49\% | -0.26\% | -0.05\% | -1.20\% | -0.44\% | -0.08\% | 0.06\% | -1.02\% | -0.34\% | -0.11\% | -0.02\% | -0.97\% | -0.24\% | -0.06\% | -0.03\% |
|  |  | -3.9001 | $-1.5654$ | -0.9742 | -0.2160 | -2.5575 | -1.1389 | -0.2368 | 0.1763 | -2.4273 | -0.9645 | -0.3091 | -0.0631 | -2.1181 | -0.5716 | -0.1536 | -0.0905 |
| CAR (1) |  | -1.04\% | -0.27\% | -0.07\% | 0.02\% | -0.73\% | -0.22\% | 0.06\% | 0.12\% | -0.49\% | -0.15\% | 0.04\% | 0.04\% | -0.68\% | -0.12\% | -0.02\% | -0.01\% |
|  |  | -2.7582 | -0.9604 | -0.2836 | 0.0875 | -1.7498 | -0.6082 | 0.1811 | 0.3703 | -1.3129 | -0.4317 | 0.1065 | 0.1173 | -1.5369 | -0.2913 | -0.0584 | -0.0383 |
| BHAR (0) |  | -1.87\% | -0.59\% | -0.17\% | -0.23\% | -1.08\% | -0.57\% | -0.81\% | -0.06\% | -0.99\% | $-0.49 \%$ | -0.16\% | 0.51\% | -1.16\% | -0.18\% | 0.08\% | -0.16\% |
|  |  | $-3.5113$ | -1.1645 | -0.3180 | -0.3808 | $-1.9731$ | $-1.0851$ | -1.4505 | -0.1120 | $-2.0583$ | -0.9963 | -0.4053 | 1.1884 | -2.2809 | -0.3646 | 0.1825 | -0.3698 |
| BHAR (1) |  | -1.11\% | -0.42\% | -0.21\% | 0.28\% | -0.84\% | -0.47\% | -0.86\% | -0.14\% | -0.41\% | -0.40\% | 0.16\% | 0.30\% | -0.95\% | -0.35\% | 0.06\% | -0.24\% |
|  |  | -2.1883 | -0.8037 | -0.4284 | 0.4579 | -1.5752 | -0.9530 | -1.4638 | -0.2418 | -0.9313 | -0.7770 | 0.3969 | 0.6224 | -1.8810 | -0.7030 | 0.1286 | -0.5275 |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.36\% | 0.59\% | 0.90\% | 0.85\% | 0.02\% | 0.70\% | 0.92\% | 0.67\% | 0.27\% | 0.92\% | 0.65\% | 0.62\% | 0.44\% | 0.69\% | 0.72\% | 0.59\% |
|  |  | -0.7289 | 1.5787 | 2.7897 | 2.8103 | 0.0402 | 1.5165 | 2.1444 | 1.6314 | 0.4696 | 1.7816 | 1.2789 | 1.2529 | 0.7426 | 1.1086 | 1.1727 | 0.9988 |
| CAR (1) |  | -0.39\% | 0.72\% | 0.86\% | 0.74\% | -0.04\% | 0.74\% | 0.76\% | 0.58\% | 0.43\% | 0.85\% | 0.52\% | 0.51\% | 0.30\% | 0.60\% | 0.50\% | 0.40\% |
|  |  | -0.8200 | 2.0349 | 2.7302 | 2.5201 | $-0.0751$ | 1.6886 | 1.7808 | 1.4345 | 0.7732 | 1.6005 | 0.9989 | 1.0357 | 0.4506 | 0.9189 | 0.7975 | 0.6781 |
| BHAR (0) |  | -0.51\% | 0.62\% | 1.16\% | 0.20\% | -0.12\% | 0.74\% | 0.99\% | 1.00\% | 0.23\% | 0.93\% | -0.21\% | $\mathbf{1 . 0 1 \%}$ | -0.12\% | 0.34\% | 1.17\% | 0.06\% |
|  |  | -0.8606 | 1.1235 | 2.0079 | 0.3540 | -0.1987 | 1.2392 | 1.5343 | 1.9197 | 0.3267 | 1.3971 | -0.2993 | 1.6967 | -0.1800 | 0.4832 | 1.7468 | 0.0940 |
| BHAR (1) |  | -0.25\% | 0.72\% | 0.85\% | 0.25\% | -0.29\% | 0.70\% | 0.70\% | 0.67\% | 0.23\% | 0.79\% | -0.21\% | 0.86\% | 0.04\% | 0.22\% | $\mathbf{0 . 8 1 \%}$ | -0.09\% |
|  |  | -0.4336 | 1.3145 | 1.4562 | 0.4594 | -0.5005 | 1.2174 | 1.1042 | 1.2518 | 0.3374 | 1.2164 | -0.2845 | 1.4178 | 0.0672 | 0.3157 | 1.1793 | -0.1351 |



| MW | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=3$ | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | -0.26\% | 0.50\% | 0.61\% | 0.73\% | 0.75\% | 1.06\% | 0.92\% | 0.87\% | 0.80\% | 1.36\% | 1.35\% | 1.23\% | 1.32\% | 1.72\% | 1.51\% | 1.36\% |
|  | -0.5783 | 1.3602 | 1.9760 | 2.7170 | 1.4799 | 2.4776 | 2.3434 | 2.4673 | 1.8226 | 3.4621 | 3.4115 | 3.2925 | 2.6262 | 3.7261 | 3.4387 | 3.3320 |
| CAR (1) | 0.16\% | 0.69\% | 0.76\% | 0.76\% | 0.84\% | 1.04\% | 0.98\% | 0.78\% | 1.20\% | 1.52\% | 1.31\% | 1.17\% | 1.22\% | 1.61\% | 1.38\% | 1.18\% |
|  | 0.3750 | 1.8928 | 2.5178 | 2.7635 | 1.8082 | 2.4116 | 2.5712 | 2.1983 | 2.7108 | 3.6254 | 3.2911 | 3.0797 | 2.5829 | 3.3991 | 3.2010 | 2.9215 |
| BHAR (0) | -0.23\% | -0.48\% | 0.68\% | 0.26\% | 0.83\% | 0.69\% | 0.48\% | 0.27\% | 0.70\% | 0.58\% | 1.17\% | 0.65\% | 1.51\% | 1.90\% | 1.18\% | 1.80\% |
|  | -0.3647 | -0.7687 | 1.1354 | 0.4806 | 1.5067 | 1.1538 | 0.8235 | 0.4840 | 1.2157 | 0.9966 | 1.9886 | 1.1872 | 2.3669 | 3.0967 | 2.2137 | 2.8092 |
| BHAR (1) | -0.03\% | -0.21\% | 1.31\% | 0.76\% | 0.43\% | 0.48\% | 0.47\% | 0.07\% | 0.80\% | 0.98\% | 0.93\% | 0.90\% | 1.16\% | 1.69\% | 1.11\% | 1.67\% |
|  | -0.0502 | -0.3585 | 2.2009 | 1.5061 | 0.7360 | $0.7611$ | 0.8073 | 0.1298 | $1.3873$ | $1.6161$ | $1.5736$ | 1.6636 | 1.9708 | 2.8736 | 2.0377 | 2.6575 |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | -0.57\% | -0.25\% | -0.04\% | 0.09\% | -0.38\% | -0.07\% | 0.18\% | 0.21\% | -0.41\% | 0.05\% | 0.14\% | 0.17\% | -0.23\% | 0.07\% | 0.17\% | 0.13\% |
|  | -1.7177 | -0.8245 | -0.1552 | 0.3859 | -0.9147 | -0.1683 | 0.5154 | 0.7001 | -0.9113 | 0.1263 | 0.3622 | 0.4907 | -0.5181 | 0.1697 | 0.4435 | 0.3631 |
| CAR (1) | -0.57\% | -0.22\% | 0.04\% | 0.07\% | -0.20\% | 0.09\% | 0.26\% | 0.21\% | -0.23\% | 0.09\% | 0.17\% | 0.14\% | -0.23\% | 0.06\% | 0.15\% | 0.08\% |
|  | -1.7718 | -0.7201 | 0.1326 | 0.2968 | -0.4895 | 0.2346 | 0.8028 | 0.7308 | -0.5351 | 0.2232 | 0.4694 | 0.4249 | -0.5452 | 0.1484 | 0.4187 | 0.2500 |
| BHAR (0) | -0.48\% | 0.04\% | 0.17\% | 0.85\% | -0.35\% | 0.15\% | 0.11\% | 0.58\% | -0.17\% | 0.31\% | 0.08\% | 0.35\% | -0.01\% | 0.29\% | 0.09\% | 0.18\% |
|  | -1.1130 | 0.0909 | 0.4254 | 2.2666 | -0.8094 | 0.3149 | 0.2484 | 1.4720 | -0.3744 | 0.7395 | 0.2063 | 0.8757 | -0.0227 | 0.6313 | 0.2046 | 0.4662 |
| BHAR (1) | -0.36\% | -0.23\% | -0.10\% | 0.83\% | -0.24\% | 0.31\% | 0.10\% | 0.45\% | -0.35\% | 0.12\% | -0.01\% | 0.11\% | -0.15\% | 0.14\% | -0.15\% | 0.06\% |
|  | -0.8880 | -0.5446 | -0.2457 | 2.3120 | -0.5824 | 0.7250 | 0.2381 | 1.1831 | -0.8030 | 0.2935 | -0.0352 | 0.3031 | -0.3231 | 0.3276 | -0.3420 | 0.1612 |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.44\% | 0.66\% | 0.67\% | 0.60\% | -0.11\% | 0.37\% | 0.50\% | 0.49\% | 0.40\% | 0.50\% | 0.61\% | 0.52\% | 0.51\% | 0.75\% | 0.67\% | 0.48\% |
|  | 1.0331 | 1.8545 | 2.1525 | 2.2300 | -0.2376 | 0.8919 | 1.3082 | 1.2922 | 0.8496 | 1.1821 | 1.5151 | 1.2405 | 1.0060 | 1.6412 | 1.5085 | 1.1302 |
| CAR (1) | 0.22\% | 0.51\% | 0.56\% | 0.54\% | -0.20\% | 0.44\% | 0.35\% | 0.33\% | 0.39\% | 0.43\% | 0.54\% | $\mathbf{0 . 4 2 \%}$ | 0.16\% | 0.56\% | 0.37\% | 0.32\% |
|  | 0.4971 | 1.4097 | 1.8791 | 1.9781 | -0.4060 | 0.9857 | 0.8755 | 0.8187 | 0.7920 | 0.9766 | 1.2153 | 0.9631 | 0.3220 | 1.1843 | 0.8039 | 0.7495 |
| BHAR (0) | 0.38\% | 0.20\% | -0.02\% | 1.09\% | -0.24\% | 0.11\% | 0.47\% | 1.82\% | 0.15\% | 1.01\% | 0.16\% | 1.00\% | 0.45\% | 0.96\% | 0.33\% | -0.01\% |
|  | 0.6638 | 0.3748 | -0.0261 | 1.7592 | -0.4491 | 0.1894 | 0.6479 | 3.4417 | 0.2837 | 1.8503 | 0.3595 | 1.9946 | 0.8902 | 1.7833 | 0.5799 | -0.0125 |
| BHAR (1) | 0.15\% | -0.08\% | -0.20\% | 1.45\% | -0.34\% | 0.08\% | 0.41\% | 1.46\% | 0.62\% | 0.93\% | 0.37\% | 0.85\% | 0.02\% | 0.45\% | 0.17\% | -0.55\% |
|  | 0.2790 | -0.1589 | -0.3105 | 2.1347 | -0.6022 | 0.1367 | 0.5533 | 2.7229 | 1.1515 | 1.7298 | 0.7435 | 1.5415 | 0.0372 | 0.8015 | 0.3017 | -0.9271 |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.92\% | 0.98\% | 0.73\% | 0.62\% | 1.46\% | 1.10\% | 1.00\% | 0.86\% | 1.09\% | 1.32\% | 1.10\% | 1.00\% | 1.52\% | 1.21\% | 1.09\% | 0.95\% |
|  | 1.3230 | 2.1575 | 2.0328 | 2.1293 | 1.6903 | 1.7358 | 2.1362 | 2.2848 | 1.1937 | 2.0863 | 2.3361 | 2.4364 | 2.0443 | 2.3229 | 2.5647 | 2.4717 |
| CAR (1) | 0.47\% | 0.56\% | 0.56\% | 0.38\% | 0.95\% | 0.71\% | 0.76\% | 0.62\% | 0.89\% | 1.08\% | 0.92\% | 0.85\% | 1.10\% | 0.91\% | 0.91\% | 0.77\% |
|  | 0.8575 | 1.4614 | 1.8352 | 1.4803 | 1.2421 | 1.3181 | 1.8537 | 1.8221 | 1.1708 | 2.0558 | 2.2618 | 2.3478 | 1.7577 | 1.9741 | 2.2957 | 2.1168 |
| BHAR (0) | 0.81\% | 0.47\% | 0.69\% | -0.39\% | 0.96\% | 0.70\% | 0.26\% | 0.60\% | 0.62\% | -0.11\% | 1.02\% | 0.09\% | 2.00\% | 2.31\% | 1.60\% | 0.91\% |
|  | 1.1830 | 0.5708 | 0.9133 | -0.4898 | 1.2196 | 0.9764 | 0.4287 | 0.8515 | 0.7305 | -0.1996 | 2.1293 | 0.1800 | 2.3820 | 2.9731 | 2.0823 | 1.8132 |
| BHAR (1) | 0.27\% | -0.31\% | 0.05\% | -0.52\% | 0.29\% | -0.19\% | 0.05\% | -0.05\% | 0.39\% | 0.06\% | 0.96\% | 0.08\% | 1.57\% | 1.42\% | 1.20\% | 0.70\% |
|  | 0.4244 | -0.3837 | 0.0858 | -0.6828 | 0.4282 | -0.3253 | 0.0894 | -0.0913 | 0.5451 | 0.0936 | 1.8668 | 0.1597 | 2.3102 | 2.2839 | 1.9455 | 1.3400 |




Panel C. The time-series momentum using inversed-volatility weighted return






| IVOL | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.82\% | 0.34\% | 0.46\% | 0.55\% | 0.32\% | 0.86\% | 0.97\% | 0.89\% | 1.03\% | 1.36\% | 1.13\% | 0.94\% | 1.27\% | 1.32\% | 1.13\% | 0.93\% |
|  |  | -1.8697 | 1.0318 | 1.5905 | 2.1945 | 0.6609 | 1.9265 | 2.4080 | 2.4690 | 2.0483 | 2.9015 | 2.6133 | 2.5373 | 2.5855 | 2.8176 | 2.6364 | 2.4064 |
| CAR (1) |  | -0.51\% | 0.42\% | 0.47\% | 0.50\% | 0.52\% | 0.89\% | 0.94\% | 0.79\% | 1.15\% | 1.09\% | 0.93\% | 0.75\% | 1.26\% | 1.16\% | 0.99\% | 0.80\% |
|  |  | -1.2640 | 1.3524 | 1.7062 | 1.9451 | 1.0654 | 2.0105 | 2.3758 | 2.2849 | 2.3154 | 2.4093 | 2.2609 | 2.1097 | 2.7596 | 2.6199 | 2.4655 | 2.1334 |
| BHAR (0) |  | -0.93\% | 0.36\% | 0.40\% | 0.49\% | 0.33\% | 0.59\% | 0.56\% | 0.80\% | 1.05\% | 1.40\% | 1.14\% | 0.63\% | 1.09\% | 1.33\% | 1.47\% | 1.48\% |
|  |  | -1.5061 | 0.8290 | 0.8455 | 1.0072 | 0.5582 | 1.0999 | 0.9006 | 1.5331 | 1.9552 | 2.4396 | 2.4709 | 1.3125 | 1.9688 | 2.4911 | 2.8636 | 2.7526 |
| BHAR (1) |  | -0.68\% | $\mathbf{0 . 4 1 \%}$ | 0.56\% | 0.93\% | 0.53\% | $\mathbf{0 . 8 1 \%}$ | 0.57\% | 0.54\% | 1.08\% | 1.29\% | 1.24\% | 0.56\% | 1.57\% | 1.40\% | 1.35\% | 1.66\% |
|  |  | -1.2361 | 0.9685 | 1.3554 | 2.0243 | 0.9047 | 1.4677 | 0.9018 | 1.0447 | 1.9043 | 2.5049 | 2.9451 | 1.2014 | 2.9329 | 2.6361 | 2.6817 | 3.1985 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.25\% | 0.37\% | 0.52\% | 0.59\% | 0.55\% | 0.90\% | 0.92\% | 0.74\% | 0.89\% | 1.13\% | 0.82\% | 0.63\% | 0.87\% | 0.78\% | 0.62\% | 0.46\% |
|  |  | -1.1653 | 1.7486 | 2.8745 | 3.8092 | 1.9019 | 3.5248 | 4.0286 | 3.4673 | 2.9016 | 4.2257 | 3.5900 | 3.0098 | 2.7962 | 2.8501 | 2.6025 | 2.0931 |
| CAR (1) |  | -0.08\% | 0.46\% | 0.55\% | 0.52\% | 0.59\% | 0.85\% | 0.77\% | 0.62\% | 0.81\% | 0.87\% | 0.59\% | 0.45\% | 0.62\% | 0.59\% | 0.44\% | 0.31\% |
|  |  | -0.3715 | 2.1941 | 3.1251 | 3.2626 | 2.0650 | 3.4294 | 3.4110 | 2.9349 | 2.7486 | 3.4280 | 2.7727 | 2.2379 | 2.0806 | 2.2677 | 1.9185 | 1.4019 |
| BHAR (0) |  | -0.41\% | 0.45\% | 0.24\% | 1.09\% | 0.31\% | 1.05\% | 0.70\% | 1.10\% | 0.71\% | 1.22\% | 1.13\% | 0.62\% | 0.84\% | 0.65\% | 0.57\% | 0.61\% |
|  |  | -1.5937 | 1.3544 | 0.7384 | 2.8476 | 0.9289 | 3.1368 | 2.4386 | 2.8425 | 1.8047 | 3.4093 | 3.4143 | 1.9569 | 2.4398 | 1.9747 | 1.8025 | 2.3319 |
| BHAR (1) |  | -0.20\% | 0.51\% | 0.09\% | 0.93\% | 0.69\% | 1.03\% | 0.69\% | 1.01\% | 0.73\% | 0.84\% | 0.87\% | 0.51\% | 0.70\% | 0.60\% | 0.19\% | 0.63\% |
|  |  | -0.7777 | 1.4648 | 0.3001 | 2.3431 | 2.0269 | 3.0826 | 2.4516 | 2.6123 | 1.9383 | 2.4640 | 2.7319 | 1.5237 | 2.1918 | 1.9324 | 0.6336 | 2.3918 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.07\% | 0.73\% | 0.76\% | $0.91 \%$ | 0.90\% | 0.96\% | 1.07\% | 1.01\% | 1.09\% | 1.26\% | 1.14\% | 1.01\% | 1.36\% | 1.28\% | 1.10\% | 0.90\% |
|  |  | 0.3403 | 3.9636 | 5.0460 | $7.1322$ | 3.7492 | 4.6815 | 6.1323 | 6.1205 | 4.5953 | 5.7043 | 5.6032 | 5.1602 | 5.3578 | 5.1654 | 4.7514 | 3.9443 |
| CAR (1) |  | 0.13\% | 0.64\% | 0.72\% | $\mathbf{0 . 8 1 \%}$ | 0.67\% | 0.83\% | 0.94\% | 0.86\% | 1.00\% | 1.11\% | 1.01\% | 0.84\% | 1.15\% | 1.08\% | 0.91\% | 0.74\% |
|  |  | 0.6361 | 3.6598 | 5.1142 | 6.4089 | 2.8976 | 4.2244 | 5.6024 | 5.3961 | 4.5258 | 5.0645 | 4.9625 | 4.2611 | 4.5101 | 4.3852 | 3.9278 | 3.2394 |
| BHAR (0) |  | 0.13\% | 0.87\% | 1.11\% | 1.03\% | 0.98\% | 1.16\% | 0.76\% | 1.13\% | 1.12\% | 1.24\% | 1.13\% | 0.94\% | 1.33\% | 1.40\% | 1.14\% | 0.80\% |
|  |  | 0.5482 | 3.3180 | 5.0243 | 3.8548 | 3.9497 | 5.3097 | 2.8071 | 5.0267 | 4.5442 | 4.4528 | 4.9791 | 3.7737 | 4.9459 | 5.4928 | 4.1280 | 3.1967 |
| BHAR (1) |  | 0.40\% | 0.77\% | 1.01\% | 0.93\% | 0.75\% | 1.02\% | 0.70\% | 0.94\% | 1.09\% | 1.11\% | 1.03\% | 0.67\% | 1.25\% | 1.09\% | 0.84\% | 0.62\% |
|  |  | 1.5402 | 2.9899 | 4.2564 | 3.6582 | 3.1227 | 5.1709 | 2.8272 | 4.4272 | 4.7140 | 3.8946 | 4.0736 | 2.7102 | 4.8698 | 4.3951 | 3.0597 | 2.6164 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.30\% | -0.47\% | -0.23\% | -0.13\% | -0.72\% | -0.20\% | -0.02\% | -0.05\% | -0.37\% | -0.02\% | -0.05\% | -0.10\% | -0.31\% | -0.13\% | -0.16\% | -0.25\% |
|  |  | -6.0176 | -2.6214 | -1.4333 | -0.9098 | -3.0540 | -0.9527 | -0.1077 | -0.2725 | -1.4576 | -0.0727 | -0.1971 | -0.4738 | -1.1573 | -0.4720 | -0.6230 | -1.0345 |
| CAR (1) |  | -1.03\% | -0.33\% | -0.12\% | -0.13\% | -0.56\% | -0.14\% | -0.03\% | -0.10\% | -0.21\% | -0.03\% | -0.09\% | -0.19\% | -0.34\% | -0.20\% | -0.25\% | -0.33\% |
|  |  | -5.3172 | -2.0242 | -0.8043 | -0.9520 | -2.4150 | -0.6425 | -0.1557 | -0.5507 | -0.8692 | -0.1268 | -0.3858 | -0.8761 | -1.2820 | -0.7501 | -0.9960 | $-1.4328$ |
| BHAR (0) |  | -1.30\% | -0.08\% | -0.24\% | -0.02\% | -0.74\% | -0.32\% | -0.18\% | -0.01\% | -0.34\% | 0.04\% | 0.04\% | -0.11\% | -0.26\% | -0.11\% | -0.05\% | -0.23\% |
|  |  | -5.0449 | -0.3608 | -0.8440 | -0.0719 | -2.7280 | -1.2041 | -0.5870 | -0.0577 | -1.2649 | 0.1591 | 0.1746 | -0.4278 | -0.9543 | -0.3678 | -0.1697 | -0.8380 |
| BHAR (1) |  | -1.03\% | -0.15\% | -0.24\% | -0.08\% | -0.59\% | -0.29\% | -0.26\% | -0.23\% | -0.27\% | -0.07\% | -0.14\% | -0.24\% | -0.47\% | -0.31\% | -0.24\% | -0.42\% |
|  |  | -4.7575 | -0.6796 | -0.8965 | -0.3075 | -2.4492 | -1.2088 | -0.8357 | -1.0976 | -1.0227 | -0.2397 | -0.5162 | -0.8961 | -1.5995 | -1.0251 | -0.8530 | -1.4188 |

## Table 7.6. Monthly after-transaction cost return of cross-sectional momentum strategy under different implementations

This table reports the average monthly returns for $16(\mathrm{JxH})$ cross-sectional momentum strategies across the 24 stock markets along with an indication of significant levels based on the Newey-West adjusted t-statistics. The reported profits all relate to an implementation where the cut-offs are set at $16 \%$.

At the end of each month if using monthly rebalancing or at the end of each holding period if using buy-and-hold, all stocks are ranked based on their average returns over past $\mathrm{J}(\mathrm{J}=3,6,9$ and 12 months). The Winner (loser) portfolio contains top (bottom) $16 \%$ stocks. All stocks in the winner and loser portfolios are equally weighted in Panel A, market value weighted in Panel B and inversed volatility weighted in Panel C. Following Moskowitz et al. (2012), inversed volatility weighting scheme is given lower proportion to higher volatile stocks in the portfolio; that is the weight of the stock in portfolio is estimated by an inverse proportion of its ex ante volatility from daily returns over $\mathrm{J}(\mathrm{J}=3,6,9$ and 12 months). The proportions of stocks in the portfolios remain same during the $\mathrm{H}(\mathrm{H}=3,6,9$ and 12 months) holding period. We implement portfolio constructions as in (Jegadeesh \& Titman, 1993) for buy-and-hold and monthly-rebalancing. For buy-and-hold (BHAR), the procedure is rolling forward at the end of each H holding period to generate a new winner and loser portfolios. For monthly-rebalancing (CAR), the procedure is rolling forward at the end of each month to produce an overlapping winner (loser) portfolio which contains of winner (loser) portfolio of the past J month. The return of the winner (loser) portfolio is then the simple average return of the H winner (loser) portfolios. CAR (1) and BHAR (1) indicates one-month gap between the formation and the holding periods to avoid the bid-ask bounce, whereas CAR $(0)$ and BHAR ( 0 ) indicates no gap between the formation and the holding periods. The return on momentum portfolio is then estimated as return difference return between winner and loser portfolio at each month.

The monthly transaction cost of each stock is inferred from the LOT - Y split model (Goyenko et al., 2009). The transaction costs of winner and loser portfolios are then estimated by Cost of portfolio $=\sum_{i=1}^{i=m} \mid \Delta$ weight $(t, t-H)_{i} \mid \times \operatorname{cost}_{i, t}$, the sum product of absolute proportion changes $\left(\Delta w e i g h t(t, t-H)_{i}\right)$ for each stock in the portfolio and its transaction cost $\left(\operatorname{cost}_{i, t}\right)$ at month t from one holding period $(\mathrm{H})$ to another. After the transaction cost cross-sectional momentum return is calculated by subtracting the transaction costs of winner and loser portfolios from the momentum return at each month.

Panel A. The time-series momentum using equal-weighted return






| EW | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.60\% | 0.35\% | 0.33\% | 0.44\% | 0.27\% | 0.50\% | 0.56\% | 0.48\% | 0.49\% | 0.68\% | 0.50\% | 0.37\% | 0.65\% | 0.57\% | 0.35\% | 0.22\% |
|  |  | -1.5317 | 1.0748 | 1.2107 | 1.8632 | 0.5882 | 1.2783 | 1.6506 | 1.5833 | 1.1071 | 1.6980 | 1.3323 | 1.0806 | 1.4219 | 1.3143 | 0.8519 | 0.5792 |
| CAR (1) |  | -0.16\% | 0.42\% | 0.42\% | $\mathbf{0 . 4 3 \%}$ | 0.42\% | 0.51\% | 0.51\% | 0.39\% | 0.61\% | 0.59\% | 0.37\% | 0.25\% | 0.49\% | 0.38\% | 0.17\% | 0.11\% |
|  |  | -0.4352 | 1.3860 | 1.6666 | 1.9734 | 0.9936 | 1.3906 | 1.5762 | 1.3195 | 1.4196 | 1.5150 | 0.9967 | 0.7551 | 1.0831 | 0.8806 | 0.4363 | 0.2878 |
| BHAR (0) |  | -0.40\% | 0.15\% | 0.34\% | $\mathbf{0 . 0 3 \%}$ | 0.36\% | 0.65\% | 0.48\% | 0.30\% | 0.54\% | 0.48\% | 0.47\% | 0.15\% | 0.58\% | 0.65\% | 0.27\% | 0.31\% |
|  |  | -0.9146 | 0.3985 | 0.9636 | 0.0681 | 0.7253 | 1.5959 | 0.9698 | 0.7866 | 1.1203 | 0.9570 | 1.0340 | 0.3358 | 1.2109 | 1.5144 | 0.6320 | 0.8599 |
| BHAR (1) |  | -0.16\% | 0.20\% | 0.37\% | 0.13\% | 0.48\% | 0.58\% | 0.46\% | 0.25\% | 0.50\% | 0.46\% | 0.43\% | 0.02\% | 0.56\% | 0.51\% | 0.11\% | 0.26\% |
|  |  | -0.3966 | 0.5400 | 1.2047 | 0.3457 | 1.0486 | 1.5569 | 0.9451 | 0.7021 | 1.0915 | 1.0290 | 0.9819 | 0.0395 | 1.1723 | 1.1887 | 0.2473 | 0.6709 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.13\% | 0.46\% | 0.48\% | 0.55\% | 0.62\% | 0.63\% | 0.70\% | 0.64\% | 0.71\% | 0.77\% | 0.67\% | 0.54\% | 0.89\% | 0.79\% | 0.60\% | 0.43\% |
|  |  | 0.5886 | 2.2547 | 2.3944 | 3.0516 | 2.2383 | 2.2507 | 2.6921 | 2.7102 | 2.1587 | 2.4276 | 2.2684 | 1.9954 | 2.6151 | 2.4019 | 1.9622 | 1.5347 |
| CAR (1) |  | 0.15\% | 0.44\% | 0.47\% | 0.49\% | 0.56\% | 0.59\% | 0.63\% | 0.51\% | 0.69\% | 0.71\% | 0.57\% | 0.41\% | 0.79\% | 0.65\% | 0.46\% | 0.30\% |
|  |  | 0.7310 | 2.1060 | 2.3585 | 2.7901 | 1.9734 | 2.0524 | 2.4433 | 2.2256 | 2.1140 | 2.2540 | 1.9629 | 1.5627 | 2.3889 | 2.0206 | 1.5540 | 1.0827 |
| BHAR (0) |  | 0.06\% | 0.40\% | 0.39\% | 0.50\% | 0.62\% | 0.77\% | 0.51\% | 0.98\% | 0.69\% | 0.59\% | 0.78\% | 0.57\% | 0.90\% | 1.01\% | 0.73\% | 0.56\% |
|  |  | 0.2229 | 1.2856 | 1.2701 | 1.4230 | 2.0425 | 2.4683 | 1.5806 | 3.5000 | 1.9983 | 1.5744 | 2.5510 | 1.8609 | 2.5986 | 3.0694 | 2.1743 | 1.8031 |
| BHAR (1) |  | 0.07\% | 0.24\% | 0.37\% | 0.46\% | 0.50\% | 0.66\% | 0.41\% | 0.80\% | $0.55 \%$ | 0.46\% | 0.66\% | 0.34\% | 0.72\% | 0.84\% | 0.50\% | 0.48\% |
|  |  | 0.2791 | 0.7692 | 1.2408 | 1.3481 | 1.5637 | 2.0595 | 1.2655 | 2.9494 | $1.6063$ | $1.2770$ | 2.2021 | 1.0197 | $2.1747$ | 2.6436 | 1.5927 | 1.5903 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.06\% | 0.60\% | 0.61\% | 0.68\% | 0.81\% | 0.82\% | 0.88\% | 0.80\% | 0.92\% | 0.98\% | 0.83\% | 0.66\% | 1.13\% | 0.97\% | 0.73\% | 0.52\% |
|  |  | 0.2071 | 2.4337 | 2.9355 | 3.8436 | 2.4178 | 2.7942 | 3.6082 | 3.6314 | 2.7140 | 3.2749 | 2.9924 | 2.6161 | 3.3326 | 3.0485 | 2.4554 | 1.8600 |
| CAR (1) |  | 0.11\% | 0.55\% | 0.58\% | 0.60\% | 0.69\% | 0.72\% | 0.77\% | 0.65\% | 0.81\% | 0.83\% | 0.66\% | 0.48\% | 0.94\% | 0.76\% | 0.53\% | 0.35\% |
|  |  | 0.4059 | 2.3341 | 3.0188 | 3.5068 | 2.1575 | 2.6756 | 3.2844 | 3.0525 | 2.5237 | 2.8421 | 2.4106 | 1.9343 | 2.8617 | 2.4376 | 1.8289 | 1.2743 |
| BHAR (0) |  | -0.11\% | 0.36\% | 0.57\% | 0.31\% | 0.77\% | 0.74\% | 0.59\% | 0.96\% | 0.88\% | 0.84\% | 0.86\% | 0.66\% | 1.00\% | 0.95\% | 0.70\% | 0.39\% |
|  |  | -0.3126 | 1.1527 | 1.8639 | 0.9464 | 2.1695 | 2.2666 | 1.7175 | 4.2490 | 2.4018 | 2.4148 | 2.9885 | 2.2133 | 2.8161 | 2.9974 | 2.0723 | 1.3380 |
| BHAR (1) |  | -0.01\% | 0.29\% | 0.43\% | 0.24\% | 0.61\% | 0.60\% | 0.52\% | 0.73\% | 0.78\% | 0.65\% | 0.62\% | 0.43\% | 0.79\% | 0.65\% | 0.36\% | 0.14\% |
|  |  | -0.0337 | 0.9808 | 1.5411 | 0.7171 | 1.8890 | 2.0570 | 1.6347 | 3.3632 | 2.3272 | 1.9964 | 2.1577 | 1.4373 | 2.3620 | 2.1710 | 1.0687 | 0.4839 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.29\% | -0.53\% | -0.29\% | -0.25\% | -0.71\% | -0.35\% | -0.22\% | -0.31\% | -0.42\% | -0.27\% | -0.36\% | -0.46\% | -0.47\% | -0.45\% | -0.55\% | -0.65\% |
|  |  | -5.1586 | -2.4962 | -1.5430 | $-1.5441$ | -2.3334 | -1.2739 | -0.9223 | -1.3690 | -1.3070 | -0.8823 | -1.2328 | -1.7246 | -1.3619 | -1.3607 | -1.7706 | -2.2796 |
| CAR (1) |  | -1.19\% | -0.43\% | -0.23\% | -0.30\% | -0.55\% | -0.27\% | -0.25\% | -0.38\% | -0.36\% | -0.32\% | -0.45\% | -0.57\% | -0.57\% | -0.55\% | -0.66\% | -0.74\% |
|  |  | -5.1376 | -2.1283 | -1.3204 | $-1.8727$ | -1.9552 | -1.0603 | -1.0658 | -1.7327 | -1.1614 | -1.0694 | -1.5482 | -2.1563 | -1.7116 | -1.7100 | -2.2064 | -2.7043 |
| BHAR (0) |  | -1.43\% | -0.51\% | -0.40\% | -0.28\% | -0.77\% | -0.35\% | -0.69\% | -0.02\% | -0.44\% | -0.43\% | -0.24\% | -0.47\% | -0.45\% | -0.29\% | -0.45\% | -0.64\% |
|  |  | -4.7422 | -2.0151 | -1.2610 | -0.9404 | -2.1987 | -1.0973 | -1.8354 | -0.0982 | -1.2318 | -1.2008 | -0.8880 | -1.6165 | -1.2505 | -0.8532 | -1.3471 | -1.9248 |
| BHAR (1) |  | -1.19\% | -0.57\% | -0.43\% | -0.38\% | -0.63\% | -0.34\% | -0.72\% | -0.32\% | -0.46\% | -0.58\% | -0.51\% | -0.68\% | -0.69\% | -0.54\% | -0.69\% | -0.81\% |
|  |  | -4.5871 | -2.1383 | -1.4235 | -1.2260 | -2.1275 | -1.2001 | -1.9869 | -1.4503 | -1.3817 | -1.6513 | -1.6633 | -2.2122 | -1.9007 | -1.6223 | -2.1621 | $-2.3629$ |

Panel B. The time-series momentum using market-weighted return







Panel C. The time-series momentum using inversed-volatility weighted return


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 6 |  | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.12\% | 0.54\% | 0.63\% | 0.74\% | 0.65\% | 0.86\% | 1.01\% | 0.93\% | 0.94\% | 1.12\% | 1.01\% | 0.86\% | 1.29\% | 1.20\% | 1.00\% | 0.79\% |
|  |  | -0.6656 | 2.9293 | 3.6274 | 4.9431 | 2.7096 | 3.5905 | 4.5200 | 4.5114 | 3.3502 | 4.1568 | 3.8637 | 3.5011 | 4.4871 | 4.2422 | 3.6288 | 3.0372 |
| CAR (1) |  | -0.17\% | 0.50\% | 0.65\% | 0.71\% | 0.67\% | 0.83\% | 0.94\% | 0.82\% | 0.95\% | 1.00\% | 0.87\% | 0.70\% | 1.13\% | 0.99\% | 0.80\% | 0.60\% |
|  |  | -0.8336 | 2.7249 | 3.8736 | 4.8031 | 2.7292 | 3.3874 | 4.2524 | 3.9601 | 3.4127 | 3.6606 | 3.3255 | 2.8664 | 3.9817 | 3.5101 | 2.9377 | 2.3597 |
| BHAR (0) |  | -0.16\% | 0.35\% | 0.30\% | 0.51\% | 0.53\% | 0.61\% | 0.77\% | 1.18\% | 0.87\% | 0.83\% | 1.12\% | 0.68\% | 1.24\% | 1.22\% | 1.00\% | 0.57\% |
|  |  | -0.6828 | 1.3350 | 1.0979 | 1.9338 | 1.8620 | 1.8403 | 2.5094 | 4.3053 | 2.9174 | 2.7879 | 3.6281 | 2.4774 | 3.7220 | 3.8704 | 3.4148 | 1.9504 |
| BHAR (1) |  | -0.28\% | 0.37\% | 0.46\% | 0.60\% | 0.63\% | 0.65\% | 0.69\% | 0.98\% | 0.93\% | 0.85\% | 0.98\% | 0.49\% | 1.12\% | 0.95\% | 0.85\% | 0.30\% |
|  |  | -1.1820 | 1.3869 | 1.6132 | 2.1256 | 2.3970 | 2.1136 | 2.4244 | 3.8296 | 3.2876 | 2.8228 | 3.3589 | 1.7455 | 3.9529 | 3.0135 | 2.8621 | 1.0344 |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.47\% | 0.15\% | 0.38\% | 0.38\% | 0.25\% | 0.51\% | 0.69\% | 0.54\% | 0.58\% | 0.68\% | 0.55\% | 0.36\% | 0.49\% | 0.45\% | 0.38\% | 0.26\% |
|  |  | -1.4118 | 0.5584 | 1.7581 | 1.8738 | 0.7556 | 1.6283 | 2.4204 | 1.9367 | 1.5609 | 1.8981 | 1.5377 | 1.0137 | 1.1629 | 1.0691 | 0.9096 | 0.6554 |
| CAR (1) |  | -0.32\% | 0.21\% | 0.40\% | 0.35\% | 0.24\% | 0.54\% | 0.60\% | 0.40\% | 0.56\% | 0.57\% | 0.42\% | 0.19\% | 0.41\% | 0.30\% | 0.26\% | 0.16\% |
|  |  | -1.0449 | 0.8691 | 1.9235 | 1.6991 | 0.7279 | 1.7990 | 2.1062 | 1.3872 | 1.4900 | 1.5259 | 1.1171 | 0.5382 | 0.9561 | 0.7071 | 0.6213 | 0.4079 |
| BHAR (0) |  | -0.97\% | -0.25\% | 0.34\% | 0.04\% | 0.03\% | 0.37\% | 0.51\% | 0.91\% | 0.47\% | 0.42\% | 0.45\% | $\mathbf{0 . 1 3 \%}$ | 0.45\% | 0.66\% | 0.61\% | 0.56\% |
|  |  | -1.9424 | -0.5598 | 0.9004 | 0.0810 | 0.0869 | 0.9863 | 1.5178 | 2.5607 | 1.1450 | 0.9587 | 1.1502 | 0.3105 | 1.0279 | 1.6243 | 1.3387 | 1.4414 |
| BHAR (1) |  | -0.12\% | -0.16\% | 0.63\% | -0.06\% | 0.41\% | 0.52\% | 0.44\% | 0.72\% | 0.58\% | 0.30\% | 0.29\% | 0.11\% | 0.42\% | 0.41\% | 0.29\% | 0.37\% |
|  |  | -0.3538 | -0.4230 | 1.8621 | -0.1165 | 1.2240 | 1.5352 | 1.2852 | 2.0390 | 1.4393 | 0.6741 | 0.7133 | 0.2530 | 0.9411 | 1.0477 | 0.6382 | 0.9826 |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.35\% | -0.29\% | -0.09\% | 0.15\% | -0.54\% | 0.04\% | 0.32\% | 0.34\% | -0.06\% | 0.31\% | 0.39\% | 0.34\% | 0.32\% | 0.44\% | 0.36\% | 0.27\% |
|  |  | -4.4101 | -1.2486 | -0.4266 | 0.8882 | -1.5442 | 0.1514 | 1.2533 | 1.4624 | -0.1559 | 0.9576 | 1.3111 | 1.2575 | 0.9142 | 1.3382 | 1.1456 | 0.9369 |
| CAR (1) |  | -1.08\% | -0.26\% | -0.09\% | 0.07\% | -0.29\% | 0.10\% | 0.36\% | 0.29\% | 0.26\% | 0.42\% | 0.40\% | 0.28\% | 0.36\% | 0.39\% | 0.29\% | 0.20\% |
|  |  | -3.5216 | -1.1144 | -0.4504 | 0.4015 | -0.9229 | 0.3728 | 1.4235 | 1.2209 | 0.7669 | 1.3436 | 1.3564 | 1.0641 | 1.0662 | 1.1874 | 0.9549 | 0.7186 |
| BHAR (0) |  | $-1.27 \%$ | -1.03\% | 0.07\% | -1.05\% | $-0.76 \%$ | $-0.26 \%$ | 0.05\% | $-0.28 \%$ | $-0.16 \%$ | 0.12\% | 0.58\% | 0.50\% | 0.30\% | 0.40\% | $0.57 \%$ | $0.30 \%$ |
|  |  | -3.4747 | $-2.3550$ | 0.1937 | -2.1508 | $-1.5858$ | $-0.6603$ | 0.1246 | -0.6305 | $-0.4598$ | 0.3323 | 1.9295 | 1.4449 | 0.8190 | 1.1242 | 1.6734 | 0.8933 |
| BHAR (1) |  | -1.28\% | -0.87\% | -0.09\% | $\mathbf{- 0 . 8 3 \%}$ | -0.34\% | 0.07\% | 0.18\% | 0.33\% | -0.03\% | 0.14\% | 0.52\% | 0.16\% | 0.30\% | 0.32\% | 0.38\% | 0.19\% |
|  |  | -3.3535 | -1.9209 | -0.2016 | -1.7799 | -0.9941 | 0.1869 | 0.4378 | 1.0650 | -0.0745 | 0.3554 | 1.6883 | 0.4196 | 0.8421 | 0.9048 | 1.1116 | 0.5388 |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.72\% | 0.00\% | 0.22\% | 0.34\% | 0.03\% | 0.40\% | 0.68\% | 0.62\% | 0.39\% | 0.66\% | 0.65\% | 0.54\% | 0.68\% | 0.69\% | 0.58\% | 0.49\% |
|  |  | -2.5169 | -0.0091 | 0.9954 | 1.6175 | 0.1041 | 1.3886 | 2.4564 | 2.3437 | 1.1523 | 2.0323 | 2.0164 | 1.8241 | 1.9262 | 1.9780 | 1.7877 | 1.6186 |
| CAR (1) |  | -0.57\% | 0.00\% | 0.23\% | 0.29\% | 0.06\% | 0.41\% | 0.62\% | 0.51\% | 0.38\% | 0.59\% | 0.53\% | $\mathbf{0 . 4 2 \%}$ | 0.59\% | 0.53\% | 0.45\% | 0.39\% |
|  |  | -1.9808 | 0.0067 | 1.0272 | 1.4049 | 0.1944 | 1.3901 | 2.1977 | 1.9660 | 1.0895 | 1.7628 | 1.6245 | 1.4341 | 1.7101 | 1.5356 | 1.3948 | 1.3052 |
| BHAR (0) |  | -0.90\% | -0.37\% | 0.10\% | -0.90\% | -0.02\% | 0.36\% | 0.72\% | 0.69\% | 0.34\% | 0.60\% | 0.61\% | 0.43\% | 0.57\% | 0.64\% | 0.58\% | 0.35\% |
|  |  | -2.5271 | -1.0415 | 0.2723 | -1.7617 | -0.0661 | 1.0572 | 1.7842 | 1.9302 | 0.8843 | 1.5530 | 1.7487 | 1.0674 | 1.6027 | 1.8017 | 1.6826 | 1.0545 |
| BHAR (1) |  | -0.60\% | -0.26\% | 0.56\% | $\mathbf{- 0 . 1 1 \%}$ | -0.12\% | 0.39\% | 0.62\% | 0.54\% | 0.29\% | 0.40\% | 0.44\% | 0.14\% | 0.41\% | 0.47\% | 0.35\% | 0.35\% |
|  |  | -1.8651 | -0.8299 | 2.0192 | -0.2613 | -0.3509 | 1.1485 | 1.5382 | 1.4834 | 0.7836 | 1.0015 | 1.2777 | 0.3361 | 1.1652 | 1.4193 | 1.0484 | 1.0966 |



| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.04\% | 0.39\% | 0.60\% | 0.63\% | 0.44\% | 0.73\% | 0.85\% | 0.78\% | 0.87\% | 0.97\% | 0.87\% | 0.74\% | 0.93\% | 0.93\% | 0.80\% | 0.65\% |
|  |  | 0.1539 | 1.7663 | 3.3215 | 3.6786 | 1.4210 | 2.7540 | 3.5578 | 3.4295 | 2.9069 | 3.3909 | 3.2183 | 2.8708 | 2.9965 | 3.1597 | 2.8517 | 2.3897 |
| CAR (1) |  | 0.03\% | 0.43\% | 0.58\% | 0.58\% | 0.54\% | 0.77\% | 0.82\% | 0.70\% | 0.92\% | 0.91\% | 0.77\% | 0.62\% | 0.91\% | 0.83\% | 0.69\% | 0.55\% |
|  |  | 0.1338 | 2.0375 | 3.2318 | 3.4700 | 1.9653 | 3.0781 | 3.5465 | 3.2132 | 3.1347 | 3.2263 | 2.8103 | 2.4207 | 3.0379 | 2.8955 | 2.4789 | 2.0611 |
| BHAR (0) |  | -0.05\% | 0.34\% | 0.65\% | 0.56\% | 0.35\% | 0.70\% | 0.72\% | 0.61\% | 0.78\% | 0.88\% | 0.95\% | 0.55\% | 0.75\% | 0.74\% | 0.87\% | 0.48\% |
|  |  | -0.1526 | 1.1692 | 2.1238 | 1.9362 | 0.9886 | 2.0550 | 2.1913 | 2.1930 | 2.3140 | 2.5961 | 2.9708 | 1.6891 | 2.3077 | 2.4621 | 2.8648 | 1.5583 |
| BHAR (1) |  | -0.07\% | 0.34\% | 0.84\% | $\mathbf{0 . 6 1 \%}$ | 0.45\% | 0.70\% | 0.73\% | 0.51\% | 0.86\% | 0.75\% | 0.74\% | 0.26\% | 0.77\% | 0.71\% | 0.76\% | 0.50\% |
|  |  | -0.2351 | 1.1575 | 2.6563 | 2.0618 | 1.4451 | 2.1033 | 2.2919 | 1.9276 | 2.5503 | 2.2486 | 2.4131 | 0.7331 | 2.4149 | 2.4000 | 2.3927 | 1.7067 |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.08\% | -0.69\% | -0.46\% | -0.27\% | -1.05\% | -0.76\% | -0.41\% | -0.36\% | -0.90\% | -0.55\% | -0.47\% | -0.47\% | -0.63\% | -0.58\% | -0.56\% | -0.57\% |
|  |  | -4.6000 | -3.1366 | -2.3538 | -1.5360 | -3.3880 | -2.6853 | -1.6116 | -1.6083 | -2.6691 | -1.7562 | -1.6454 | -1.8487 | -1.8764 | -1.8368 | -1.9266 | -2.1463 |
| CAR (1) |  | -0.99\% | -0.64\% | -0.34\% | -0.26\% | -0.94\% | -0.61\% | -0.33\% | -0.38\% | -0.65\% | -0.44\% | -0.44\% | -0.48\% | -0.58\% | -0.61\% | -0.58\% | -0.58\% |
|  |  | -4.4637 | -2.9943 | -1.8435 | -1.5536 | -3.1271 | -2.1851 | -1.3347 | -1.7764 | -2.0223 | -1.4527 | -1.6148 | -2.0052 | -1.7947 | -1.9837 | -2.0836 | -2.2956 |
| BHAR (0) |  | -1.23\% | -0.44\% | -0.40\% | -0.10\% | -1.00\% | -0.77\% | -0.48\% | -0.04\% | -0.83\% | -0.48\% | -0.24\% | -0.33\% | -0.60\% | -0.55\% | -0.55\% | -0.60\% |
|  |  | -4.4382 | -1.5098 | -1.3646 | -0.3493 | -2.8594 | -2.2428 | -1.4877 | -0.1327 | -2.3400 | -1.3798 | -0.8440 | -1.3034 | -1.7383 | -1.6173 | -1.8168 | -2.0129 |
| BHAR (1) |  | -1.13\% | -0.46\% | -0.43\% | -0.07\% | -1.07\% | -1.02\% | -0.42\% | -0.21\% | -0.82\% | -0.39\% | -0.35\% | -0.45\% | -0.68\% | -0.78\% | -0.75\% | -0.68\% |
|  |  | -4.4464 | -1.6882 | -1.5521 | -0.2670 | -3.2978 | -3.0689 | -1.4765 | -0.8253 | -2.5168 | -1.2375 | -1.2770 | -1.8623 | -2.0934 | -2.4016 | -2.5318 | -2.2647 |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.16\% | 0.34\% | 0.49\% | 0.56\% | 0.46\% | 0.67\% | 0.83\% | 0.76\% | 0.67\% | 0.91\% | 0.85\% | 0.77\% | 0.94\% | 0.88\% | 0.83\% | 0.74\% |
|  |  | -0.5346 | 1.5148 | 2.5147 | 2.8444 | 1.5309 | 2.5573 | 3.2091 | 2.9740 | 2.0622 | 2.9667 | 2.7467 | 2.5681 | 2.5694 | 2.5190 | 2.3929 | 2.1649 |
| CAR (1) |  | -0.20\% | 0.35\% | 0.50\% | 0.47\% | 0.43\% | 0.72\% | 0.75\% | 0.65\% | 0.76\% | 0.88\% | 0.78\% | 0.68\% | 0.85\% | 0.78\% | 0.73\% | 0.66\% |
|  |  | -0.7454 | 1.6465 | 2.5474 | 2.3985 | 1.4970 | 2.7504 | 2.8218 | 2.5054 | 2.3794 | 2.7551 | 2.4432 | 2.2335 | 2.3377 | 2.2158 | 2.0785 | 1.9631 |
| BHAR (0) |  | -0.11\% | 0.31\% | 0.50\% | 0.15\% | 0.52\% | 0.80\% | 0.69\% | 1.16\% | 0.63\% | 0.68\% | 1.03\% | 0.96\% | 0.77\% | 0.81\% | 0.82\% | 0.75\% |
|  |  | -0.3053 | 0.9092 | 1.5598 | 0.3884 | 1.4990 | 2.4479 | 1.7237 | 4.1280 | 1.7823 | 1.7566 | 3.0610 | 2.5223 | 1.8899 | 2.2461 | 2.1591 | 2.0295 |
| BHAR (1) |  | -0.14\% | 0.20\% | 0.29\% | 0.07\% | 0.30\% | 0.70\% | 0.62\% | 0.88\% | 0.74\% | 0.56\% | 1.00\% | 0.73\% | 0.63\% | 0.65\% | 0.72\% | 0.70\% |
|  |  | -0.3792 | 0.6298 | 0.8561 | 0.2045 | 0.9042 | 2.1450 | 1.6515 | 2.9921 | 2.1943 | 1.4519 | 2.9105 | 1.8294 | 1.5295 | 1.7669 | 2.0048 | 1.9755 |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.83\% | 1.10\% | 0.89\% | 0.87\% | 1.04\% | 1.04\% | 1.01\% | 0.89\% | 1.00\% | 1.03\% | 0.89\% | 0.78\% | 1.13\% | 1.01\% | 0.82\% | 0.64\% |
|  |  | 1.4481 | 2.8657 | 3.0584 | 3.6690 | 3.1070 | 3.6334 | 3.8904 | 3.9395 | 3.0904 | 3.5399 | 3.2583 | 3.1961 | 3.3020 | 3.1082 | 2.8457 | 2.5256 |
| CAR (1) |  | 0.74\% | 0.92\% | 0.81\% | 0.73\% | 0.96\% | 0.96\% | 0.91\% | 0.73\% | 0.95\% | 0.94\% | 0.78\% | 0.63\% | 0.96\% | 0.86\% | 0.69\% | 0.50\% |
|  |  | 1.3726 | 2.5683 | 2.9945 | 3.3035 | 2.9930 | 3.5041 | 3.6487 | 3.3487 | 3.1891 | 3.3087 | 2.9195 | 2.6498 | 2.8916 | 2.7813 | 2.4943 | 2.0159 |
| BHAR (0) |  | 0.69\% | 0.76\% | 0.77\% | $\mathbf{0 . 1 1 \%}$ | 1.21\% | 1.16\% | 0.86\% | 0.88\% | 1.28\% | 1.08\% | 1.09\% | 1.01\% | 1.13\% | 1.08\% | 0.70\% | 0.72\% |
|  |  | 1.1041 | 2.3195 | 1.2343 | 0.3366 | 3.1566 | 3.1872 | 2.3411 | 3.0102 | 3.5034 | 3.0461 | 3.2785 | 3.4447 | 3.1751 | 3.2066 | 2.4742 | 1.9407 |
| BHAR (1) |  | 0.74\% | 0.59\% | 0.47\% | 0.15\% | 1.20\% | 0.90\% | 0.72\% | 0.60\% | 1.22\% | 1.04\% | 1.01\% | 0.93\% | 1.08\% | 0.80\% | 0.57\% | 0.75\% |
|  |  | 1.5592 | 1.8059 | 0.9702 | 0.4804 | 3.2574 | 2.5233 | 2.1953 | 1.9693 | 3.2540 | 3.0167 | 3.0124 | 3.3364 | 2.9563 | 2.3228 | 2.0396 | 2.0537 |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| H |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.77\% | -0.07\% | 0.25\% | 0.32\% | -0.16\% | 0.20\% | 0.51\% | 0.39\% | 0.39\% | 0.59\% | 0.45\% | 0.24\% | 0.53\% | 0.36\% | 0.22\% | 0.02\% |
|  |  | -2.1754 | -0.2662 | 1.0299 | 1.3416 | $-0.4215$ | 0.5722 | 1.5025 | 1.2304 | 0.9217 | 1.4510 | 1.1302 | 0.6614 | 1.2109 | 0.8598 | 0.5275 | 0.0571 |
| CAR (1) |  | -0.94\% | -0.08\% | $\mathbf{0 . 2 1 \%}$ | 0.18\% | -0.10\% | 0.32\% | 0.47\% | 0.25\% | 0.42\% | 0.51\% | 0.29\% | 0.06\% | 0.21\% | 0.11\% | 0.01\% | -0.15\% |
|  |  | -2.9952 | -0.3243 | 0.8451 | 0.7560 | -0.2778 | 0.9064 | 1.3944 | 0.7880 | 0.9999 | 1.2160 | 0.7328 | 0.1745 | 0.4722 | 0.2538 | 0.0346 | -0.3853 |
| BHAR (0) |  | -0.73\% | -0.03\% | 0.38\% | $\mathbf{0 . 4 1 \%}$ | -0.21\% | 0.32\% | 0.40\% | 0.99\% | 0.61\% | 0.56\% | 0.45\% | $\mathbf{0 . 6 2 \%}$ | 0.45\% | 0.42\% | 0.33\% | -0.09\% |
|  |  | -1.5940 | -0.0606 | 1.0380 | 0.9804 | -0.4902 | 0.7480 | 0.9004 | 2.7413 | 1.3021 | 1.1810 | 0.9771 | 1.3561 | 0.9218 | 0.9582 | 0.7215 | -0.1938 |
| BHAR (1) |  | -1.01\% | -0.08\% | 0.24\% | 0.12\% | -0.14\% | 0.32\% | 0.33\% | 0.62\% | 0.55\% | 0.55\% | 0.38\% | 0.53\% | 0.26\% | 0.12\% | 0.33\% | -0.24\% |
|  |  | -2.6386 | -0.2409 | 0.7541 | 0.3003 | -0.3583 | 0.7330 | 0.8228 | 1.7087 | 1.2690 | 1.2337 | 0.8713 | 1.2936 | 0.5750 | 0.2660 | 0.7818 | -0.5407 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.89\% | 0.02\% | 0.22\% | 0.21\% | -0.03\% | 0.37\% | 0.50\% | 0.42\% | 0.36\% | 0.45\% | 0.39\% | 0.27\% | 0.36\% | 0.30\% | 0.24\% | 0.18\% |
|  |  | -2.2218 | 0.0512 | 0.7288 | 0.7763 | -0.0603 | 0.9475 | 1.3980 | 1.3049 | 0.8062 | 1.0277 | 0.9588 | 0.7016 | 0.7678 | 0.6761 | 0.5698 | 0.4683 |
| CAR (1) |  | -0.85\% | 0.00\% | 0.24\% | $\mathbf{0 . 1 9 \%}$ | 0.00\% | 0.37\% | 0.41\% | 0.31\% | 0.29\% | 0.35\% | 0.28\% | 0.16\% | 0.25\% | 0.24\% | 0.18\% | 0.09\% |
|  |  | -1.9680 | -0.0142 | 0.6830 | 0.6344 | -0.0064 | 0.9268 | 1.1448 | 0.9552 | 0.6492 | 0.8030 | 0.6861 | 0.4330 | 0.5492 | 0.5454 | 0.4346 | 0.2309 |
| BHAR (0) |  | -1.16\% | 0.13\% | 0.11\% | 0.23\% | -0.14\% | 0.05\% | 0.45\% | 0.32\% | 0.03\% | 0.66\% | 0.46\% | $\mathbf{0 . 4 9 \%}$ | 0.38\% | 0.35\% | 0.16\% | -0.20\% |
|  |  | -1.7990 | 0.2108 | 0.1880 | 0.3318 | -0.2629 | 0.0986 | 0.7054 | 0.6791 | 0.0482 | 1.1176 | 0.8898 | 0.9587 | 0.7547 | 0.7542 | 0.3386 | -0.4290 |
| BHAR (1) |  | -0.90\% | 0.67\% | 0.54\% | 0.67\% | -0.42\% | 0.44\% | 0.53\% | 0.20\% | 0.15\% | 0.39\% | 0.18\% | $\mathbf{0 . 1 1 \%}$ | 0.06\% | 0.22\% | 0.22\% | -0.19\% |
|  |  | -1.5368 | 1.2230 | 0.7465 | 1.0297 | -0.7704 | 0.7750 | 0.7419 | 0.4113 | 0.3161 | 0.7706 | 0.3765 | 0.2072 | 0.1335 | 0.4783 | 0.4486 | -0.4063 |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.00\% | -0.06\% | 0.07\% | 0.00\% | -0.36\% | -0.01\% | 0.04\% | -0.07\% | -0.23\% | -0.07\% | -0.13\% | -0.22\% | -0.32\% | -0.22\% | -0.29\% | -0.37\% |
|  |  | -2.2718 | -0.1854 | 0.2388 | -0.0131 | -0.8524 | -0.0315 | 0.1053 | -0.2196 | -0.4901 | -0.1593 | -0.3470 | -0.6113 | -0.6705 | -0.5188 | -0.7481 | $-1.0428$ |
| CAR (1) |  | -0.98\% | -0.07\% | 0.00\% | -0.05\% | -0.32\% | -0.08\% | -0.07\% | -0.14\% | -0.29\% | -0.17\% | -0.28\% | -0.33\% | -0.44\% | -0.36\% | -0.43\% | -0.42\% |
|  |  | -2.3326 | -0.2678 | -0.0182 | -0.2041 | -0.8172 | -0.2041 | -0.2046 | -0.4781 | -0.6343 | -0.4018 | -0.7485 | -0.9578 | -0.9729 | -0.8829 | -1.1640 | -1.2805 |
| BHAR (0) |  | -1.21\% | -0.73\% | 0.08\% | -0.08\% | -0.24\% | 0.01\% | -0.18\% | 0.14\% | -0.14\% | -0.16\% | 0.12\% | -0.31\% | -0.21\% | 0.03\% | -0.13\% | -0.25\% |
|  |  | -2.3969 | -1.4973 | 0.2428 | -0.2604 | -0.4673 | 0.0238 | -0.3915 | 0.3347 | -0.2686 | -0.3337 | 0.3343 | -0.7034 | -0.4174 | 0.0778 | -0.3112 | -0.6605 |
| BHAR (1) |  | -1.05\% | -0.67\% | 0.15\% | -0.15\% | -0.22\% | 0.10\% | -0.26\% | 0.25\% | -0.28\% | -0.27\% | 0.10\% | -0.36\% | -0.32\% | -0.03\% | -0.43\% | -0.24\% |
|  |  | -2.4647 | -1.8495 | 0.4543 | -0.5190 | -0.5083 | 0.2533 | -0.5608 | 0.7953 | -0.5937 | -0.6195 | 0.3238 | -0.8704 | -0.7067 | -0.0697 | -1.0982 | -0.6407 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.34\% | 0.02\% | 0.30\% | 0.37\% | 0.06\% | 0.37\% | 0.56\% | 0.49\% | 0.55\% | 0.72\% | 0.71\% | 0.64\% | 0.69\% | 0.69\% | 0.68\% | 0.59\% |
|  |  | -1.5272 | 0.1171 | 1.5571 | 2.1462 | 0.2287 | 1.3617 | 2.1136 | 2.0187 | 1.6638 | 2.2986 | 2.3187 | 2.2247 | 1.9596 | 2.0246 | 2.0330 | 1.8138 |
| CAR (1) |  | -0.36\% | 0.06\% | 0.32\% | 0.35\% | 0.13\% | 0.41\% | 0.48\% | 0.42\% | 0.60\% | 0.72\% | 0.68\% | 0.55\% | 0.63\% | 0.63\% | 0.59\% | 0.50\% |
|  |  | -1.7013 | 0.2795 | 1.6599 | 2.0489 | 0.4502 | 1.4366 | 1.7867 | 1.7584 | 1.7613 | 2.2201 | 2.2260 | 1.9371 | 1.8121 | 1.8559 | 1.7919 | 1.5773 |
| BHAR (0) |  | -0.45\% | -0.31\% | 0.29\% | 0.40\% | -0.15\% | 0.46\% | 0.77\% | 0.40\% | 0.60\% | 0.82\% | 0.85\% | 0.47\% | 0.67\% | 0.70\% | 0.84\% | 0.44\% |
|  |  | -1.6733 | -0.9423 | 0.8017 | 1.1354 | -0.4917 | 1.3036 | 1.8371 | 1.2969 | 1.5898 | 2.2136 | 2.3351 | 1.4757 | 1.8365 | 1.7971 | 2.4255 | 1.1517 |
| BHAR (1) |  | -0.57\% | -0.31\% | 0.26\% | 0.19\% | -0.06\% | 0.55\% | 0.48\% | 0.23\% | 0.45\% | 0.67\% | 0.56\% | 0.13\% | 0.51\% | 0.51\% | 0.79\% | 0.30\% |
|  |  | -1.8547 | -0.8219 | 0.7548 | 0.5450 | -0.1980 | 1.6949 | 1.2221 | 0.7545 | 1.1911 | 1.7457 | 1.5405 | 0.3987 | 1.3995 | 1.3469 | 2.2662 | 0.7707 |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| H |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.39\% | 0.30\% | 0.40\% | 0.55\% | 0.40\% | 0.54\% | 0.65\% | 0.57\% | 0.65\% | 0.79\% | 0.62\% | 0.47\% | 0.72\% | 0.57\% | 0.37\% | 0.28\% |
|  |  | -1.0277 | 0.8106 | 1.3359 | 2.1687 | 0.9225 | 1.3025 | 1.8143 | 1.7287 | 1.4497 | 1.8729 | 1.5462 | 1.2897 | 1.5058 | 1.1950 | 0.8549 | 0.7028 |
| CAR (1) |  | -0.38\% | 0.26\% | 0.40\% | 0.48\% | 0.34\% | 0.51\% | 0.56\% | 0.43\% | 0.66\% | 0.70\% | 0.48\% | 0.34\% | 0.47\% | 0.39\% | 0.20\% | 0.17\% |
|  |  | -1.0022 | 0.7739 | 1.4468 | 1.9192 | 0.7881 | 1.2795 | 1.6011 | 1.3070 | 1.4379 | 1.6789 | 1.2137 | 0.9691 | 0.9645 | 0.8393 | 0.4693 | 0.4306 |
| BHAR (0) |  | -0.15\% | 0.13\% | 0.60\% | 0.04\% | 0.55\% | 0.76\% | 0.74\% | 0.54\% | 0.71\% | 0.59\% | 0.57\% | 0.30\% | 0.63\% | 0.72\% | 0.34\% | 0.43\% |
|  |  | -0.3565 | 0.2715 | 1.5847 | 0.1025 | 1.1529 | 1.8119 | 1.4307 | 1.3460 | 1.5021 | 1.1689 | 1.2353 | 0.6455 | 1.2724 | 1.6031 | 0.7637 | 1.1339 |
| BHAR (1) |  | -0.20\% | -0.04\% | 0.29\% | 0.35\% | 0.53\% | 0.66\% | 0.81\% | 0.38\% | 0.68\% | 0.65\% | 0.51\% | 0.18\% | 0.55\% | 0.53\% | 0.15\% | 0.35\% |
|  |  | -0.5219 | -0.0826 | 0.8553 | 0.7450 | 1.1692 | 1.6380 | 1.6003 | 1.0025 | 1.4798 | 1.3990 | 1.1407 | 0.3939 | 1.1058 | 1.1867 | 0.3295 | 0.8827 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.01\% | 0.35\% | 0.41\% | 0.51\% | 0.43\% | 0.52\% | 0.64\% | 0.60\% | 0.60\% | 0.72\% | 0.67\% | 0.54\% | 0.86\% | 0.81\% | 0.62\% | 0.47\% |
|  |  | -0.0450 | 1.6743 | 2.0136 | 2.7879 | 1.5317 | 1.7842 | 2.3634 | 2.4526 | 1.7605 | 2.1629 | 2.1287 | 1.8808 | 2.4020 | 2.3490 | 1.9069 | 1.5381 |
| CAR (1) |  | -0.13\% | 0.24\% | 0.38\% | 0.42\% | 0.30\% | 0.45\% | 0.57\% | 0.47\% | 0.59\% | 0.69\% | 0.58\% | 0.42\% | 0.74\% | 0.67\% | 0.49\% | 0.34\% |
|  |  | -0.5970 | 1.1107 | 1.8429 | 2.2947 | 1.0456 | 1.5092 | 2.1093 | 1.9440 | 1.7050 | 2.0571 | 1.8641 | 1.4804 | 2.1221 | 1.9527 | 1.5068 | 1.1173 |
| BHAR (0) |  | -0.05\% | 0.29\% | 0.23\% | 0.45\% | 0.37\% | 0.59\% | 0.50\% | 0.98\% | 0.60\% | 0.61\% | 0.76\% | 0.61\% | 0.89\% | 0.98\% | 0.74\% | 0.49\% |
|  |  | -0.1906 | 0.8945 | 0.7009 | 1.2385 | 1.2073 | 1.7942 | 1.5071 | 3.3036 | 1.6536 | 1.5488 | 2.3470 | 1.8950 | 2.4599 | 2.8242 | 2.1021 | 1.4775 |
| BHAR (1) |  | -0.25\% | 0.00\% | 0.16\% | 0.37\% | 0.22\% | 0.40\% | 0.36\% | 0.79\% | 0.44\% | 0.44\% | 0.63\% | 0.31\% | 0.66\% | 0.80\% | 0.54\% | 0.44\% |
|  |  | -0.9602 | 0.0001 | 0.4903 | 1.0327 | 0.6440 | 1.1645 | 1.0932 | 2.6627 | 1.1741 | 1.1332 | 1.9459 | 0.8891 | 1.8371 | 2.3483 | 1.5626 | 1.3647 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.07\% | 0.64\% | 0.65\% | 0.76\% | 0.82\% | 0.89\% | 0.99\% | 0.90\% | 0.98\% | 1.11\% | 0.94\% | 0.75\% | 1.20\% | 1.08\% | 0.81\% | 0.60\% |
|  |  | 0.3158 | 2.8915 | 3.3740 | 4.4974 | 2.6901 | 3.2077 | 4.0835 | 4.0345 | 3.0970 | 3.7202 | 3.3602 | 2.8510 | 3.7155 | 3.4221 | 2.7745 | 2.1848 |
| CAR (1) |  | 0.05\% | 0.55\% | 0.61\% | 0.68\% | 0.64\% | 0.78\% | 0.86\% | 0.72\% | 0.88\% | 0.97\% | 0.76\% | 0.55\% | 1.03\% | 0.87\% | 0.61\% | 0.43\% |
|  |  | 0.2084 | 2.5761 | 3.3619 | 4.1648 | 2.1696 | 2.9510 | 3.6530 | 3.3261 | 2.8399 | 3.2842 | 2.7514 | 2.1425 | 3.2479 | 2.8077 | 2.1189 | 1.5770 |
| BHAR (0) |  | -0.04\% | 0.41\% | 0.78\% | 0.46\% | 0.70\% | 0.77\% | 0.64\% | 1.07\% | 0.88\% | 0.86\% | 0.97\% | 0.74\% | 1.06\% | 1.08\% | 0.91\% | 0.49\% |
|  |  | -0.1452 | 1.3915 | 2.6875 | 1.4595 | 2.0493 | 2.3196 | 1.8383 | 4.6558 | 2.5024 | 2.4351 | 3.4621 | 2.5370 | 3.1271 | 3.4437 | 2.7424 | 1.6060 |
| BHAR (1) |  | 0.10\% | 0.10\% | 0.73\% | 0.41\% | 0.57\% | 0.67\% | 0.61\% | 0.91\% | 0.85\% | 0.80\% | 0.86\% | 0.53\% | 0.89\% | 0.79\% | 0.55\% | 0.24\% |
|  |  | 0.3300 | 0.3211 | 2.5975 | 1.3686 | 1.8309 | 2.3596 | 1.9006 | 4.3913 | 2.5398 | 2.2731 | 2.8588 | 1.8038 | 2.7987 | 2.7012 | 1.7006 | 0.8123 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.46\% | -0.67\% | -0.34\% | -0.27\% | -0.96\% | -0.39\% | -0.19\% | -0.23\% | -0.55\% | -0.24\% | -0.25\% | -0.33\% | -0.57\% | -0.41\% | -0.42\% | -0.49\% |
|  |  | -5.5888 | -3.0330 | -1.7805 | -1.6008 | -3.1881 | -1.4386 | -0.7729 | -1.0537 | -1.7029 | -0.7957 | -0.8737 | -1.2620 | -1.6676 | -1.2295 | -1.3650 | -1.7457 |
| CAR (1) |  | -1.31\% | -0.49\% | -0.24\% | -0.27\% | -0.70\% | -0.24\% | -0.18\% | -0.26\% | -0.39\% | -0.24\% | -0.30\% | -0.40\% | -0.60\% | -0.43\% | -0.50\% | -0.54\% |
|  |  | -5.5691 | -2.4181 | -1.3474 | -1.6719 | -2.4168 | -0.9413 | -0.7477 | -1.1665 | -1.2676 | -0.7884 | -1.0458 | -1.5428 | -1.7861 | -1.3415 | -1.6669 | -2.0061 |
| BHAR (0) |  | -1.63\% | -0.68\% | -0.49\% | -0.31\% | -0.93\% | -0.34\% | -0.61\% | 0.11\% | -0.54\% | -0.37\% | -0.12\% | -0.26\% | -0.49\% | -0.19\% | -0.26\% | -0.47\% |
|  |  | -5.0809 | -2.5571 | -1.4253 | -1.0416 | -2.6908 | -1.0911 | -1.6427 | 0.4903 | -1.5181 | -1.0345 | -0.4406 | -0.8963 | -1.3673 | -0.5692 | -0.7950 | -1.4415 |
| BHAR (1) |  | -1.38\% | -0.68\% | -0.52\% | -0.35\% | -0.77\% | -0.32\% | -0.63\% | -0.16\% | -0.50\% | -0.46\% | -0.36\% | -0.45\% | -0.68\% | -0.41\% | -0.49\% | -0.62\% |
|  |  | -4.8959 | -2.5031 | -1.6009 | -1.1486 | -2.5592 | -1.1173 | -1.7238 | -0.7245 | -1.4668 | -1.2885 | -1.1549 | -1.4639 | -1.8342 | -1.2152 | -1.5162 | -1.8462 |

## Table 7.7a. Turnover ratios for time-series winner portfolio

| EW | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.9\% | 30.0\% | 20.5\% | 15.5\% | 44.4\% | 29.6\% | 20.4\% | 15.4\% | 38.3\% | 25.9\% | 20.1\% | 15.3\% | 34.1\% | 23.6\% | 18.3\% | 15.0\% |
| CAR (1) |  | 58.4\% | 30.2\% | 20.6\% | 15.6\% | 44.8\% | 29.8\% | 20.5\% | 15.5\% | 38.7\% | 26.1\% | 20.2\% | 15.3\% | 34.3\% | 23.8\% | 18.4\% | 15.0\% |
| BHAR (0) |  | 57.9\% | 29.4\% | 20.5\% | 14.8\% | 44.6\% | 29.2\% | 20.6\% | 14.8\% | 38.4\% | 25.4\% | 19.6\% | 14.9\% | 34.1\% | 23.6\% | 18.0\% | 15.6\% |
| BHAR (1) |  | 58.5\% | 29.6\% | 20.7\% | 14.8\% | 45.0\% | 29.4\% | 20.7\% | 14.9\% | 38.8\% | 25.7\% | 19.7\% | 15.0\% | 34.3\% | 23.7\% | 18.1\% | 15.7\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.1\% | 29.0\% | 19.9\% | 14.8\% | 44.1\% | 28.7\% | 19.6\% | 14.8\% | 38.3\% | 25.2\% | 19.3\% | 14.8\% | 31.9\% | 21.9\% | 17.1\% | 14.4\% |
| CAR (1) |  | 56.5\% | 29.2\% | 20.0\% | 14.8\% | 44.5\% | 28.9\% | 19.8\% | 14.9\% | 38.4\% | 25.3\% | 19.4\% | 14.9\% | 32.2\% | 22.1\% | 17.2\% | 14.4\% |
| BHAR (0) |  | 56.2\% | 29.0\% | 20.7\% | 14.3\% | 44.9\% | 29.3\% | 20.3\% | 14.0\% | 39.0\% | 25.4\% | 18.7\% | 14.1\% | 32.0\% | 21.7\% | 17.1\% | 14.4\% |
| BHAR (1) |  | 56.7\% | 29.3\% | 20.7\% | 14.4\% | 45.4\% | 29.9\% | 20.7\% | 14.3\% | 39.2\% | 25.9\% | 18.8\% | 14.1\% | $32.2 \%$ | 21.8\% | 17.2\% | 14.5\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.2\% | 30.0\% | 20.2\% | 15.5\% | 45.6\% | 29.5\% | 20.4\% | 15.4\% | 39.7\% | 26.2\% | 20.0\% | 15.3\% | 37.0\% | 24.6\% | 18.6\% | 15.2\% |
| CAR (1) |  | 58.8\% | 30.2\% | 20.4\% | 15.5\% | 46.2\% | 29.9\% | 20.5\% | 15.5\% | 40.3\% | 26.7\% | 20.2\% | 15.4\% | 37.5\% | 24.8\% | 18.8\% | 15.3\% |
| BHAR (0) |  | 58.0\% | 29.4\% | 19.6\% | 13.8\% | 46.3\% | 30.3\% | 20.3\% | 15.1\% | 40.4\% | 25.8\% | 20.0\% | 14.9\% | 37.1\% | 23.9\% | 17.7\% | 15.0\% |
| BHAR (1) |  | 58.6\% | 29.7\% | 20.0\% | 13.9\% | 47.3\% | 30.9\% | 20.6\% | 15.4\% | 41.9\% | 26.8\% | 20.4\% | 15.0\% | 37.8\% | 24.1\% | 17.7\% | 15.3\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.9\% | 30.2\% | 20.1\% | 15.3\% | 45.1\% | 29.3\% | 19.8\% | 15.1\% | 36.9\% | 24.9\% | 19.3\% | 14.8\% | 32.8\% | 22.4\% | 17.5\% | 14.5\% |
| CAR (1) |  | 58.9\% | 30.6\% | 20.3\% | 15.5\% | 45.8\% | 29.6\% | 20.1\% | 15.3\% | 37.2\% | 25.1\% | 19.5\% | 14.9\% | 33.1\% | 22.6\% | 17.6\% | 14.6\% |
| BHAR (0) |  | 58.1\% | 29.9\% | 20.3\% | 13.6\% | 45.7\% | 29.8\% | 20.3\% | 14.1\% | 37.3\% | 24.5\% | 19.3\% | 14.6\% | 32.7\% | 22.0\% | 17.1\% | 14.9\% |
| BHAR (1) |  | 59.1\% | 30.3\% | 20.6\% | 13.7\% | 46.7\% | 30.6\% | 20.5\% | 14.2\% | 37.8\% | 24.8\% | 19.4\% | 14.7\% | 33.1\% | 22.3\% | 17.4\% | 15.2\% |


| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H = |  | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.1\% | 29.9\% | 20.0\% | 15.1\% | 44.7\% | 28.9\% | 19.7\% | 15.0\% | 36.9\% | 25.0\% | 19.1\% | 14.6\% | 34.0\% | 22.8\% | 17.8\% | 14.5\% |
| CAR (1) |  | 58.6\% | 30.1\% | 20.1\% | 15.1\% | 45.3\% | 29.1\% | 19.9\% | 15.0\% | 37.3\% | 25.1\% | 19.2\% | 14.7\% | $34.2 \%$ | 22.9\% | 17.8\% | $14.6 \%$ |
| BHAR (0) |  | 56.6\% | 29.0\% | 19.2\% | 13.3\% | 43.8\% | 29.0\% | 19.2\% | 13.8\% | 36.8\% | 23.5\% | 18.1\% | 14.4\% | 33.3\% | 22.5\% | 18.1\% | 14.7\% |
| BHAR (1) |  | 57.5\% | 28.9\% | 19.3\% | 13.4\% | 44.5\% | 29.7\% | 19.3\% | 14.0\% | 37.3\% | 23.8\% | 18.1\% | 14.5\% | 33.6\% | 22.6\% | 18.3\% | 14.7\% |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.4\% | 29.4\% | 19.3\% | 14.8\% | 46.6\% | 28.5\% | 19.3\% | 14.5\% | 39.5\% | 25.1\% | 18.8\% | 14.2\% | 36.4\% | 23.1\% | 17.5\% | 13.9\% |
| CAR (1) |  | 57.4\% | 29.3\% | 19.3\% | 14.7\% | 47.1\% | 28.9\% | 19.5\% | 14.6\% | 39.8\% | 25.5\% | 18.8\% | 14.2\% | 36.9\% | 23.2\% | 17.5\% | 14.0\% |
| BHAR (0) |  | 59.0\% | 30.4\% | 18.5\% | 13.7\% | 46.8\% | 28.8\% | 18.1\% | 14.2\% | 40.0\% | 24.4\% | 19.9\% | 15.2\% | 36.5\% | 22.5\% | 18.4\% | 13.6\% |
| BHAR (1) |  | 59.5\% | 29.7\% | 18.6\% | 13.7\% | 47.4\% | 29.0\% | 18.2\% | 14.3\% | 40.4\% | 25.0\% | 20.1\% | 15.3\% | 36.9\% | 22.7\% | 18.5\% | 13.7\% |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.7\% | 30.3\% | 20.7\% | 15.6\% | 46.0\% | 30.0\% | 20.4\% | 15.4\% | 39.8\% | 26.2\% | 20.1\% | 15.2\% | 35.0\% | 23.5\% | 18.2\% | 15.0\% |
| CAR (1) |  | 60.2\% | 30.5\% | 20.9\% | 15.7\% | 46.6\% | 30.3\% | 20.6\% | 15.5\% | 40.2\% | 26.4\% | 20.2\% | 15.3\% | 35.4\% | 23.7\% | 18.3\% | 15.1\% |
| BHAR (0) |  | 59.4\% | 30.0\% | 20.1\% | 14.4\% | 45.8\% | 29.9\% | 20.0\% | 14.4\% | 39.2\% | 25.3\% | 19.5\% | 14.3\% | 34.4\% | 23.4\% | 17.6\% | 15.1\% |
| BHAR (1) |  | 60.0\% | 30.3\% | 20.3\% | 14.5\% | 46.3\% | 30.3\% | 20.3\% | 14.6\% | 39.7\% | 25.6\% | 19.6\% | 14.5\% | 34.8\% | 23.6\% | 17.7\% | 15.2\% |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.3\% | 29.8\% | 20.1\% | 15.1\% | 45.4\% | 29.5\% | 20.1\% | 15.2\% | 38.6\% | 25.6\% | 19.8\% | 15.2\% | 34.5\% | 23.4\% | 18.2\% | 15.0\% |
| CAR (1) |  | 58.5\% | 29.9\% | 20.2\% | 15.2\% | 45.7\% | 29.7\% | 20.3\% | 15.3\% | 38.8\% | 25.7\% | 19.9\% | 15.2\% | 34.7\% | 23.5\% | 18.3\% | 15.1\% |
| BHAR (0) |  | 58.2\% | 28.9\% | 19.8\% | 13.9\% | 45.5\% | 29.9\% | 20.1\% | 14.3\% | 38.9\% | 25.0\% | 19.6\% | 14.9\% | 34.2\% | 23.6\% | 17.9\% | 15.2\% |
| BHAR (1) |  | 58.5\% | 29.0\% | 19.9\% | 13.9\% | 46.1\% | 30.4\% | 20.1\% | 14.4\% | 39.2\% | 25.2\% | 19.8\% | 15.0\% | 34.3\% | 23.7\% | 18.0\% | 15.2\% |


| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.5\% | 31.0\% | 21.0\% | 15.7\% | 48.5\% | 30.0\% | 20.5\% | 15.6\% | 42.5\% | 26.5\% | 19.6\% | 14.8\% | 38.3\% | 24.3\% | 17.9\% | 14.3\% |
| CAR (1) |  | 60.7\% | 31.1\% | 21.0\% | 15.7\% | 48.7\% | 30.1\% | 20.6\% | 15.6\% | 42.6\% | 26.6\% | 19.6\% | 14.9\% | 38.3\% | 24.3\% | 17.9\% | 14.3\% |
| BHAR (0) |  | 60.2\% | 30.5\% | 20.5\% | 15.6\% | 48.9\% | 30.4\% | 21.3\% | 15.0\% | 43.4\% | 24.8\% | 19.3\% | 14.5\% | 36.7\% | 22.9\% | 16.5\% | 13.6\% |
| BHAR (1) |  | 60.5\% | 30.7\% | 20.6\% | 15.6\% | 49.3\% | 30.4\% | 21.7\% | 15.1\% | 43.8\% | 24.9\% | 19.3\% | 14.5\% | 36.6\% | 23.0\% | 16.5\% | 13.6\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.1\% | 30.8\% | 20.7\% | 15.6\% | 48.2\% | 30.3\% | 20.7\% | 15.6\% | 42.1\% | 27.3\% | 20.4\% | 15.4\% | 38.3\% | 25.0\% | 19.0\% | 15.2\% |
| CAR (1) |  | 60.5\% | 30.9\% | 20.7\% | 15.7\% | 48.5\% | 30.5\% | 20.8\% | 15.6\% | 42.2\% | 27.4\% | 20.4\% | 15.4\% | 38.4\% | 25.1\% | 18.9\% | 15.2\% |
| BHAR (0) |  | 60.0\% | 30.2\% | 20.7\% | 14.5\% | 47.9\% | $30.4 \%$ | 20.7\% | 14.7\% | 42.3\% | 27.1\% | 19.7\% | 15.3\% | 39.1\% | 24.6\% | 18.7\% | 15.7\% |
| BHAR (1) |  | 60.3\% | 30.4\% | 20.8\% | 14.5\% | 48.2\% | 30.5\% | 20.7\% | 14.9\% | 42.4\% | 27.3\% | 19.8\% | 15.4\% | 39.2\% | 24.7\% | 18.7\% | 15.7\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.2\% | 29.7\% | 20.5\% | 15.4\% | 45.4\% | 29.5\% | 20.3\% | 15.3\% | 39.2\% | 25.4\% | 19.5\% | 14.8\% | 34.7\% | 22.7\% | 17.3\% | 14.0\% |
| CAR (1) |  | 58.0\% | 29.9\% | 20.6\% | 15.6\% | 46.2\% | 29.9\% | 20.5\% | 15.5\% | 40.1\% | 25.8\% | 19.7\% | 15.0\% | 34.9\% | 23.1\% | 17.6\% | 14.2\% |
| BHAR (0) |  | 58.8\% | 28.8\% | 20.8\% | 14.5\% | 45.2\% | 28.9\% | 21.0\% | 13.8\% | 37.1\% | 24.4\% | 17.3\% | 13.6\% | 34.7\% | 22.4\% | 17.6\% | 14.2\% |
| BHAR (1) |  | 59.0\% | 28.8\% | 21.0\% | 14.5\% | 45.5\% | 29.0\% | 21.3\% | 14.1\% | 37.2\% | 24.7\% | 17.4\% | 13.7\% | 35.0\% | 22.4\% | 17.6\% | 14.3\% |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.2\% | 30.8\% | 20.5\% | 15.6\% | 48.9\% | 30.7\% | 20.6\% | 15.5\% | 42.3\% | 27.3\% | 20.2\% | 15.2\% | 38.7\% | 25.0\% | 18.6\% | 14.9\% |
| CAR (1) |  | 60.7\% | 30.9\% | 20.6\% | 15.7\% | 49.2\% | 30.9\% | 20.7\% | 15.6\% | 42.5\% | 27.3\% | 20.2\% | 15.2\% | 38.8\% | 25.1\% | 18.6\% | 14.9\% |
| BHAR (0) |  | 60.7\% | 30.5\% | 20.1\% | 15.0\% | 48.2\% | 30.3\% | 20.7\% | 14.6\% | 42.7\% | 26.8\% | 20.2\% | 15.2\% | 39.6\% | 24.9\% | 19.0\% | 15.5\% |
| BHAR (1) |  | 61.4\% | 30.8\% | 20.3\% | 15.0\% | 48.8\% | 30.8\% | 20.8\% | 14.7\% | 43.1\% | 27.1\% | 20.3\% | 15.2\% | 39.8\% | 25.0\% | 19.0\% | 15.5\% |


| EW J = |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 59.3\% | 31.1\% | 21.2\% | 16.1\% | 46.8\% | 29.9\% | 20.6\% | 15.6\% | 41.4\% | 26.7\% | 20.3\% | 15.6\% | 37.5\% | 24.3\% | 18.7\% | 15.2\% |
| CAR (1) | 60.1\% | 31.5\% | 21.3\% | 16.1\% | 47.5\% | 30.1\% | 20.7\% | 15.6\% | 41.8\% | 27.0\% | 20.5\% | 15.7\% | 37.7\% | 24.6\% | 18.8\% | 15.3\% |
| BHAR (0) | 59.6\% | 31.6\% | 22.1\% | 15.3\% | 47.1\% | 30.8\% | 20.4\% | 15.6\% | 42.1\% | 25.9\% | 20.0\% | 15.2\% | 37.8\% | 25.3\% | 19.0\% | 16.0\% |
| BHAR (1) | 60.8\% | 32.3\% | 22.3\% | 15.4\% | 47.7\% | 31.2\% | 20.6\% | 15.7\% | 42.8\% | 26.1\% | 20.1\% | 15.3\% | 38.2\% | 25.9\% | 19.5\% | 16.1\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 59.9\% | 31.0\% | 20.4\% | 15.3\% | 50.8\% | 30.9\% | 20.5\% | 15.3\% | 43.5\% | 27.6\% | 20.3\% | 15.2\% | 39.1\% | 25.1\% | 18.8\% | 15.0\% |
| CAR (1) | 60.2\% | 31.1\% | 20.4\% | 15.3\% | 51.1\% | 31.0\% | 20.6\% | 15.3\% | 43.6\% | 27.6\% | 20.3\% | 15.2\% | 39.2\% | 25.1\% | 18.8\% | 15.0\% |
| BHAR (0) | 59.9\% | 29.9\% | 20.1\% | 14.7\% | 50.4\% | 30.7\% | 20.2\% | 13.9\% | 43.3\% | 27.1\% | 19.6\% | 14.3\% | 38.4\% | 24.7\% | 18.4\% | 15.1\% |
| BHAR (1) | 60.3\% | 30.1\% | 20.2\% | 14.8\% | 50.6\% | 30.8\% | 20.2\% | 14.0\% | 43.4\% | 27.3\% | 19.6\% | 14.3\% | 38.5\% | 24.7\% | 18.4\% | 15.1\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 60.3\% | 31.4\% | 21.4\% | 16.1\% | 49.2\% | 31.3\% | 21.4\% | 16.0\% | 42.6\% | 27.5\% | 20.4\% | 15.3\% | 36.7\% | 24.0\% | 18.2\% | 14.7\% |
| CAR (1) | 61.2\% | 32.0\% | 21.6\% | 16.2\% | 50.4\% | 31.7\% | 21.6\% | 16.1\% | 43.5\% | 27.9\% | 20.6\% | 15.5\% | 37.3\% | 24.2\% | 18.3\% | 14.7\% |
| BHAR (0) | 57.9\% | 31.9\% | 20.3\% | 14.7\% | 47.0\% | 30.1\% | 20.5\% | 13.1\% | 42.9\% | 26.2\% | 20.4\% | 14.7\% | 35.5\% | 22.8\% | 17.5\% | 14.4\% |
| BHAR (1) | 58.3\% | $32.1 \%$ | 20.6\% | 14.8\% | 47.4\% | 30.2\% | 20.6\% | 13.4\% | 43.4\% | 26.5\% | 20.9\% | 14.8\% | 35.7\% | 23.0\% | 17.9\% | 14.6\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.1\% | 30.0\% | 20.6\% | 15.7\% | 43.8\% | 28.8\% | 19.9\% | 15.5\% | 37.4\% | 25.2\% | 19.8\% | 15.2\% | 33.5\% | 23.2\% | 18.1\% | 15.0\% |
| CAR (1) | 59.1\% | 30.4\% | 20.8\% | 15.8\% | 44.2\% | 29.1\% | 20.2\% | 15.6\% | 37.5\% | 25.6\% | 20.0\% | 15.3\% | 33.9\% | 23.5\% | 18.2\% | 15.1\% |
| BHAR (0) | 57.8\% | 29.3\% | 20.0\% | 15.5\% | 43.1\% | 28.4\% | 20.8\% | 15.6\% | 36.6\% | 24.3\% | 19.3\% | 14.7\% | 33.2\% | 22.2\% | 17.9\% | 13.9\% |
| BHAR (1) | 58.5\% | 30.0\% | 19.8\% | 15.7\% | 43.7\% | 28.6\% | 21.1\% | 15.9\% | 36.9\% | 24.9\% | 19.5\% | 14.8\% | 33.4\% | $22.2 \%$ | 18.1\% | 13.9\% |


| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.5\% | 30.8\% | 21.0\% | 16.1\% | 46.8\% | 29.5\% | 20.5\% | 15.7\% | 43.3\% | 27.2\% | 20.4\% | 15.7\% | $37.1 \%$ | 23.8\% | 17.9\% | 14.6\% |
| CAR (1) |  | 60.6\% | 31.1\% | 21.2\% | 16.3\% | 48.3\% | 30.0\% | 20.8\% | 15.8\% | 44.0\% | 27.7\% | 20.6\% | 15.9\% | 37.2\% | 24.0\% | 18.0\% | 14.6\% |
| BHAR (0) |  | 59.2\% | 29.2\% | 20.1\% | 14.6\% | 46.0\% | 26.8\% | 21.0\% | 15.0\% | 43.3\% | 25.9\% | 20.8\% | 15.1\% | 36.5\% | 23.6\% | 17.3\% | 14.4\% |
| BHAR (1) |  | 59.8\% | 29.4\% | 19.8\% | 14.7\% | 47.5\% | 27.1\% | 21.3\% | 15.3\% | 44.2\% | 26.3\% | 21.1\% | 15.4\% | 37.0\% | 24.0\% | 17.6\% | 14.7\% |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.7\% | 30.8\% | 21.2\% | 16.1\% | 44.7\% | 30.8\% | 21.1\% | 15.9\% | 40.7\% | 26.8\% | 20.8\% | 15.6\% | $36.1 \%$ | 23.7\% | 18.3\% | 15.5\% |
| CAR (1) |  | 60.4\% | 31.2\% | 21.4\% | 16.1\% | 45.4\% | 31.3\% | 21.3\% | 16.0\% | 41.4\% | 27.2\% | 21.0\% | 15.7\% | 36.8\% | 24.0\% | 18.5\% | 15.6\% |
| BHAR (0) |  | 59.4\% | 30.0\% | 20.9\% | 15.5\% | 45.4\% | 31.5\% | 22.5\% | 15.1\% | 40.6\% | 25.6\% | 20.8\% | 15.3\% | $36.2 \%$ | 23.5\% | 17.6\% | 15.7\% |
| BHAR (1) |  | 60.1\% | 30.6\% | 21.1\% | 15.5\% | 46.1\% | 32.1\% | 21.7\% | 15.6\% | 41.3\% | 25.6\% | 21.7\% | 15.4\% | 37.5\% | $24.1 \%$ | 17.7\% | 16.1\% |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 61.0\% | 31.5\% | 21.4\% | 16.1\% | 49.4\% | 30.8\% | 21.0\% | 15.9\% | 45.3\% | 29.1\% | 21.4\% | 16.1\% | 41.2\% | 27.0\% | 20.1\% | 16.0\% |
| CAR (1) |  | 61.4\% | 31.7\% | 21.5\% | 16.2\% | 50.0\% | 31.0\% | 21.2\% | 15.9\% | 45.8\% | 29.4\% | 21.5\% | 16.2\% | 41.4\% | 27.2\% | 20.1\% | 16.1\% |
| BHAR (0) |  | 61.0\% | 31.4\% | 20.8\% | 15.1\% | 47.9\% | 30.1\% | 20.7\% | 15.0\% | 43.5\% | 27.6\% | 20.5\% | 16.2\% | 39.8\% | 26.7\% | 19.8\% | 17.6\% |
| BHAR (1) |  | 61.2\% | 31.4\% | 21.0\% | 15.2\% | 48.3\% | 30.1\% | 20.8\% | 15.1\% | 43.8\% | 28.0\% | 20.7\% | 16.3\% | 40.1\% | 27.2\% | 19.9\% | 17.6\% |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\overline{\text { CAR (0) }}$ |  | 59.2\% | 30.3\% | 20.5\% | 15.4\% | 48.5\% | 29.6\% | 19.9\% | 14.9\% | 40.5\% | 25.9\% | 19.5\% | 14.8\% | 37.3\% | 23.6\% | 17.9\% | 14.4\% |
| CAR (1) |  | 59.6\% | 30.5\% | 20.6\% | 15.4\% | 48.9\% | 29.8\% | 20.0\% | 14.9\% | 40.8\% | 26.1\% | 19.5\% | 14.8\% | 37.6\% | 23.7\% | 18.0\% | 14.4\% |
| BHAR (0) |  | 59.9\% | 30.4\% | 20.7\% | 14.0\% | 48.7\% | 30.6\% | 20.4\% | 13.7\% | 40.4\% | 25.2\% | 18.9\% | 14.6\% | 35.4\% | 22.0\% | 17.6\% | 14.3\% |
| BHAR (1) |  | 60.5\% | 30.7\% | 20.9\% | 14.1\% | 48.7\% | 30.8\% | 20.6\% | 13.3\% | 40.7\% | 25.7\% | 19.0\% | 14.7\% | 35.6\% | $22.2 \%$ | 17.7\% | 14.4\% |


| EW | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.9\% | 31.2\% | 21.5\% | 16.4\% | 49.3\% | 31.3\% | 21.7\% | 16.5\% | 43.1\% | 27.7\% | 20.7\% | 15.7\% | $37.5 \%$ | 24.8\% | 18.9\% | 15.2\% |
| CAR (1) |  | 61.3\% | 31.9\% | 21.9\% | 16.6\% | 50.6\% | 31.8\% | 22.1\% | 16.8\% | 44.2\% | 28.1\% | 20.9\% | 15.9\% | 38.1\% | 24.9\% | 19.2\% | 15.5\% |
| BHAR (0) |  | 60.4\% | 31.5\% | 21.1\% | 15.2\% | 49.6\% | 31.4\% | 21.5\% | 15.1\% | 43.1\% | 26.7\% | 19.9\% | 15.8\% | $36.8 \%$ | 24.0\% | 18.2\% | 15.0\% |
| BHAR (1) |  | 61.6\% | 32.3\% | 21.4\% | 15.3\% | 51.0\% | $32.3 \%$ | 21.7\% | 15.3\% | 43.8\% | 27.3\% | 20.0\% | 16.0\% | $37.2 \%$ | 24.2\% | 18.3\% | 15.1\% |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.2\% | 29.1\% | 19.7\% | 14.9\% | 45.7\% | 28.5\% | 19.5\% | 14.7\% | 40.8\% | 25.8\% | 19.3\% | 14.7\% | 36.3\% | 23.7\% | 18.0\% | 14.5\% |
| CAR (1) |  | 57.6\% | 29.3\% | 19.8\% | 15.0\% | 46.1\% | 28.8\% | 19.7\% | 14.8\% | 41.3\% | 25.9\% | 19.3\% | 14.7\% | 36.3\% | 23.8\% | 18.0\% | 14.5\% |
| BHAR (0) |  | 57.4\% | 29.2\% | 19.2\% | 14.4\% | 44.2\% | 26.8\% | 19.2\% | 13.3\% | 40.3\% | 24.6\% | 18.9\% | 14.1\% | $36.4 \%$ | 22.5\% | 17.6\% | 14.0\% |
| BHAR (1) |  | 57.5\% | 29.2\% | 19.3\% | 14.5\% | 44.4\% | 27.0\% | 19.4\% | 13.4\% | 40.6\% | 25.0\% | 19.1\% | 14.1\% | 36.7\% | 22.8\% | 17.6\% | 14.0\% |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.1\% | 31.0\% | 21.2\% | 15.9\% | 47.4\% | 30.7\% | 21.0\% | 15.9\% | 40.5\% | 26.6\% | 20.3\% | 15.4\% | $35.1 \%$ | 23.8\% | 18.4\% | 15.0\% |
| CAR (1) |  | 61.2\% | 31.5\% | 21.4\% | 16.1\% | 48.2\% | 31.2\% | 21.3\% | 16.0\% | 41.1\% | 26.9\% | 20.5\% | 15.6\% | $35.5 \%$ | 24.1\% | 18.5\% | 15.1\% |
| BHAR (0) |  | 60.0\% | 30.6\% | 20.1\% | 14.4\% | 47.5\% | 30.6\% | 20.7\% | 14.5\% | 40.2\% | 25.7\% | 19.7\% | 15.2\% | 34.4\% | 23.6\% | 17.7\% | 15.5\% |
| BHAR (1) |  | 61.0\% | 31.0\% | 20.3\% | 14.5\% | 48.3\% | 30.9\% | 20.9\% | 14.7\% | 40.7\% | 26.2\% | 19.9\% | 15.4\% | 34.7\% | 23.8\% | 17.8\% | 15.6\% |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.6\% | 30.1\% | 20.3\% | 15.6\% | 46.0\% | 29.6\% | 20.2\% | 15.4\% | 38.7\% | 25.6\% | 19.9\% | 15.2\% | $35.2 \%$ | 23.3\% | 18.1\% | 14.9\% |
| CAR (1) |  | 59.5\% | 30.5\% | 20.5\% | 15.7\% | 46.8\% | 30.0\% | 20.4\% | 15.6\% | 39.2\% | 25.9\% | 20.0\% | 15.3\% | 35.6\% | 23.6\% | 18.2\% | 15.0\% |
| BHAR (0) |  | 58.7\% | 29.9\% | 19.7\% | 14.4\% | 45.8\% | 29.2\% | 20.5\% | 14.3\% | 38.7\% | 25.5\% | 19.1\% | 15.2\% | 34.6\% | 22.6\% | 17.5\% | 15.1\% |
| BHAR (1) |  | 59.7\% | 30.5\% | 19.9\% | 14.5\% | 46.6\% | 29.7\% | 20.8\% | 14.5\% | 39.3\% | 25.9\% | 19.3\% | 15.3\% | 35.0\% | 22.9\% | 17.7\% | 15.2\% |




| MW |  |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 62.7\% | 31.7\% | 21.2\% | 15.6\% | 54.0\% | 30.8\% | 20.6\% | 15.2\% | 47.3\% | 27.7\% | 19.8\% | 14.6\% | 43.7\% | 25.4\% | 18.0\% | 14.1\% |
| CAR (1) |  | 62.4\% | 31.7\% | 21.1\% | 15.6\% | 53.9\% | 30.8\% | 20.6\% | 15.2\% | 47.2\% | 27.6\% | 19.7\% | 14.6\% | 43.2\% | 25.4\% | 17.9\% | 14.1\% |
| BHAR (0) |  | 62.8\% | 31.4\% | 20.8\% | 15.1\% | 55.3\% | $32.2 \%$ | 21.0\% | 14.2\% | 49.1\% | 25.7\% | 19.2\% | 13.2\% | 41.6\% | 24.5\% | 17.0\% | 13.3\% |
| BHAR (1) |  | 62.3\% | 31.7\% | 20.8\% | 15.1\% | 55.2\% | $32.1 \%$ | 21.0\% | 14.2\% | 49.4\% | 25.7\% | 19.2\% | 13.2\% | 41.4\% | 24.5\% | 17.1\% | 13.3\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.5\% | 31.1\% | 20.8\% | 15.7\% | 50.2\% | 30.3\% | 20.6\% | 15.4\% | 44.1\% | 27.5\% | 20.0\% | 15.3\% | 40.1\% | 25.3\% | 18.8\% | 15.1\% |
| CAR (1) |  | 60.1\% | 31.1\% | 20.8\% | 15.7\% | 49.9\% | 30.1\% | 20.7\% | 15.4\% | 43.6\% | 27.4\% | 19.9\% | 15.3\% | 39.8\% | 25.1\% | 18.7\% | 15.0\% |
| BHAR (0) |  | 60.1\% | 30.5\% | 20.9\% | 14.9\% | 50.0\% | 29.9\% | 20.0\% | 14.8\% | 44.8\% | 27.6\% | 19.4\% | 14.9\% | 41.1\% | 26.0\% | 18.1\% | 15.7\% |
| BHAR (1) |  | 59.9\% | 30.5\% | 20.9\% | 14.9\% | 49.7\% | 29.9\% | 19.9\% | 14.8\% | 44.3\% | 27.5\% | 19.3\% | 14.9\% | 40.6\% | 25.9\% | 18.0\% | 15.7\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.6\% | 29.4\% | 20.0\% | 14.7\% | 46.1\% | 28.6\% | 19.4\% | 14.4\% | 39.6\% | 25.0\% | 18.7\% | 14.2\% | 35.4\% | 22.2\% | 17.0\% | 13.4\% |
| CAR (1) |  | 56.5\% | 29.3\% | 20.1\% | 14.7\% | 45.7\% | 28.5\% | 19.5\% | 14.4\% | 39.6\% | 25.0\% | 18.7\% | 14.2\% | 35.1\% | 22.2\% | 17.0\% | 13.3\% |
| BHAR (0) |  | 57.1\% | 28.1\% | 20.6\% | 14.2\% | 46.1\% | 27.4\% | 19.6\% | 12.8\% | 37.2\% | 24.2\% | 16.4\% | 13.2\% | 37.7\% | 22.4\% | 17.2\% | 12.9\% |
| BHAR (1) |  | 56.9\% | 28.0\% | 20.6\% | 14.3\% | 46.0\% | 27.4\% | 19.5\% | 13.2\% | 37.1\% | 24.2\% | 16.4\% | 13.2\% | 37.7\% | 22.3\% | 17.2\% | 12.8\% |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.3\% | 30.3\% | 20.4\% | 15.3\% | 48.3\% | 29.6\% | 20.0\% | 15.2\% | 41.6\% | 26.0\% | 20.0\% | 15.1\% | 35.4\% | 23.8\% | 18.3\% | 14.9\% |
| CAR (1) |  | 60.0\% | 30.2\% | 20.3\% | 15.3\% | 48.0\% | 29.4\% | 20.0\% | 15.2\% | 41.4\% | 25.9\% | 19.9\% | 15.1\% | 35.2\% | 23.6\% | 18.2\% | 14.8\% |
| BHAR (0) |  | 60.7\% | 30.7\% | 19.9\% | 14.9\% | 47.0\% | 29.4\% | 20.0\% | 14.2\% | 42.3\% | 26.4\% | 19.7\% | 14.7\% | 36.2\% | 23.6\% | 18.2\% | 14.9\% |
| BHAR (1) |  | 60.3\% | 30.7\% | 19.9\% | 14.8\% | 46.4\% | 29.2\% | 19.9\% | 14.2\% | 41.6\% | 26.4\% | 19.7\% | 14.7\% | 35.8\% | 23.4\% | 18.2\% | 14.9\% |


| MW $\mathrm{J}=$ | $\mathrm{J}=$ | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=3$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 59.1\% | 29.7\% | 20.1\% | 14.8\% | 48.4\% | 29.0\% | 19.3\% | 14.4\% | 41.3\% | 25.1\% | 19.0\% | 14.4\% | 37.6\% | 22.6\% | 17.2\% | 13.6\% |
| CAR (1) | 58.7\% | 29.8\% | 20.1\% | 14.8\% | 47.8\% | 28.8\% | 19.4\% | 14.3\% | 40.4\% | 24.9\% | 19.0\% | 14.3\% | 37.1\% | 22.6\% | 17.1\% | 13.6\% |
| BHAR (0) | 59.3\% | 30.6\% | 20.0\% | 14.7\% | 49.8\% | 29.4\% | 19.1\% | 13.8\% | 41.3\% | 22.9\% | 18.8\% | 13.3\% | 35.9\% | 22.7\% | 16.5\% | 13.9\% |
| BHAR (1) | 59.1\% | 30.9\% | 20.0\% | 14.6\% | 49.7\% | 29.4\% | 19.1\% | 13.8\% | 40.7\% | 22.5\% | 18.7\% | 13.2\% | 35.1\% | 22.7\% | 16.5\% | 13.9\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 60.6\% | 30.8\% | 20.4\% | 15.4\% | 51.3\% | 30.6\% | 20.6\% | 15.4\% | 45.2\% | 28.1\% | 20.5\% | 15.3\% | 41.0\% | 25.8\% | 19.0\% | 15.1\% |
| CAR (1) | 60.3\% | 30.8\% | 20.3\% | 15.4\% | 51.2\% | 30.5\% | 20.6\% | 15.4\% | 44.7\% | 28.0\% | 20.4\% | 15.3\% | 40.7\% | 25.6\% | 18.9\% | 15.0\% |
| BHAR (0) | 60.6\% | 30.4\% | 20.2\% | 14.8\% | 51.2\% | 30.6\% | 20.3\% | 14.6\% | 45.0\% | 27.9\% | 19.7\% | 14.8\% | 40.0\% | 25.4\% | 18.7\% | 15.1\% |
| BHAR (1) | 60.4\% | 30.4\% | 20.2\% | 14.8\% | 50.7\% | 30.5\% | 20.3\% | 14.6\% | 44.6\% | 28.1\% | 19.6\% | 14.8\% | 39.7\% | 25.3\% | 18.7\% | 15.1\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 59.8\% | 30.1\% | 19.8\% | 15.0\% | 50.6\% | 29.9\% | 19.9\% | 14.8\% | 44.5\% | 27.7\% | 19.8\% | 14.6\% | 40.1\% | 24.4\% | 17.8\% | 14.1\% |
| CAR (1) | 59.4\% | 30.2\% | 19.8\% | 15.0\% | 50.4\% | 29.9\% | 19.8\% | 14.8\% | 44.7\% | 27.5\% | 19.7\% | 14.6\% | 39.8\% | 24.1\% | 17.6\% | 14.0\% |
| BHAR (0) | 57.9\% | 30.6\% | 18.6\% | 13.8\% | 48.8\% | 29.1\% | 19.9\% | 12.8\% | 44.2\% | 27.0\% | 20.1\% | 14.6\% | 38.9\% | 24.0\% | 17.6\% | 14.7\% |
| BHAR (1) | 57.6\% | 30.8\% | 18.6\% | 13.8\% | 48.5\% | 28.6\% | 19.9\% | 13.0\% | 44.0\% | 27.3\% | 20.1\% | 14.7\% | 39.1\% | 23.8\% | 17.6\% | 14.7\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.5\% | 30.2\% | 20.4\% | 15.3\% | 45.8\% | 29.1\% | 19.9\% | 14.9\% | 38.8\% | 25.9\% | 19.6\% | 14.8\% | 36.7\% | 24.1\% | 18.6\% | 14.7\% |
| CAR (1) | 58.2\% | 30.2\% | 20.4\% | 15.3\% | 45.6\% | 29.0\% | 19.9\% | 14.9\% | 38.6\% | 25.9\% | 19.5\% | 14.8\% | 36.8\% | 24.2\% | 18.6\% | 14.6\% |
| BHAR (0) | 57.6\% | 30.1\% | 20.3\% | 15.2\% | 46.1\% | 28.6\% | 20.5\% | 14.7\% | 40.2\% | 26.3\% | 18.7\% | 14.9\% | 35.7\% | 24.1\% | 17.9\% | 14.0\% |
| BHAR (1) | 57.3\% | 30.2\% | 20.3\% | 15.2\% | 45.7\% | 28.5\% | 20.5\% | 15.0\% | 39.6\% | 26.4\% | 18.5\% | 14.9\% | 35.9\% | 23.8\% | 17.9\% | 14.0\% |


| MW | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.0\% | 29.6\% | 19.8\% | 14.8\% | 45.8\% | 28.0\% | 19.1\% | 14.3\% | 42.1\% | 26.3\% | 19.5\% | 14.5\% | $37.8 \%$ | 23.9\% | 17.6\% | 14.0\% |
| CAR (1) |  | 57.5\% | 29.4\% | 19.7\% | 14.7\% | 45.4\% | 27.8\% | 19.0\% | 14.2\% | 41.9\% | 26.2\% | 19.3\% | 14.5\% | 37.3\% | 23.7\% | 17.5\% | 13.9\% |
| BHAR (0) |  | 58.0\% | 28.4\% | 18.9\% | 13.4\% | 45.7\% | 26.5\% | 19.9\% | 14.1\% | 42.4\% | 26.4\% | 20.1\% | 14.5\% | 35.7\% | 23.2\% | 16.5\% | 14.0\% |
| BHAR (1) |  | 57.4\% | 28.5\% | 18.5\% | 13.4\% | 45.3\% | 26.3\% | 19.9\% | 14.1\% | 42.2\% | 26.3\% | 19.9\% | 14.5\% | 35.6\% | 23.0\% | 16.4\% | 13.9\% |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.7\% | 30.9\% | 20.5\% | 15.2\% | 45.4\% | 29.9\% | 20.3\% | 15.1\% | 39.3\% | 26.5\% | 19.9\% | 15.0\% | 36.5\% | 23.8\% | 18.3\% | 14.8\% |
| CAR (1) |  | 59.4\% | 30.9\% | 20.5\% | 15.1\% | 45.0\% | 29.8\% | 20.3\% | 15.1\% | 39.2\% | 26.4\% | 19.8\% | 15.0\% | $36.4 \%$ | 23.8\% | 18.2\% | 14.6\% |
| BHAR (0) |  | 60.8\% | 30.4\% | 20.4\% | 14.7\% | 45.4\% | $30.4 \%$ | 21.2\% | 15.2\% | 36.9\% | 25.6\% | 20.2\% | 14.8\% | $34.2 \%$ | 23.2\% | 18.8\% | 14.6\% |
| BHAR (1) |  | 60.5\% | 30.6\% | 20.3\% | 14.7\% | 45.3\% | 30.0\% | 21.2\% | 14.7\% | 36.5\% | 26.1\% | 20.2\% | 14.7\% | 33.7\% | 22.5\% | 18.5\% | 14.4\% |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 61.0\% | 30.9\% | 20.5\% | 15.4\% | 49.8\% | 30.3\% | 20.3\% | 15.0\% | 45.5\% | 28.3\% | 20.5\% | 15.2\% | 40.9\% | 26.2\% | 19.1\% | 15.1\% |
| CAR (1) |  | 60.6\% | 30.9\% | 20.5\% | 15.4\% | 49.4\% | $30.1 \%$ | 20.4\% | 15.0\% | 45.1\% | 28.3\% | 20.4\% | 15.2\% | 40.4\% | 26.0\% | 18.9\% | 15.0\% |
| BHAR (0) |  | 60.6\% | 30.8\% | 20.1\% | 15.1\% | 49.4\% | 29.3\% | 20.0\% | 14.8\% | 44.6\% | 27.3\% | 20.2\% | 15.4\% | 40.6\% | 26.1\% | 19.0\% | 15.6\% |
| BHAR (1) |  | 60.4\% | 30.8\% | 20.1\% | 15.1\% | 48.9\% | 29.3\% | 20.0\% | 14.8\% | 44.3\% | 27.5\% | 20.1\% | 15.4\% | 40.3\% | 25.9\% | 18.9\% | 15.6\% |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 61.1\% | 30.6\% | 20.1\% | 15.0\% | 51.2\% | 29.8\% | 19.5\% | 14.5\% | 44.3\% | 26.2\% | 19.0\% | 14.2\% | 41.0\% | 24.3\% | 17.6\% | 13.9\% |
| CAR (1) |  | 60.9\% | 30.6\% | 20.0\% | 15.0\% | 50.7\% | 29.6\% | 19.5\% | 14.3\% | 44.1\% | 26.1\% | 18.9\% | 14.1\% | 41.0\% | 24.3\% | 17.5\% | 13.8\% |
| BHAR (0) |  | 61.2\% | 30.4\% | 19.9\% | 14.4\% | 51.5\% | 30.2\% | 20.8\% | 13.9\% | 45.0\% | 26.7\% | 18.3\% | 13.9\% | 38.2\% | 23.6\% | 17.4\% | 13.6\% |
| BHAR (1) |  | 61.0\% | 30.6\% | 19.7\% | 14.4\% | 50.4\% | 29.7\% | 20.8\% | 13.4\% | 44.3\% | 27.0\% | 18.2\% | 13.9\% | 37.8\% | 23.2\% | 17.1\% | 13.6\% |


| MW | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.0\% | 30.4\% | 20.3\% | 15.3\% | 49.9\% | 29.9\% | 20.2\% | 15.2\% | 42.5\% | 26.9\% | 19.6\% | 14.8\% | $37.7 \%$ | 23.9\% | 17.9\% | $14.4 \%$ |
| CAR (1) |  | 59.7\% | 30.4\% | 20.3\% | 15.2\% | 49.6\% | 29.7\% | 20.2\% | 15.2\% | 42.3\% | 26.7\% | 19.5\% | 14.7\% | 37.7\% | 23.6\% | 17.8\% | 14.3\% |
| BHAR (0) |  | 60.6\% | 30.8\% | 19.8\% | 14.4\% | 49.9\% | 30.0\% | 20.2\% | 14.2\% | 42.5\% | 26.0\% | 19.5\% | 14.7\% | 38.7\% | 23.3\% | 17.0\% | 14.2\% |
| BHAR (1) |  | 60.3\% | 30.8\% | 19.9\% | 14.5\% | 49.4\% | 29.7\% | 20.2\% | 14.3\% | 42.3\% | 26.1\% | 19.5\% | 14.7\% | 38.8\% | 23.3\% | 17.1\% | $14.2 \%$ |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.5\% | 29.5\% | 19.8\% | 14.6\% | 48.9\% | 29.0\% | 19.5\% | 14.6\% | 43.2\% | 26.2\% | 19.1\% | 14.5\% | $38.2 \%$ | 24.3\% | 17.9\% | 14.4\% |
| CAR (1) |  | 59.2\% | 29.5\% | 19.8\% | 14.6\% | 48.7\% | 29.0\% | 19.5\% | 14.6\% | 42.9\% | 26.1\% | 19.0\% | 14.4\% | 37.7\% | 24.2\% | 17.8\% | 14.3\% |
| BHAR (0) |  | 60.1\% | 30.1\% | 19.3\% | 13.4\% | 47.8\% | 27.4\% | 19.8\% | 13.3\% | 42.6\% | 25.2\% | 18.2\% | 14.1\% | 38.5\% | 22.8\% | 17.6\% | 13.8\% |
| BHAR (1) |  | 59.9\% | 30.2\% | 19.4\% | 13.5\% | 47.7\% | 27.2\% | 19.8\% | 13.4\% | 42.4\% | 25.6\% | 18.2\% | 14.1\% | 38.4\% | 22.7\% | 17.5\% | 13.7\% |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 61.6\% | 30.7\% | 20.5\% | 15.3\% | 50.7\% | 30.4\% | 20.5\% | 15.4\% | 45.5\% | 27.6\% | 20.3\% | 15.2\% | $39.7 \%$ | 25.7\% | 19.1\% | 15.0\% |
| CAR (1) |  | 61.4\% | 30.7\% | 20.5\% | 15.3\% | 50.5\% | 30.3\% | 20.5\% | 15.4\% | 45.1\% | 27.5\% | 20.2\% | 15.2\% | 39.6\% | 25.6\% | 19.0\% | 14.9\% |
| BHAR (0) |  | 62.1\% | 29.5\% | 19.9\% | 14.2\% | 50.9\% | 30.4\% | 20.5\% | 14.8\% | 45.6\% | 26.7\% | 20.0\% | 14.9\% | 40.1\% | 24.7\% | 18.4\% | 15.2\% |
| BHAR (1) |  | 61.8\% | 29.6\% | 20.0\% | 14.2\% | 50.5\% | 30.3\% | 20.5\% | 14.9\% | 45.1\% | 26.8\% | 19.9\% | 14.9\% | $39.9 \%$ | 24.6\% | 18.3\% | 15.2\% |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.5\% | 29.9\% | 19.8\% | 14.9\% | 47.8\% | 29.3\% | 19.6\% | 14.6\% | 40.8\% | 25.6\% | 19.3\% | 14.5\% | $36.8 \%$ | 23.5\% | 17.8\% | 14.3\% |
| CAR (1) |  | 59.1\% | 29.9\% | 19.8\% | 14.9\% | 47.3\% | 29.1\% | 19.6\% | 14.6\% | 40.2\% | 25.5\% | 19.2\% | 14.5\% | 36.5\% | 23.4\% | 17.7\% | 14.2\% |
| BHAR (0) |  | 59.9\% | 29.5\% | 19.5\% | 14.4\% | 47.6\% | 28.8\% | 19.9\% | 14.1\% | 40.9\% | 25.3\% | 18.8\% | 14.6\% | $36.4 \%$ | 22.8\% | 17.4\% | 14.5\% |
| BHAR (1) |  | 59.5\% | 29.5\% | 19.5\% | 14.4\% | 47.1\% | 28.6\% | 19.9\% | 14.1\% | 40.6\% | 25.4\% | 18.7\% | 14.6\% | $35.8 \%$ | 22.6\% | 17.3\% | 14.4\% |


| IVOL $\mathrm{J}=$ | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 59.1\% | 29.7\% | 20.2\% | 15.1\% | 45.9\% | 29.0\% | 19.8\% | 14.9\% | 39.4\% | 25.6\% | 19.4\% | 14.7\% | 35.2\% | 23.4\% | 17.8\% | 14.4\% |
| CAR (1) | 59.7\% | 29.9\% | 20.3\% | 15.1\% | 46.3\% | 29.1\% | 19.9\% | 14.9\% | 39.8\% | 25.6\% | 19.4\% | 14.7\% | 35.8\% | 23.6\% | 17.8\% | 14.4\% |
| BHAR (0) | 59.3\% | 29.2\% | 19.9\% | 14.4\% | 45.9\% | 28.9\% | 19.9\% | 14.6\% | 39.3\% | 25.2\% | 19.0\% | 14.4\% | 35.0\% | 23.4\% | 17.4\% | 14.9\% |
| BHAR (1) | 59.8\% | 29.2\% | 20.0\% | 14.5\% | 46.1\% | 29.0\% | 19.9\% | 14.7\% | 39.6\% | 25.3\% | 19.1\% | 14.5\% | 35.2\% | 23.5\% | 17.4\% | 14.9\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.2\% | 29.0\% | 19.3\% | 14.4\% | 46.2\% | 28.1\% | 18.9\% | 14.2\% | 39.6\% | 24.6\% | 18.4\% | 13.8\% | 32.8\% | 21.4\% | 16.1\% | 13.3\% |
| CAR (1) | 57.7\% | 29.0\% | 19.4\% | 14.4\% | 46.3\% | 28.2\% | 19.0\% | 14.1\% | 40.1\% | 24.6\% | 18.4\% | 13.8\% | 33.3\% | 21.6\% | 16.2\% | 13.3\% |
| BHAR (0) | 57.4\% | 28.9\% | 19.8\% | 14.2\% | 47.2\% | 28.6\% | 19.5\% | 13.8\% | 39.3\% | 24.5\% | 18.1\% | 13.6\% | 33.3\% | 21.6\% | 16.3\% | 13.5\% |
| BHAR (1) | 57.8\% | 29.1\% | 19.9\% | 14.3\% | 46.5\% | 28.3\% | 19.2\% | 14.0\% | 39.9\% | 24.5\% | 18.1\% | 13.3\% | 33.6\% | 21.2\% | 16.4\% | 13.5\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 59.2\% | 29.6\% | 19.7\% | 14.7\% | 46.8\% | 28.7\% | 19.2\% | 14.3\% | 40.1\% | 25.2\% | 18.8\% | 14.2\% | 36.8\% | 23.7\% | 17.6\% | 14.0\% |
| CAR (1) | 59.7\% | 29.8\% | 19.7\% | 14.7\% | 47.0\% | 28.7\% | 19.2\% | 14.3\% | 40.3\% | 25.2\% | 18.8\% | 14.1\% | 36.9\% | 23.6\% | 17.5\% | 14.0\% |
| BHAR (0) | 59.2\% | 29.0\% | 19.2\% | 13.0\% | 46.6\% | 29.2\% | 19.1\% | 13.3\% | 40.1\% | 24.8\% | 18.4\% | 14.0\% | 36.0\% | 22.8\% | 16.9\% | 14.2\% |
| BHAR (1) | 59.4\% | 29.2\% | 19.5\% | 13.0\% | 47.1\% | 29.3\% | 19.2\% | 13.5\% | 40.5\% | 25.1\% | 18.4\% | 14.1\% | 36.1\% | 22.8\% | 16.9\% | 14.3\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.7\% | 29.3\% | 19.4\% | 14.7\% | 45.4\% | 28.3\% | 19.1\% | 14.4\% | 37.6\% | 24.6\% | 18.8\% | 14.3\% | 33.6\% | 22.3\% | 17.1\% | 14.0\% |
| CAR (1) | 57.9\% | 29.4\% | 19.4\% | 14.7\% | 45.4\% | 28.4\% | 19.1\% | 14.4\% | 37.5\% | 24.5\% | 18.7\% | 14.2\% | 33.5\% | 22.3\% | 17.1\% | 14.0\% |
| BHAR (0) | 57.6\% | 29.2\% | 19.1\% | 13.6\% | 45.8\% | 28.6\% | 19.5\% | 13.9\% | 38.4\% | 24.2\% | 18.6\% | 14.0\% | 33.3\% | 22.1\% | 16.6\% | 14.3\% |
| BHAR (1) | 57.8\% | 29.0\% | 19.1\% | 13.3\% | 46.1\% | 28.6\% | 19.5\% | 13.7\% | 38.4\% | 24.3\% | 18.6\% | 14.0\% | 33.3\% | 22.1\% | 16.6\% | 14.3\% |



| IVOL $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 60.2\% | 30.6\% | 20.6\% | 15.4\% | 49.0\% | 29.4\% | 19.9\% | 15.1\% | 43.3\% | 26.4\% | 19.3\% | 14.5\% | 39.0\% | 24.3\% | 17.6\% | 14.0\% |
| CAR (1) | 60.0\% | 30.4\% | 20.5\% | 15.4\% | 48.9\% | 29.4\% | 19.9\% | 15.0\% | 43.0\% | 26.3\% | 19.2\% | 14.5\% | 38.6\% | 24.2\% | 17.5\% | 13.9\% |
| BHAR (0) | 59.7\% | 30.1\% | 20.1\% | 15.2\% | 50.2\% | 30.1\% | 20.5\% | 14.7\% | 44.0\% | 24.6\% | 18.9\% | 14.2\% | 37.2\% | 22.9\% | 16.3\% | 13.2\% |
| BHAR (1) | 59.2\% | 29.5\% | 20.1\% | 15.2\% | 50.3\% | 30.3\% | 20.5\% | 14.7\% | 44.0\% | 24.7\% | 18.9\% | 14.2\% | 37.2\% | 22.9\% | 16.3\% | 13.2\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 60.3\% | 30.5\% | 20.4\% | 15.4\% | 49.2\% | 30.1\% | 20.5\% | 15.4\% | 43.1\% | 27.2\% | 20.1\% | 15.2\% | 39.1\% | 25.0\% | 18.8\% | 15.0\% |
| CAR (1) | 60.7\% | 30.5\% | 20.4\% | 15.4\% | 49.5\% | 30.2\% | 20.5\% | 15.3\% | 43.4\% | 27.2\% | 20.1\% | 15.2\% | 39.3\% | 25.1\% | 18.7\% | 15.0\% |
| BHAR (0) | 60.5\% | 30.0\% | 20.3\% | 14.4\% | 49.0\% | 30.1\% | 20.1\% | 14.6\% | 43.3\% | 27.0\% | 19.5\% | 15.0\% | 39.9\% | 24.8\% | 18.5\% | 15.6\% |
| BHAR (1) | 60.8\% | 30.1\% | 20.3\% | 14.4\% | 49.3\% | 30.2\% | 20.2\% | 14.7\% | 43.5\% | 27.1\% | 19.6\% | 15.0\% | 40.3\% | 24.8\% | 18.5\% | 15.6\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.0\% | 29.0\% | 19.7\% | 14.6\% | 46.0\% | 28.5\% | 19.3\% | 14.4\% | 39.8\% | 24.6\% | 18.4\% | 13.9\% | 34.4\% | $22.2 \%$ | 16.6\% | 13.1\% |
| CAR (1) | 57.6\% | 29.1\% | 19.7\% | 14.6\% | 46.3\% | 28.5\% | 19.3\% | 14.3\% | 40.1\% | 24.7\% | 18.5\% | 13.8\% | 34.3\% | 22.2\% | 16.5\% | 13.0\% |
| BHAR (0) | 58.5\% | 28.0\% | 20.2\% | 13.6\% | 46.5\% | 27.8\% | 19.7\% | 13.7\% | 38.5\% | 24.0\% | 16.5\% | 13.1\% | 35.7\% | 22.1\% | 17.2\% | 13.0\% |
| BHAR (1) | 58.6\% | 28.2\% | 20.3\% | 13.4\% | 46.7\% | 27.8\% | 19.7\% | 13.7\% | 38.5\% | 24.1\% | 16.6\% | 13.1\% | 35.8\% | 22.1\% | 17.2\% | 13.2\% |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 60.8\% | 30.5\% | 20.4\% | 15.4\% | 49.9\% | 30.1\% | 20.2\% | 15.2\% | 43.5\% | 27.2\% | 20.1\% | 15.0\% | 39.5\% | 25.1\% | 18.5\% | 14.8\% |
| CAR (1) | 61.0\% | 30.6\% | 20.4\% | 15.4\% | 50.3\% | 30.2\% | 20.2\% | 15.2\% | 43.8\% | 27.3\% | 20.1\% | 15.0\% | 39.7\% | 25.2\% | 18.5\% | 14.7\% |
| BHAR (0) | 61.1\% | 30.0\% | 19.6\% | 14.8\% | 49.4\% | 29.9\% | 20.3\% | 14.5\% | 43.8\% | 26.6\% | 19.9\% | 14.7\% | 40.1\% | 24.7\% | 18.5\% | 15.2\% |
| BHAR (1) | 61.3\% | 30.2\% | 19.8\% | 14.9\% | 50.0\% | 30.0\% | 20.3\% | 14.6\% | 44.0\% | 26.9\% | 19.9\% | 14.7\% | 40.1\% | 24.7\% | 18.4\% | 15.3\% |


| IVOL | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.7\% | 30.2\% | 20.1\% | 15.1\% | 47.1\% | 28.7\% | 19.3\% | 14.4\% | 40.6\% | 25.4\% | 19.1\% | 14.4\% | $37.8 \%$ | 23.7\% | 17.7\% | $14.2 \%$ |
| CAR (1) |  | 60.1\% | 30.3\% | 20.2\% | 15.0\% | 47.3\% | 28.7\% | 19.4\% | 14.4\% | 40.8\% | 25.4\% | 19.0\% | 14.4\% | 37.7\% | 23.7\% | 17.6\% | 14.2\% |
| BHAR (0) |  | 60.1\% | 30.2\% | 19.8\% | 14.4\% | 47.3\% | 29.5\% | 19.2\% | 14.2\% | 41.3\% | 24.6\% | 19.3\% | 14.3\% | 38.3\% | 24.7\% | 18.2\% | 14.9\% |
| BHAR (1) |  | 60.5\% | 30.3\% | 19.8\% | 14.4\% | 47.1\% | 29.6\% | 19.2\% | 14.3\% | 41.5\% | 24.5\% | 19.3\% | 14.3\% | $38.5 \%$ | 24.9\% | 18.1\% | 14.9\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.5\% | 30.8\% | 20.2\% | 15.1\% | 51.4\% | 30.7\% | 20.3\% | 15.1\% | 44.6\% | 27.7\% | 20.2\% | 15.1\% | 40.0\% | 25.2\% | 18.7\% | 14.9\% |
| CAR (1) |  | 60.8\% | 30.8\% | 20.2\% | 15.1\% | 51.5\% | 30.7\% | 20.3\% | 15.1\% | 44.6\% | 27.7\% | 20.2\% | 15.0\% | 40.1\% | 25.2\% | 18.7\% | 14.9\% |
| BHAR (0) |  | 60.7\% | 29.7\% | 19.8\% | 14.5\% | 51.1\% | 30.5\% | 20.0\% | 13.8\% | 44.3\% | 27.3\% | 19.5\% | 14.2\% | $39.3 \%$ | 24.8\% | 18.4\% | 14.9\% |
| BHAR (1) |  | 60.9\% | 29.8\% | 19.8\% | 14.5\% | 51.2\% | 30.6\% | 20.0\% | 13.9\% | 44.4\% | 27.4\% | 19.5\% | 14.2\% | 39.4\% | 24.8\% | 18.4\% | 15.0\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.2\% | 29.7\% | 19.9\% | 14.7\% | 48.3\% | 28.9\% | 19.5\% | 14.3\% | 42.5\% | 26.2\% | 19.0\% | 14.2\% | $36.4 \%$ | $22.7 \%$ | 16.8\% | 13.5\% |
| CAR (1) |  | 59.3\% | 29.8\% | 19.9\% | 14.7\% | 48.6\% | 29.0\% | 19.5\% | 14.4\% | 42.7\% | 26.1\% | 19.0\% | 14.1\% | $36.5 \%$ | 22.6\% | 16.8\% | 13.5\% |
| BHAR (0) |  | 58.0\% | 29.8\% | 19.1\% | 13.6\% | 46.9\% | 28.4\% | 19.1\% | 12.8\% | 42.9\% | 25.5\% | 19.3\% | 14.0\% | 35.7\% | 22.3\% | 16.7\% | 13.7\% |
| BHAR (1) |  | 58.5\% | 29.9\% | 19.2\% | 13.7\% | 47.4\% | 28.5\% | 19.1\% | 12.9\% | 42.9\% | 25.8\% | 19.2\% | 14.0\% | 35.7\% | 22.3\% | 16.7\% | 13.8\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.1\% | 29.1\% | 19.7\% | 14.9\% | 44.4\% | 27.9\% | 19.1\% | 14.4\% | 38.0\% | 24.8\% | 19.0\% | 14.3\% | 34.3\% | $22.7 \%$ | 17.3\% | 14.0\% |
| CAR (1) |  | 58.3\% | 29.3\% | 19.8\% | 14.9\% | 44.5\% | 28.0\% | 19.1\% | 14.4\% | 38.3\% | 25.0\% | 18.9\% | 14.3\% | 34.5\% | 22.9\% | 17.2\% | 14.0\% |
| BHAR (0) |  | 58.1\% | 28.8\% | 19.3\% | 14.8\% | 44.1\% | 27.4\% | 20.0\% | 14.3\% | 37.9\% | 24.3\% | 18.5\% | 14.0\% | $33.9 \%$ | 22.5\% | 16.4\% | $13.2 \%$ |
| BHAR (1) |  | 57.9\% | 29.0\% | 19.4\% | 14.9\% | 44.3\% | 27.6\% | 20.2\% | 14.4\% | 38.2\% | 24.6\% | 18.5\% | 14.0\% | 34.1\% | 22.5\% | 16.4\% | 13.2\% |


| IVOL $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  | 9 |  |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.9\% | 29.1\% | 19.4\% | 14.7\% | 46.6\% | 28.0\% | 18.9\% | 14.2\% | 42.7\% | 26.0\% | 19.0\% | 14.4\% | 37.4\% | 23.3\% | 17.1\% | 13.7\% |
| CAR (1) | 58.3\% | 29.1\% | 19.5\% | 14.7\% | 46.7\% | 27.9\% | 18.9\% | 14.2\% | 42.8\% | 26.0\% | 18.9\% | 14.4\% | 37.2\% | 23.3\% | 17.1\% | 13.7\% |
| BHAR (0) | 57.5\% | 28.0\% | 18.7\% | 13.8\% | 46.1\% | 26.5\% | 19.6\% | 14.0\% | 42.0\% | 25.4\% | 19.4\% | 13.8\% | 37.0\% | 23.1\% | 16.6\% | 13.2\% |
| BHAR (1) | 57.6\% | 27.9\% | 18.8\% | 13.7\% | 46.0\% | 26.4\% | 19.7\% | 14.0\% | 42.1\% | 25.6\% | 19.4\% | 13.9\% | 37.1\% | 23.1\% | 16.6\% | 13.3\% |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 61.7\% | 30.6\% | 20.6\% | 15.2\% | 50.4\% | 30.0\% | 20.1\% | 14.8\% | 44.8\% | 27.1\% | 19.8\% | 14.7\% | 39.6\% | 24.3\% | 18.0\% | 14.6\% |
| CAR (1) | 62.7\% | 30.8\% | 20.5\% | 15.3\% | 52.5\% | 30.6\% | 20.2\% | 14.7\% | 46.0\% | 27.4\% | 19.8\% | 14.7\% | 40.9\% | 24.7\% | 18.1\% | $14.6 \%$ |
| BHAR (0) | 61.4\% | 30.1\% | 20.6\% | 14.8\% | 50.7\% | 29.8\% | 20.1\% | 14.0\% | 45.1\% | 25.9\% | 19.0\% | 14.1\% | 39.1\% | 23.0\% | 17.7\% | 14.8\% |
| BHAR (1) | 62.5\% | 30.2\% | 20.7\% | 14.4\% | 53.7\% | 30.9\% | 20.4\% | 13.6\% | 46.8\% | 26.9\% | 19.5\% | 14.0\% | 40.7\% | 23.4\% | 17.8\% | 14.8\% |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 60.1\% | 30.4\% | 20.6\% | 15.4\% | 49.1\% | 29.8\% | 20.2\% | 15.1\% | 45.0\% | 28.1\% | 20.5\% | 15.3\% | 41.0\% | $26.1 \%$ | 19.3\% | 15.2\% |
| CAR (1) | 60.2\% | 30.5\% | 20.6\% | 15.4\% | 49.3\% | 29.8\% | 20.2\% | 15.1\% | 45.2\% | 28.2\% | 20.5\% | 15.3\% | 40.9\% | 26.1\% | 19.3\% | 15.2\% |
| BHAR (0) | 60.1\% | 30.3\% | 20.1\% | 14.7\% | 48.1\% | 29.1\% | 20.0\% | 14.6\% | 44.1\% | 27.3\% | 20.0\% | 15.4\% | 40.6\% | 26.0\% | 18.6\% | 15.5\% |
| BHAR (1) | 60.2\% | 30.3\% | 20.1\% | 14.8\% | 48.1\% | 29.1\% | 20.0\% | 14.6\% | 44.4\% | 27.7\% | 20.0\% | 15.4\% | 40.8\% | 26.1\% | 18.6\% | 15.6\% |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 59.9\% | 29.9\% | 19.9\% | 15.0\% | 49.1\% | 29.1\% | 19.3\% | 14.4\% | 41.9\% | 25.6\% | 18.9\% | 14.2\% | 38.3\% | 23.5\% | 17.4\% | 13.9\% |
| CAR (1) | 60.4\% | 30.2\% | 19.9\% | 14.9\% | 49.2\% | 29.2\% | 19.3\% | 14.3\% | 41.9\% | 25.6\% | 18.9\% | 14.2\% | 38.6\% | 23.5\% | 17.4\% | 13.8\% |
| BHAR (0) | 59.8\% | 29.3\% | 19.7\% | 13.9\% | 48.3\% | 29.5\% | 20.1\% | 13.3\% | 42.1\% | 25.3\% | 18.5\% | 14.1\% | 36.4\% | 22.2\% | 17.5\% | 13.9\% |
| BHAR (1) | 60.9\% | 30.2\% | 19.4\% | 14.0\% | 48.6\% | 29.5\% | 20.1\% | 13.3\% | 42.4\% | 25.7\% | 18.5\% | 14.1\% | 36.6\% | 22.1\% | 17.5\% | 13.9\% |


| IVOL $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.7\% | 29.6\% | 20.0\% | 14.9\% | 48.5\% | 29.3\% | 20.0\% | 15.0\% | 41.7\% | 26.1\% | 19.3\% | 14.5\% | 37.0\% | 23.7\% | 17.9\% | $14.2 \%$ |
| CAR (1) | 59.0\% | 29.7\% | 20.0\% | 14.9\% | 48.5\% | 29.3\% | 19.9\% | 14.9\% | 41.7\% | 26.0\% | 19.2\% | 14.5\% | 37.1\% | 23.6\% | 17.8\% | 14.2\% |
| BHAR (0) | 59.2\% | 29.8\% | 19.6\% | 14.0\% | 48.6\% | 29.3\% | 19.6\% | 14.0\% | 41.8\% | 25.5\% | 19.1\% | 14.6\% | 36.7\% | 23.5\% | 17.4\% | 14.5\% |
| BHAR (1) | 59.5\% | 29.8\% | 19.6\% | 14.0\% | 48.6\% | 29.4\% | 19.6\% | 14.2\% | 41.7\% | 25.6\% | 19.1\% | 14.6\% | 36.7\% | 23.5\% | 17.4\% | 14.5\% |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.1\% | 29.2\% | 19.6\% | 14.5\% | 46.5\% | 28.2\% | 19.0\% | 14.2\% | 41.8\% | 25.5\% | 18.9\% | 14.3\% | 37.0\% | 23.6\% | 17.7\% | 14.1\% |
| CAR (1) | 58.5\% | 29.3\% | 19.6\% | 14.5\% | 47.1\% | 28.4\% | 19.1\% | 14.3\% | 41.9\% | 25.5\% | 18.8\% | 14.2\% | 36.9\% | 23.7\% | 17.6\% | 14.1\% |
| BHAR (0) | 58.3\% | 29.2\% | 18.9\% | 13.6\% | 45.4\% | 27.0\% | 18.9\% | 13.1\% | 41.5\% | 24.5\% | 18.7\% | 13.7\% | 37.4\% | 22.6\% | 17.2\% | 13.7\% |
| BHAR (1) | 58.7\% | 29.3\% | 19.0\% | 13.6\% | 45.8\% | 27.1\% | 18.9\% | 13.2\% | 41.5\% | 25.0\% | 18.6\% | 13.6\% | 37.4\% | 22.6\% | 17.2\% | 13.7\% |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 60.4\% | 29.9\% | 20.2\% | 14.9\% | 48.2\% | 29.6\% | 19.8\% | 14.8\% | 41.9\% | 26.1\% | 19.5\% | 14.6\% | 36.3\% | 23.6\% | 17.8\% | 14.4\% |
| CAR (1) | 61.1\% | 30.1\% | 20.3\% | 15.0\% | 48.9\% | 29.8\% | 19.9\% | 14.8\% | 42.3\% | 26.2\% | 19.5\% | 14.6\% | 36.6\% | 23.7\% | 17.8\% | 14.4\% |
| BHAR (0) | 60.3\% | 29.4\% | 19.5\% | 13.9\% | 48.2\% | 29.5\% | 19.7\% | 13.8\% | 41.5\% | 25.3\% | 19.0\% | 14.4\% | 35.7\% | 23.4\% | 17.2\% | 14.8\% |
| BHAR (1) | 61.0\% | 30.0\% | 19.7\% | 14.0\% | 49.1\% | 29.8\% | 19.7\% | 13.9\% | 41.7\% | 25.6\% | 19.1\% | 14.4\% | 36.0\% | 23.5\% | 17.2\% | 14.9\% |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.3\% | 29.3\% | 19.7\% | 14.8\% | 46.8\% | 29.0\% | 19.4\% | 14.6\% | 40.0\% | 25.3\% | 19.2\% | 14.5\% | 36.2\% | 23.2\% | 17.6\% | 14.3\% |
| CAR (1) | 58.3\% | 29.3\% | 19.6\% | 14.8\% | 46.9\% | 29.0\% | 19.4\% | 14.6\% | 40.1\% | 25.3\% | 19.1\% | 14.4\% | 36.2\% | 23.2\% | 17.6\% | 14.3\% |
| BHAR (0) | 58.5\% | 29.1\% | 19.2\% | 13.9\% | 46.1\% | 28.6\% | 19.8\% | 13.8\% | 40.3\% | 25.1\% | 18.5\% | 14.3\% | 35.8\% | 22.6\% | 17.1\% | 14.5\% |
| BHAR (1) | 59.2\% | 29.1\% | 19.2\% | 13.9\% | 46.7\% | 28.5\% | 19.7\% | 13.8\% | 39.8\% | 25.2\% | 18.4\% | 14.3\% | 35.8\% | 22.6\% | 17.1\% | 14.5\% |

Table 7.7b. Turnover ratios for time-series loser portfolio

| EW | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.2\% | 29.4\% | 20.2\% | 15.3\% | 47.3\% | 30.1\% | 20.6\% | 15.7\% | 41.4\% | 27.3\% | 20.9\% | 15.9\% | 37.9\% | 25.4\% | 19.5\% | 15.9\% |
| CAR (1) |  | 58.7\% | 29.6\% | 20.3\% | 15.4\% | 47.9\% | 30.5\% | 20.8\% | 15.8\% | 41.9\% | 27.6\% | 21.0\% | 16.0\% | 38.2\% | 25.7\% | 19.7\% | 16.0\% |
| BHAR (0) |  | 58.3\% | 29.2\% | 20.0\% | 15.1\% | 47.5\% | 30.7\% | 21.0\% | 15.1\% | 42.4\% | 27.4\% | 20.4\% | 15.9\% | 38.9\% | 25.6\% | 19.2\% | 16.8\% |
| BHAR (1) |  | 58.8\% | 29.6\% | 20.2\% | 15.3\% | 48.4\% | 31.2\% | 21.3\% | 15.6\% | 42.9\% | 27.9\% | 20.7\% | 16.0\% | 38.9\% | 25.9\% | 19.7\% | 16.8\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.1\% | 29.7\% | 20.2\% | 15.4\% | 46.2\% | 29.6\% | 20.0\% | 15.3\% | 37.8\% | 25.3\% | 19.6\% | 15.2\% | 33.9\% | 22.9\% | 17.9\% | 15.0\% |
| CAR (1) |  | 58.0\% | 30.0\% | 20.5\% | 15.4\% | 46.7\% | 29.8\% | 20.2\% | 15.4\% | 38.3\% | 25.6\% | 19.8\% | 15.3\% | 34.4\% | 23.2\% | 18.1\% | 15.2\% |
| BHAR (0) |  | 57.0\% | 30.2\% | 19.8\% | 16.5\% | 47.0\% | 29.7\% | 19.7\% | 15.0\% | 39.3\% | 25.7\% | 18.8\% | 15.9\% | 33.7\% | 23.4\% | 18.5\% | 16.2\% |
| BHAR (1) |  | 57.7\% | 30.5\% | 19.8\% | 16.5\% | 47.5\% | 30.2\% | 20.7\% | 15.2\% | 39.6\% | 25.7\% | 19.1\% | 15.9\% | 34.2\% | 24.1\% | 18.3\% | 17.1\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.0\% | 29.4\% | 20.1\% | 15.4\% | 44.2\% | 28.8\% | 19.6\% | 15.1\% | 38.5\% | 24.9\% | 19.3\% | 14.9\% | 35.7\% | 23.1\% | 18.0\% | 14.9\% |
| CAR (1) |  | 58.8\% | 29.7\% | 20.3\% | 15.5\% | 45.0\% | 29.1\% | 19.9\% | 15.2\% | 39.0\% | 25.2\% | 19.4\% | 15.0\% | 36.2\% | 23.4\% | 18.1\% | 15.1\% |
| BHAR (0) |  | 57.2\% | 29.8\% | 20.9\% | 16.8\% | 45.4\% | 30.2\% | 20.1\% | 16.9\% | 40.3\% | 25.3\% | 19.1\% | 15.2\% | 35.0\% | 22.1\% | 17.9\% | 14.4\% |
| BHAR (1) |  | 58.6\% | 30.2\% | 21.3\% | 16.9\% | 47.1\% | 30.8\% | 20.4\% | 17.6\% | 41.0\% | 25.7\% | 19.3\% | 15.5\% | 35.6\% | 22.5\% | 18.1\% | 14.6\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.8\% | 29.0\% | 19.6\% | 15.0\% | 45.8\% | 29.4\% | 20.1\% | 15.4\% | 39.1\% | 26.1\% | 20.3\% | 15.5\% | 35.2\% | 24.0\% | 18.8\% | 15.6\% |
| CAR (1) |  | 57.4\% | 29.3\% | 19.8\% | 15.1\% | 46.3\% | 29.8\% | 20.3\% | 15.5\% | 39.6\% | 26.5\% | 20.5\% | 15.7\% | 35.7\% | 24.3\% | 19.0\% | 15.7\% |
| BHAR (0) |  | 57.3\% | 29.3\% | 19.5\% | 15.5\% | 46.6\% | 30.2\% | 20.0\% | 15.6\% | 40.2\% | 26.0\% | 19.6\% | 15.5\% | 35.2\% | 23.9\% | 18.6\% | 16.1\% |
| BHAR (1) |  | 57.9\% | 29.6\% | 19.6\% | 15.6\% | 47.3\% | 30.6\% | 20.2\% | 15.9\% | 40.9\% | 26.4\% | 19.8\% | 15.7\% | 35.7\% | 24.2\% | 18.8\% | 16.2\% |


| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | H = |  | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.9\% | 29.1\% | 19.8\% | 15.2\% | 45.7\% | 29.4\% | 20.2\% | 15.3\% | 39.8\% | 26.0\% | 19.8\% | 15.1\% | 35.7\% | 23.5\% | 18.0\% | 14.7\% |
| CAR (1) |  | 57.5\% | 29.4\% | 19.9\% | 15.3\% | 45.8\% | 29.6\% | 20.4\% | 15.3\% | 40.6\% | 26.4\% | 20.0\% | 15.3\% | 36.0\% | 23.6\% | 18.1\% | 14.8\% |
| BHAR (0) |  | 56.6\% | 28.5\% | 20.2\% | 16.1\% | 46.3\% | 29.3\% | 19.3\% | 14.7\% | 40.1\% | 26.5\% | 19.3\% | 14.5\% | 34.8\% | 23.6\% | 17.7\% | 15.7\% |
| BHAR (1) |  | 57.5\% | 29.2\% | 20.4\% | 16.1\% | 46.0\% | 29.6\% | 19.1\% | 14.9\% | 41.5\% | 27.5\% | 19.3\% | 14.7\% | 35.3\% | 23.7\% | 18.1\% | 15.8\% |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 55.2\% | 28.2\% | 18.8\% | 14.5\% | 44.1\% | 27.0\% | 18.1\% | 13.8\% | 36.1\% | 23.7\% | 17.7\% | 13.6\% | 33.0\% | 21.6\% | 16.4\% | 13.3\% |
| CAR (1) |  | 55.3\% | 28.4\% | 18.9\% | 14.6\% | 44.5\% | 27.3\% | 18.2\% | 13.9\% | 36.5\% | 23.8\% | 17.8\% | 13.7\% | 32.9\% | 21.7\% | 16.5\% | 13.4\% |
| BHAR (0) |  | 54.9\% | 26.7\% | 19.6\% | 12.9\% | 41.5\% | 26.6\% | 16.7\% | 13.6\% | 36.1\% | 24.5\% | 17.3\% | 15.2\% | 32.9\% | 20.1\% | 16.6\% | 13.0\% |
| BHAR (1) |  | 54.7\% | 26.8\% | 19.6\% | 13.3\% | 42.0\% | 26.9\% | 16.9\% | 14.0\% | 36.4\% | 24.6\% | 17.4\% | 15.4\% | 33.5\% | 20.6\% | 16.5\% | 13.3\% |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.5\% | 29.5\% | 20.3\% | 15.5\% | 46.4\% | 29.9\% | 20.3\% | 15.4\% | 39.9\% | 26.1\% | 20.0\% | 15.3\% | 35.6\% | 23.6\% | 18.5\% | 15.4\% |
| CAR (1) |  | 59.2\% | 29.9\% | 20.5\% | 15.6\% | 47.2\% | 30.3\% | 20.6\% | 15.6\% | 40.4\% | 26.5\% | 20.2\% | 15.5\% | 36.0\% | 23.9\% | 18.7\% | 15.5\% |
| BHAR (0) |  | 58.2\% | 29.7\% | 20.2\% | 16.1\% | 46.3\% | 30.3\% | 20.2\% | 15.9\% | 39.3\% | 25.8\% | 19.2\% | 15.6\% | 35.1\% | 23.4\% | 18.4\% | 15.6\% |
| BHAR (1) |  | 58.9\% | 30.0\% | 20.5\% | 16.2\% | 47.2\% | 30.8\% | 20.4\% | 16.5\% | 39.8\% | 26.1\% | 19.4\% | 15.9\% | 35.6\% | 23.7\% | 18.7\% | 15.8\% |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.7\% | 29.2\% | 20.0\% | 15.3\% | 46.5\% | 30.0\% | 20.4\% | 15.5\% | 40.5\% | 26.7\% | 20.3\% | 15.5\% | 36.6\% | 24.6\% | 19.0\% | 15.5\% |
| CAR (1) |  | 57.3\% | 29.5\% | 20.1\% | 15.4\% | 47.3\% | 30.4\% | 20.6\% | 15.6\% | 41.1\% | 27.0\% | 20.5\% | 15.6\% | 37.3\% | 24.9\% | 19.2\% | 15.6\% |
| BHAR (0) |  | 56.5\% | 28.7\% | 19.7\% | 15.1\% | 46.7\% | 30.0\% | 19.3\% | 15.2\% | 40.7\% | 26.1\% | 19.5\% | 15.9\% | 36.4\% | 23.8\% | 18.1\% | 15.1\% |
| BHAR (1) |  | 57.1\% | 29.2\% | 19.8\% | 15.3\% | 47.5\% | 30.5\% | 19.6\% | 15.5\% | 41.5\% | 26.9\% | 19.4\% | 16.0\% | 37.1\% | 24.3\% | 18.5\% | 15.5\% |


| EW |  |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.4\% | 29.6\% | 20.0\% | 15.4\% | 47.6\% | 28.7\% | 19.4\% | 14.9\% | 42.3\% | 25.4\% | 19.0\% | 14.5\% | 38.5\% | 23.8\% | 17.8\% | 14.1\% |
| CAR (1) |  | 59.6\% | 29.8\% | 20.3\% | 15.5\% | 48.0\% | 28.9\% | 19.6\% | 14.9\% | 42.6\% | 25.7\% | 19.1\% | 14.6\% | 38.8\% | 23.9\% | 17.8\% | 14.2\% |
| BHAR (0) |  | 59.2\% | 28.8\% | 20.2\% | 13.6\% | 46.7\% | 28.4\% | 18.2\% | 15.2\% | 44.3\% | 24.3\% | 19.3\% | 14.8\% | 37.8\% | 23.0\% | 18.1\% | 14.4\% |
| BHAR (1) |  | 59.6\% | 28.9\% | 20.7\% | 13.7\% | 47.1\% | 28.9\% | 17.7\% | 15.3\% | 44.8\% | 24.8\% | 19.0\% | 14.9\% | 38.5\% | 23.0\% | 18.7\% | 14.5\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.4\% | 30.4\% | 20.5\% | 15.7\% | 49.6\% | 30.6\% | 20.9\% | 15.9\% | 43.0\% | 27.7\% | 20.9\% | 15.9\% | 40.7\% | 26.7\% | 20.0\% | 15.9\% |
| CAR (1) |  | 60.8\% | 30.6\% | 20.7\% | 15.8\% | 49.9\% | 30.8\% | 21.0\% | 15.9\% | 43.4\% | 27.9\% | 20.9\% | 15.9\% | 41.2\% | 27.0\% | 20.2\% | 16.0\% |
| BHAR (0) |  | 60.3\% | 29.4\% | 20.5\% | 15.5\% | 48.8\% | $30.4 \%$ | 20.8\% | 15.6\% | 43.3\% | 27.3\% | 20.1\% | 16.0\% | 40.7\% | 25.4\% | 18.8\% | 15.8\% |
| BHAR (1) |  | 60.9\% | 29.7\% | 20.7\% | 15.5\% | 49.2\% | 30.7\% | 20.9\% | 15.7\% | 43.6\% | 27.6\% | 20.2\% | 16.0\% | 41.3\% | 25.9\% | 19.0\% | 16.1\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 55.5\% | 28.2\% | 19.2\% | 14.6\% | 43.2\% | 27.7\% | 19.0\% | 14.3\% | 39.5\% | 25.0\% | 18.8\% | 14.5\% | 34.3\% | 23.0\% | 17.7\% | 14.5\% |
| CAR (1) |  | 56.1\% | 28.5\% | 19.4\% | 14.8\% | 43.6\% | 27.9\% | 19.1\% | 14.5\% | 40.2\% | 25.4\% | 19.0\% | 14.6\% | 34.8\% | 23.3\% | 17.8\% | 14.6\% |
| BHAR (0) |  | 55.4\% | 28.4\% | 19.5\% | 14.5\% | 43.6\% | 28.9\% | 20.1\% | 14.3\% | 38.9\% | 25.5\% | 17.5\% | 15.8\% | 34.5\% | 22.0\% | 19.2\% | 15.6\% |
| BHAR (1) |  | 56.2\% | 29.0\% | 19.8\% | 15.0\% | 44.5\% | 29.0\% | 20.3\% | 14.5\% | 38.5\% | 25.6\% | 18.4\% | 15.5\% | 34.3\% | 22.2\% | 19.1\% | 15.7\% |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.3\% | 30.5\% | 20.7\% | 15.8\% | 49.8\% | 30.9\% | 21.1\% | 16.2\% | 43.0\% | 27.6\% | 20.8\% | 15.8\% | 40.8\% | 26.7\% | 20.2\% | 16.2\% |
| CAR (1) |  | 60.9\% | 30.8\% | 20.8\% | 15.9\% | 50.3\% | 31.2\% | 21.4\% | 16.3\% | 43.6\% | 28.0\% | 20.9\% | 15.7\% | 41.1\% | 27.2\% | 20.4\% | 16.3\% |
| BHAR (0) |  | 60.6\% | 30.5\% | 20.2\% | 16.2\% | 49.0\% | $30.2 \%$ | 21.2\% | 16.7\% | 42.9\% | 27.5\% | 20.9\% | 15.5\% | 40.2\% | 26.1\% | 20.2\% | 16.4\% |
| BHAR (1) |  | 61.1\% | 30.8\% | 20.2\% | 16.4\% | 49.3\% | 30.3\% | 21.2\% | 16.9\% | 43.7\% | 28.0\% | 21.2\% | 15.5\% | 40.7\% | 26.5\% | 20.4\% | 16.4\% |


| EW J = |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=3$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 59.2\% | $30.1 \%$ | 20.5\% | 15.4\% | 49.9\% | 30.0\% | 20.5\% | 15.5\% | 44.4\% | 27.9\% | 20.7\% | 15.5\% | 40.2\% | 25.6\% | 19.1\% | 15.4\% |
| CAR (1) | 59.6\% | 30.6\% | 20.7\% | 15.7\% | 50.8\% | 30.3\% | 21.0\% | 15.8\% | 45.2\% | 28.2\% | 21.0\% | 15.8\% | 41.0\% | 26.0\% | 19.3\% | 15.8\% |
| BHAR (0) | 61.6\% | 30.2\% | 21.2\% | 15.4\% | 50.4\% | 29.7\% | 20.7\% | 14.5\% | 45.5\% | 28.7\% | 20.4\% | 16.4\% | 41.2\% | 26.4\% | 18.5\% | 16.5\% |
| BHAR (1) | 62.1\% | 30.5\% | 21.2\% | 16.0\% | 50.9\% | $30.2 \%$ | 21.0\% | 14.3\% | 47.0\% | 29.1\% | 20.8\% | 16.5\% | 42.0\% | 26.9\% | 18.3\% | 17.2\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 60.5\% | 31.0\% | 20.4\% | 15.3\% | 52.8\% | 31.3\% | 20.6\% | 15.3\% | 46.2\% | 28.2\% | 20.4\% | 15.3\% | 42.6\% | 26.1\% | 19.3\% | 15.4\% |
| CAR (1) | 60.9\% | 31.2\% | 20.5\% | 15.4\% | 53.2\% | 31.5\% | 20.8\% | 15.4\% | 46.4\% | 28.4\% | 20.5\% | 15.3\% | 42.8\% | 26.3\% | 19.4\% | 15.4\% |
| BHAR (0) | 60.6\% | 29.7\% | 20.1\% | 15.5\% | 52.0\% | 31.0\% | 19.9\% | 16.2\% | 46.4\% | 27.8\% | 19.5\% | 15.9\% | 42.4\% | 26.1\% | 19.2\% | 15.8\% |
| BHAR (1) | 60.9\% | 30.0\% | 20.3\% | 15.6\% | 52.4\% | 31.1\% | 20.0\% | 16.3\% | 46.6\% | 28.1\% | 19.6\% | 16.0\% | 42.5\% | 26.2\% | 19.3\% | 15.8\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.1\% | 30.2\% | 20.5\% | 15.6\% | 47.6\% | 30.3\% | 20.5\% | 15.7\% | 40.6\% | 26.5\% | 20.4\% | 15.6\% | 36.4\% | 23.8\% | 18.7\% | 15.3\% |
| CAR (1) | 58.8\% | 30.7\% | 20.9\% | 15.8\% | 48.2\% | 30.5\% | 20.7\% | 15.9\% | 40.9\% | 26.9\% | 20.7\% | 15.7\% | 36.7\% | 24.2\% | 18.8\% | 15.5\% |
| BHAR (0) | 58.0\% | 29.9\% | 20.2\% | 15.1\% | 46.9\% | 31.2\% | 20.2\% | 15.9\% | 41.4\% | 26.1\% | 19.8\% | 15.5\% | 35.2\% | 22.9\% | 18.3\% | 15.8\% |
| BHAR (1) | 58.5\% | 30.3\% | 20.4\% | 15.4\% | 47.3\% | 31.4\% | 20.5\% | 16.0\% | 41.3\% | 26.2\% | 19.8\% | 15.7\% | 35.3\% | 23.1\% | 18.3\% | 15.9\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 56.8\% | 28.8\% | 19.9\% | 15.2\% | 43.5\% | 28.5\% | 19.6\% | 15.0\% | 38.9\% | 25.0\% | 19.4\% | 15.0\% | 34.3\% | 23.2\% | 17.9\% | 14.8\% |
| CAR (1) | 57.5\% | 29.2\% | 20.0\% | 15.2\% | 44.0\% | 28.8\% | 19.7\% | 15.1\% | 39.2\% | 25.2\% | 19.5\% | 15.1\% | 34.5\% | 23.4\% | 18.1\% | 14.9\% |
| BHAR (0) | 56.5\% | 27.9\% | 19.8\% | 14.9\% | 42.7\% | 28.9\% | 20.2\% | 14.4\% | 37.5\% | 24.1\% | 19.1\% | 14.3\% | 34.1\% | 23.3\% | 18.0\% | 15.2\% |
| BHAR (1) | 57.1\% | 28.1\% | 19.9\% | 15.3\% | 43.0\% | 28.9\% | 20.3\% | 14.5\% | 37.7\% | 24.4\% | 19.0\% | 14.5\% | 34.4\% | 23.6\% | 18.2\% | 15.5\% |


| EW J = |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 59.4\% | 30.5\% | 20.7\% | 15.7\% | 49.3\% | $30.2 \%$ | 20.6\% | 15.7\% | 42.1\% | 26.7\% | 20.0\% | 15.2\% | 39.3\% | 25.5\% | 19.4\% | 15.6\% |
| CAR (1) | 60.1\% | 30.9\% | 20.8\% | 15.9\% | 49.8\% | 30.4\% | 20.8\% | 15.7\% | 42.4\% | 27.0\% | 20.1\% | 15.4\% | 39.7\% | 25.9\% | 19.6\% | 15.8\% |
| BHAR (0) | 57.2\% | 29.0\% | 21.1\% | 15.0\% | 49.4\% | 30.7\% | 20.8\% | 15.6\% | 42.1\% | 25.5\% | 19.0\% | 15.5\% | 38.5\% | 25.2\% | 19.2\% | 15.6\% |
| BHAR (1) | 58.0\% | 29.2\% | 21.1\% | 15.0\% | 49.8\% | 30.9\% | 21.0\% | 15.7\% | 42.5\% | 25.9\% | 19.3\% | 15.6\% | 38.9\% | 25.5\% | 19.2\% | 15.9\% |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.5\% | 29.0\% | 19.8\% | 15.5\% | 44.9\% | 29.2\% | 19.6\% | 15.2\% | 39.2\% | 25.8\% | 20.0\% | 15.3\% | 36.7\% | 23.7\% | 18.4\% | 15.3\% |
| CAR (1) | 58.3\% | 29.5\% | 20.1\% | 15.8\% | 45.7\% | 29.5\% | 19.9\% | 15.3\% | 39.6\% | 26.3\% | 20.2\% | 15.3\% | 37.1\% | 24.0\% | 18.6\% | 15.4\% |
| BHAR (0) | 57.5\% | 29.6\% | 19.6\% | 14.9\% | 44.2\% | 28.7\% | 20.1\% | 14.4\% | 38.9\% | 25.1\% | 19.0\% | 14.8\% | 37.9\% | 24.4\% | 18.3\% | 15.5\% |
| BHAR (1) | 58.3\% | 29.8\% | 19.7\% | 15.3\% | 44.5\% | 28.9\% | 20.2\% | 14.3\% | 39.2\% | 25.5\% | 19.0\% | 15.0\% | 37.8\% | 24.5\% | 18.4\% | 15.6\% |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.7\% | 29.1\% | 19.7\% | 15.0\% | 47.1\% | 28.2\% | 19.0\% | 14.7\% | 43.0\% | 26.7\% | 19.6\% | 14.7\% | 38.5\% | 24.9\% | 18.3\% | 14.5\% |
| CAR (1) | 59.3\% | 29.4\% | 19.8\% | 15.0\% | 47.3\% | 28.3\% | 19.3\% | 14.6\% | 43.4\% | 26.8\% | 19.7\% | 14.8\% | 38.8\% | 25.0\% | 18.3\% | 14.6\% |
| BHAR (0) | 58.1\% | 29.5\% | 19.6\% | 15.3\% | 47.1\% | 29.4\% | 18.8\% | 14.6\% | 43.1\% | 26.6\% | 19.1\% | 15.0\% | 37.1\% | 24.8\% | 17.3\% | 15.1\% |
| BHAR (1) | 58.8\% | 29.9\% | 20.1\% | 15.5\% | 47.3\% | 29.5\% | 19.0\% | 14.7\% | 43.4\% | 27.1\% | 19.3\% | 15.3\% | 37.3\% | 24.8\% | 17.5\% | 14.7\% |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\overline{\text { CAR (0) }}$ | 56.3\% | 28.4\% | 19.0\% | 14.3\% | 46.6\% | 28.2\% | 18.6\% | 13.8\% | 37.1\% | 23.9\% | 18.1\% | 13.4\% | 34.3\% | 21.5\% | 16.4\% | 13.1\% |
| CAR (1) | 56.5\% | 28.6\% | 19.1\% | 14.4\% | 46.7\% | 28.4\% | 18.6\% | 13.9\% | 37.7\% | 24.2\% | 18.2\% | 13.5\% | 34.4\% | 21.5\% | 16.4\% | 13.1\% |
| BHAR (0) | 58.1\% | 29.0\% | 19.4\% | 13.9\% | 46.9\% | 29.4\% | 20.2\% | 13.4\% | 37.7\% | 24.7\% | 16.9\% | 14.4\% | 35.4\% | 21.0\% | 15.3\% | 13.5\% |
| BHAR (1) | 58.3\% | 29.2\% | 19.4\% | 14.5\% | 46.6\% | 29.4\% | 20.4\% | 13.6\% | 37.9\% | 24.1\% | 16.3\% | 14.4\% | 35.5\% | 21.0\% | 15.3\% | 13.5\% |


| EW J = |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.9\% | 29.8\% | 20.8\% | 15.9\% | 48.3\% | 29.9\% | 20.6\% | 15.9\% | 41.5\% | 26.4\% | 20.0\% | 15.4\% | 37.1\% | 24.2\% | 18.4\% | 15.0\% |
| CAR (1) | 58.5\% | 30.2\% | 21.0\% | 16.2\% | 49.1\% | $30.2 \%$ | 21.1\% | 16.0\% | 41.6\% | 26.5\% | 20.1\% | 15.4\% | 37.4\% | 24.6\% | 18.6\% | 15.2\% |
| BHAR (0) | 57.9\% | 29.2\% | 21.3\% | 15.3\% | 48.8\% | 30.9\% | 20.7\% | 16.5\% | 39.8\% | 24.9\% | 18.5\% | 14.4\% | 37.7\% | 24.9\% | 18.9\% | 14.8\% |
| BHAR (1) | 58.0\% | 29.5\% | 21.2\% | 15.6\% | 49.1\% | 31.3\% | 21.1\% | 16.6\% | 40.1\% | 25.4\% | 18.6\% | 14.6\% | 37.8\% | 25.5\% | 19.1\% | 15.0\% |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.2\% | 29.7\% | 20.3\% | 15.4\% | 48.5\% | 30.2\% | 20.5\% | 15.6\% | 43.3\% | 27.3\% | 20.6\% | 15.9\% | 38.9\% | 25.2\% | 19.4\% | 15.6\% |
| CAR (1) | 58.6\% | 30.1\% | 20.5\% | 15.4\% | 48.4\% | 30.3\% | 20.6\% | 15.7\% | 43.6\% | 27.6\% | 20.8\% | 16.0\% | 39.5\% | 25.6\% | 19.5\% | 15.7\% |
| BHAR (0) | 58.3\% | 30.7\% | 20.0\% | 16.2\% | 48.9\% | 30.0\% | 19.9\% | 15.5\% | 44.4\% | 27.3\% | 19.4\% | 16.0\% | 37.8\% | 24.7\% | 18.2\% | $15.1 \%$ |
| BHAR (1) | 58.7\% | 30.9\% | 20.1\% | 16.0\% | 48.3\% | 30.3\% | 20.0\% | 15.8\% | 44.9\% | 27.5\% | 19.6\% | 16.4\% | 38.3\% | 25.0\% | 18.6\% | 15.1\% |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 56.6\% | 29.3\% | 20.5\% | 15.8\% | 44.6\% | 29.6\% | 20.7\% | 16.0\% | 39.3\% | 26.5\% | 20.7\% | 16.0\% | 35.0\% | 24.3\% | 19.1\% | 15.9\% |
| CAR (1) | 57.3\% | 29.8\% | 20.8\% | 15.9\% | 45.3\% | 30.0\% | 21.0\% | 16.2\% | 40.0\% | 27.0\% | 21.0\% | 16.2\% | 35.6\% | 24.7\% | 19.4\% | 16.1\% |
| BHAR (0) | 57.0\% | 29.4\% | 20.7\% | 16.0\% | 44.9\% | 29.8\% | 20.7\% | 15.9\% | 39.5\% | 26.4\% | 20.1\% | 16.2\% | 35.5\% | 24.1\% | 19.1\% | 16.5\% |
| BHAR (1) | 57.8\% | 29.9\% | 20.9\% | 16.2\% | 45.7\% | 30.3\% | 21.0\% | 16.2\% | 40.2\% | 26.9\% | 20.4\% | 16.4\% | 36.1\% | 24.5\% | 19.3\% | 16.8\% |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.2\% | 29.5\% | 20.0\% | 15.3\% | 47.2\% | 29.8\% | 20.1\% | 15.3\% | 40.5\% | 26.3\% | 20.2\% | 15.3\% | 37.0\% | 24.0\% | 18.6\% | 15.4\% |
| CAR (1) | 58.6\% | 29.7\% | 20.1\% | 15.4\% | 47.6\% | 30.1\% | 20.3\% | 15.4\% | 40.8\% | 26.6\% | 20.3\% | 15.5\% | 37.4\% | 24.3\% | 18.7\% | 15.5\% |
| BHAR (0) | 58.3\% | 28.7\% | 19.3\% | 14.8\% | 46.9\% | 29.5\% | 19.8\% | 15.3\% | 40.7\% | 25.9\% | 19.3\% | 15.2\% | 37.2\% | 23.4\% | 18.3\% | 15.8\% |
| BHAR (1) | 58.7\% | 28.9\% | 19.5\% | 14.9\% | 47.3\% | 29.7\% | 20.0\% | 15.5\% | 41.1\% | 26.2\% | 19.4\% | 15.3\% | 37.6\% | 23.6\% | 18.4\% | 16.0\% |


| MW |  |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 62.1\% | 30.8\% | 21.0\% | 15.7\% | 54.3\% | 31.1\% | 20.9\% | 15.7\% | 47.9\% | 28.8\% | 20.8\% | 15.7\% | 44.8\% | 27.6\% | 20.0\% | 15.6\% |
| CAR (1) |  | 62.3\% | 30.8\% | 21.0\% | 15.7\% | 54.7\% | 31.2\% | 20.9\% | 15.7\% | 48.5\% | 28.9\% | 20.8\% | 15.7\% | 45.5\% | 27.7\% | 20.0\% | 15.6\% |
| BHAR (0) |  | 62.3\% | 30.0\% | 20.6\% | 15.4\% | 54.5\% | 31.2\% | 21.1\% | 15.4\% | 47.2\% | 28.8\% | 20.7\% | 15.6\% | 45.3\% | 27.5\% | 19.9\% | 16.0\% |
| BHAR (1) |  | 62.5\% | 30.1\% | 20.6\% | 15.4\% | 55.1\% | 31.4\% | 21.1\% | 15.4\% | 47.9\% | 29.1\% | 20.7\% | 15.6\% | 46.1\% | 27.5\% | 20.0\% | 16.0\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.5\% | 30.2\% | 19.6\% | 14.7\% | 51.7\% | 30.7\% | 19.9\% | 14.6\% | 44.5\% | 26.8\% | 19.6\% | 14.7\% | 40.5\% | 24.5\% | 18.2\% | 14.6\% |
| CAR (1) |  | 59.9\% | 30.2\% | 19.7\% | 14.7\% | 52.1\% | 30.6\% | 19.8\% | 14.6\% | 44.8\% | 26.9\% | 19.6\% | 14.7\% | 40.8\% | 24.7\% | 18.3\% | $14.6 \%$ |
| BHAR (0) |  | 59.2\% | 29.7\% | 19.7\% | 14.9\% | 53.7\% | 31.9\% | 19.4\% | 14.4\% | 45.9\% | 27.8\% | 18.7\% | 15.5\% | 39.1\% | 23.7\% | 17.7\% | 15.2\% |
| BHAR (1) |  | 59.6\% | 29.4\% | 19.8\% | 14.9\% | 53.5\% | 31.9\% | 19.5\% | 14.4\% | 46.2\% | 27.4\% | 18.7\% | 15.5\% | 39.6\% | 24.1\% | 17.8\% | 15.2\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.9\% | 29.2\% | 20.0\% | 15.1\% | 50.3\% | 29.6\% | 20.1\% | 15.2\% | 44.3\% | 27.3\% | 20.1\% | 15.0\% | 42.6\% | 25.4\% | 19.2\% | 15.2\% |
| CAR (1) |  | 60.5\% | 29.2\% | 20.0\% | 15.1\% | 50.7\% | 29.7\% | 20.1\% | 15.1\% | 44.8\% | 27.4\% | 20.1\% | 15.0\% | 42.9\% | 25.5\% | 19.2\% | 15.2\% |
| BHAR (0) |  | 58.6\% | 29.5\% | 20.9\% | 15.3\% | 50.2\% | 31.0\% | 20.8\% | 15.0\% | 46.4\% | 29.2\% | 19.8\% | 15.4\% | 43.5\% | 25.1\% | 19.5\% | 15.3\% |
| BHAR (1) |  | 59.5\% | 29.6\% | 20.9\% | 15.2\% | 50.3\% | 31.1\% | 20.8\% | 15.3\% | 46.7\% | 29.5\% | 20.0\% | 15.5\% | 43.9\% | 25.3\% | 19.7\% | 15.3\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.5\% | 30.4\% | 20.5\% | 15.3\% | 51.6\% | 30.6\% | 20.5\% | 15.3\% | 45.7\% | 27.8\% | 20.4\% | 15.3\% | 43.5\% | 26.6\% | 19.4\% | 15.1\% |
| CAR (1) |  | 60.8\% | 30.4\% | 20.5\% | 15.3\% | 52.2\% | 30.7\% | 20.5\% | 15.2\% | 46.3\% | 28.0\% | 20.4\% | 15.3\% | 44.1\% | 26.7\% | 19.4\% | 15.1\% |
| BHAR (0) |  | 60.5\% | 30.2\% | 19.7\% | 14.9\% | 52.1\% | 30.2\% | 19.9\% | 15.1\% | 46.6\% | 28.1\% | 19.5\% | 15.5\% | 42.7\% | 25.5\% | 19.1\% | 15.6\% |
| BHAR (1) |  | 60.8\% | 30.2\% | 19.7\% | 14.9\% | 52.6\% | 30.3\% | 20.0\% | 15.3\% | 47.2\% | 28.3\% | 19.5\% | 15.5\% | 43.3\% | 25.6\% | 19.1\% | 15.5\% |


| MW |  |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.7\% | 30.5\% | 20.0\% | 15.2\% | 50.5\% | $30.2 \%$ | 20.4\% | 15.1\% | 44.9\% | 27.5\% | 19.9\% | 14.9\% | 42.3\% | 25.8\% | 18.7\% | 14.7\% |
| CAR (1) |  | 59.0\% | 30.5\% | 20.0\% | 15.1\% | 50.5\% | 30.3\% | 20.4\% | 15.1\% | 45.4\% | 27.6\% | 19.9\% | 14.8\% | 42.3\% | 25.8\% | 18.7\% | 14.7\% |
| BHAR (0) |  | 60.0\% | 29.3\% | 20.4\% | 15.0\% | 50.9\% | 30.1\% | 20.6\% | 14.9\% | 44.2\% | 26.7\% | 19.1\% | 14.3\% | 43.8\% | 26.4\% | 19.0\% | 15.2\% |
| BHAR (1) |  | 60.2\% | 29.3\% | 20.4\% | 15.0\% | 50.4\% | 30.2\% | 20.2\% | 14.9\% | 44.6\% | 27.0\% | 19.2\% | 14.3\% | 43.6\% | 26.5\% | 19.0\% | 15.2\% |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.5\% | 28.1\% | 19.0\% | 14.5\% | 46.5\% | 27.4\% | 17.8\% | 13.6\% | 41.6\% | 24.4\% | 17.8\% | 13.3\% | 37.7\% | 22.6\% | 16.1\% | 12.8\% |
| CAR (1) |  | 56.5\% | 28.1\% | 19.0\% | 14.5\% | 47.0\% | 27.6\% | 17.8\% | 13.7\% | 42.2\% | 24.6\% | 17.8\% | 13.3\% | 37.8\% | 22.7\% | 16.1\% | 12.8\% |
| BHAR (0) |  | 56.2\% | 25.9\% | 19.8\% | 12.4\% | 43.9\% | 26.0\% | 16.2\% | 13.9\% | 41.6\% | 25.6\% | 17.6\% | 14.5\% | 38.7\% | 21.1\% | 16.7\% | 12.3\% |
| BHAR (1) |  | 56.0\% | 25.9\% | 19.8\% | 12.8\% | 44.2\% | 26.5\% | 16.2\% | 14.3\% | 42.3\% | 25.9\% | 18.0\% | 14.5\% | 39.2\% | 21.6\% | 16.8\% | 12.8\% |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 61.6\% | 30.3\% | 20.5\% | 15.4\% | 52.9\% | 30.8\% | 20.5\% | 15.5\% | 47.5\% | 28.5\% | 20.6\% | 15.4\% | 44.9\% | 26.8\% | 19.6\% | 15.4\% |
| CAR (1) |  | 61.7\% | 30.3\% | 20.5\% | 15.4\% | 53.2\% | 30.9\% | 20.4\% | 15.4\% | 47.9\% | 28.6\% | 20.6\% | 15.4\% | 45.3\% | 26.9\% | 19.6\% | 15.4\% |
| BHAR (0) |  | 61.8\% | 29.9\% | 20.3\% | 15.3\% | 53.4\% | 30.8\% | 20.3\% | 15.3\% | 48.2\% | 27.7\% | 20.4\% | 15.4\% | 44.6\% | 26.1\% | 19.5\% | 15.7\% |
| BHAR (1) |  | 61.9\% | 29.8\% | 20.3\% | 15.3\% | 53.7\% | 30.9\% | 20.2\% | 15.2\% | 48.4\% | 27.7\% | 20.4\% | 15.4\% | 44.9\% | 26.1\% | 19.5\% | 15.7\% |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 61.7\% | 31.2\% | 20.8\% | 15.8\% | 52.8\% | 30.8\% | 20.7\% | 15.6\% | 48.0\% | 28.8\% | 20.9\% | 15.6\% | 45.6\% | 27.7\% | 19.9\% | 15.5\% |
| CAR (1) |  | 62.0\% | 31.2\% | 20.9\% | 15.8\% | 53.2\% | 30.9\% | 20.7\% | 15.5\% | 48.5\% | 28.9\% | 20.9\% | 15.5\% | 46.1\% | 27.8\% | 19.9\% | 15.5\% |
| BHAR (0) |  | 61.1\% | 29.8\% | 20.7\% | 15.6\% | 54.2\% | 31.2\% | 20.7\% | 15.6\% | 49.2\% | 28.4\% | 20.7\% | 15.7\% | 46.4\% | 26.2\% | 19.7\% | 15.3\% |
| BHAR (1) |  | 61.3\% | 29.8\% | 20.7\% | 15.6\% | 54.4\% | 31.3\% | 20.7\% | 15.5\% | 49.6\% | 28.5\% | 20.7\% | 15.7\% | 47.0\% | 26.2\% | 19.7\% | 15.4\% |


| MW |  |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.0\% | 29.5\% | 19.7\% | 14.8\% | 49.9\% | 28.7\% | 19.1\% | 14.2\% | 46.1\% | 26.1\% | 18.5\% | 13.5\% | 41.0\% | 24.5\% | 17.3\% | 13.3\% |
| CAR (1) |  | 60.1\% | 29.5\% | 19.7\% | 14.8\% | 50.1\% | 28.6\% | 19.0\% | 14.1\% | 46.3\% | 26.1\% | 18.4\% | 13.5\% | 40.9\% | 24.4\% | 17.1\% | 13.2\% |
| BHAR (0) |  | 60.0\% | 29.0\% | 18.8\% | 12.8\% | 49.6\% | 28.5\% | 18.7\% | 13.6\% | 47.9\% | 25.8\% | 19.1\% | 13.4\% | 40.9\% | 23.4\% | 17.5\% | 13.8\% |
| BHAR (1) |  | 60.2\% | 29.0\% | 18.7\% | 12.8\% | 49.4\% | 28.6\% | 17.8\% | 13.7\% | 48.5\% | 25.8\% | 18.8\% | 13.5\% | 40.9\% | 23.0\% | 17.6\% | 13.8\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 62.6\% | 31.1\% | 20.8\% | 15.7\% | 54.3\% | 31.2\% | 21.0\% | 15.8\% | 49.1\% | 28.9\% | 20.7\% | 15.5\% | 47.3\% | 28.1\% | 20.2\% | 15.5\% |
| CAR (1) |  | 62.8\% | 31.1\% | 20.8\% | 15.7\% | 54.6\% | 31.2\% | 21.0\% | 15.7\% | 49.6\% | 29.0\% | 20.7\% | 15.5\% | 47.8\% | 28.2\% | 20.2\% | 15.5\% |
| BHAR (0) |  | 62.6\% | 30.9\% | 20.7\% | 15.6\% | 53.7\% | 31.1\% | 21.2\% | 15.6\% | 49.1\% | 28.5\% | 20.4\% | 15.5\% | 46.8\% | 26.7\% | 19.3\% | 15.0\% |
| BHAR (1) |  | 62.8\% | 31.1\% | 20.7\% | 15.6\% | 54.0\% | 31.1\% | 21.2\% | 15.7\% | 49.4\% | 28.6\% | 20.5\% | 15.5\% | 47.4\% | 26.9\% | 19.4\% | 15.1\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.5\% | 28.9\% | 19.6\% | 14.7\% | 47.4\% | 27.7\% | 18.8\% | 14.1\% | 42.9\% | 25.5\% | 18.5\% | 14.2\% | 40.1\% | 23.8\% | 17.7\% | 13.9\% |
| CAR (1) |  | 57.8\% | 28.9\% | 19.6\% | 14.6\% | 47.7\% | 27.7\% | 18.8\% | 14.1\% | 43.3\% | 25.5\% | 18.5\% | 14.2\% | 40.0\% | 23.9\% | 17.6\% | 13.9\% |
| BHAR (0) |  | 57.4\% | 29.2\% | 20.3\% | 13.7\% | 47.5\% | 27.9\% | 19.3\% | 13.1\% | 39.8\% | 25.4\% | 16.7\% | 14.9\% | 39.4\% | 22.1\% | 18.8\% | 14.5\% |
| BHAR (1) |  | 57.8\% | 29.2\% | 20.4\% | 13.8\% | 48.5\% | 27.7\% | 19.3\% | 13.4\% | 39.7\% | 25.2\% | 17.0\% | 14.9\% | 39.8\% | 21.7\% | 18.9\% | 14.5\% |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 62.2\% | 30.9\% | 20.7\% | 15.6\% | 53.9\% | 30.9\% | 21.0\% | 15.7\% | 47.2\% | 28.5\% | 20.5\% | 15.2\% | 44.8\% | 27.4\% | 19.7\% | 15.3\% |
| CAR (1) |  | 62.3\% | 30.9\% | 20.7\% | 15.6\% | 54.3\% | 31.0\% | 21.0\% | 15.7\% | 47.5\% | 28.6\% | 20.4\% | 15.1\% | 45.2\% | 27.7\% | 19.7\% | 15.3\% |
| BHAR (0) |  | 62.7\% | 30.7\% | 20.2\% | 15.9\% | 53.7\% | 30.7\% | 21.1\% | 15.2\% | 46.9\% | 28.2\% | 20.6\% | 14.7\% | 43.0\% | 26.9\% | 19.1\% | 15.5\% |
| BHAR (1) |  | 62.8\% | 30.9\% | 20.2\% | 15.9\% | 54.0\% | 30.7\% | 21.1\% | 15.2\% | 47.3\% | 28.5\% | 20.7\% | 14.7\% | 43.4\% | 27.0\% | 19.2\% | 15.5\% |


| MW $\mathrm{J}=$ |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 60.0\% | 29.7\% | 20.0\% | 14.9\% | 51.5\% | 29.7\% | 20.0\% | 15.0\% | 48.3\% | 28.0\% | 20.2\% | 15.0\% | 45.9\% | 26.4\% | 19.1\% | 15.0\% |
| CAR (1) | 59.9\% | 29.8\% | 19.9\% | 14.9\% | 51.7\% | 29.8\% | 20.1\% | 15.0\% | 48.7\% | 28.1\% | 20.1\% | 15.0\% | 46.2\% | 26.5\% | 19.1\% | 15.0\% |
| BHAR (0) | 61.2\% | 29.4\% | 20.4\% | 14.7\% | 52.2\% | 29.5\% | 20.6\% | 14.1\% | 49.0\% | 29.0\% | 20.0\% | 15.6\% | 46.3\% | 26.4\% | 17.9\% | 15.1\% |
| BHAR (1) | 60.9\% | 29.5\% | 20.4\% | 14.6\% | 51.8\% | 29.4\% | 20.6\% | 13.8\% | 49.5\% | 29.2\% | 20.0\% | 15.7\% | 46.8\% | 26.5\% | 17.6\% | 15.1\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 61.5\% | 31.0\% | 20.5\% | 15.4\% | 54.7\% | 31.4\% | 20.6\% | 15.2\% | 49.4\% | 28.9\% | 20.6\% | 15.3\% | 45.9\% | 27.1\% | 19.5\% | 15.3\% |
| CAR (1) | 61.8\% | 31.0\% | 20.5\% | 15.4\% | 54.9\% | 31.5\% | 20.6\% | 15.2\% | 49.7\% | 29.0\% | 20.6\% | 15.3\% | 46.3\% | 27.2\% | 19.5\% | 15.3\% |
| BHAR (0) | 61.6\% | 29.5\% | 20.2\% | 15.4\% | 54.5\% | 31.1\% | 20.4\% | 15.4\% | 50.3\% | 28.7\% | 20.0\% | 15.6\% | 46.0\% | 27.1\% | 19.2\% | 15.8\% |
| BHAR (1) | 61.7\% | 29.7\% | 20.3\% | 15.4\% | 54.7\% | 31.2\% | 20.3\% | 15.5\% | 50.6\% | 28.9\% | 20.0\% | 15.6\% | 46.3\% | 27.1\% | 19.3\% | 15.8\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 61.8\% | 31.3\% | 20.6\% | 15.5\% | 54.3\% | 31.4\% | 20.5\% | 15.4\% | 49.0\% | 28.7\% | 20.7\% | 15.4\% | 45.6\% | 27.1\% | 19.4\% | 15.2\% |
| CAR (1) | 61.9\% | 31.3\% | 20.6\% | 15.5\% | 54.7\% | 31.4\% | 20.6\% | 15.4\% | 49.1\% | 28.9\% | 20.7\% | 15.4\% | 45.9\% | 27.2\% | 19.5\% | 15.3\% |
| BHAR (0) | 60.6\% | 31.0\% | 20.2\% | 14.2\% | 52.3\% | 32.2\% | 20.7\% | 15.2\% | 48.4\% | 28.5\% | 20.7\% | 14.8\% | 44.2\% | 26.3\% | 18.8\% | 15.7\% |
| BHAR (1) | 60.7\% | 31.0\% | 20.2\% | 14.2\% | 52.7\% | 32.3\% | 20.7\% | 15.3\% | 48.5\% | 28.6\% | 20.7\% | 14.8\% | 44.9\% | 26.4\% | 19.1\% | 15.9\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 59.5\% | 30.4\% | 20.4\% | 15.2\% | 50.0\% | 30.0\% | 20.1\% | 15.2\% | 46.1\% | 27.9\% | 20.1\% | 15.1\% | 42.2\% | 26.3\% | 19.0\% | 14.7\% |
| CAR (1) | 59.7\% | 30.4\% | 20.4\% | 15.2\% | 50.3\% | 30.1\% | 20.1\% | 15.1\% | 46.5\% | 28.0\% | 20.1\% | 15.1\% | 42.0\% | 26.4\% | 19.0\% | 14.7\% |
| BHAR (0) | 59.6\% | 29.7\% | 20.9\% | 15.1\% | 49.3\% | 30.1\% | 20.8\% | 14.8\% | 46.0\% | 27.7\% | 19.7\% | 15.4\% | 43.2\% | 25.7\% | 18.7\% | 15.1\% |
| BHAR (1) | 59.8\% | 29.8\% | 20.9\% | 15.1\% | 49.4\% | 30.2\% | 20.8\% | 14.8\% | 46.2\% | 27.7\% | 19.8\% | 15.4\% | 43.2\% | 25.7\% | 18.8\% | 15.1\% |


| MW | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 61.7\% | 30.9\% | 20.3\% | 15.2\% | 53.7\% | 30.7\% | 20.4\% | 15.2\% | 48.1\% | 28.0\% | 20.0\% | 14.9\% | 44.4\% | 26.4\% | 19.3\% | 15.0\% |
| CAR (1) |  | 61.9\% | 30.9\% | 20.3\% | 15.2\% | 54.0\% | 30.8\% | 20.4\% | 15.2\% | 48.6\% | 28.1\% | 19.9\% | 14.9\% | 44.6\% | 26.5\% | 19.3\% | 14.9\% |
| BHAR (0) |  | 61.0\% | 29.6\% | 20.3\% | 15.0\% | 53.4\% | 30.6\% | 20.6\% | 15.0\% | 46.9\% | 27.0\% | 19.5\% | 14.9\% | 45.0\% | 26.8\% | 19.2\% | 14.5\% |
| BHAR (1) |  | 61.2\% | 29.7\% | 20.3\% | 15.0\% | 53.8\% | 30.7\% | 20.6\% | 15.0\% | 47.4\% | 27.4\% | 19.7\% | 14.9\% | 45.4\% | 26.9\% | 19.3\% | 14.4\% |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.8\% | 29.1\% | 19.3\% | 15.2\% | 48.1\% | 28.9\% | 19.1\% | 14.6\% | 42.8\% | 26.6\% | 19.7\% | 15.0\% | 42.5\% | 25.6\% | 18.6\% | 14.9\% |
| CAR (1) |  | 57.9\% | 29.1\% | 19.2\% | 15.1\% | 48.4\% | 29.0\% | 19.1\% | 14.5\% | 43.1\% | 26.8\% | 19.8\% | 14.9\% | 42.5\% | 25.7\% | 18.6\% | 14.9\% |
| BHAR (0) |  | 56.8\% | 28.0\% | 20.4\% | 14.2\% | 46.0\% | 28.2\% | 20.2\% | 13.7\% | 42.2\% | 25.5\% | 18.9\% | 14.7\% | 43.8\% | 26.7\% | 18.2\% | 15.3\% |
| BHAR (1) |  | 57.3\% | 28.0\% | 20.4\% | 14.1\% | 46.6\% | 28.5\% | 20.3\% | 13.9\% | 42.6\% | 25.7\% | 19.0\% | 14.8\% | 43.8\% | 26.9\% | 18.2\% | 15.3\% |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.7\% | 29.6\% | 19.7\% | 14.8\% | 49.6\% | 28.9\% | 19.3\% | 14.4\% | 44.6\% | 26.9\% | 19.4\% | 14.5\% | 42.2\% | 26.2\% | 18.6\% | 14.3\% |
| CAR (1) |  | 59.9\% | 29.7\% | 19.7\% | 14.8\% | 49.8\% | 28.8\% | 19.3\% | 14.3\% | 44.9\% | 26.9\% | 19.4\% | 14.4\% | 42.5\% | 26.4\% | 18.6\% | 14.3\% |
| BHAR (0) |  | 60.2\% | 29.2\% | 19.8\% | 14.9\% | 49.6\% | 30.4\% | 19.4\% | 14.0\% | 46.9\% | 27.8\% | 19.5\% | 14.9\% | 41.0\% | 26.5\% | 18.3\% | 14.6\% |
| BHAR (1) |  | 60.4\% | 29.3\% | 19.9\% | 14.9\% | 49.4\% | 30.5\% | 19.3\% | 14.0\% | 47.3\% | 27.8\% | 19.5\% | 14.9\% | 41.3\% | 26.6\% | 18.3\% | 14.6\% |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.4\% | 29.4\% | 19.1\% | 14.7\% | 50.1\% | 29.5\% | 19.3\% | 14.3\% | 42.9\% | 25.6\% | 18.8\% | 13.8\% | 41.6\% | $24.2 \%$ | 17.4\% | 13.7\% |
| CAR (1) |  | 58.5\% | 29.3\% | 19.1\% | 14.7\% | 50.2\% | 29.6\% | 19.2\% | 14.2\% | 42.9\% | 25.5\% | 18.7\% | 13.7\% | 41.7\% | 24.1\% | 17.3\% | 13.6\% |
| BHAR (0) |  | 60.0\% | 30.3\% | 19.3\% | 13.1\% | 49.6\% | 29.7\% | 20.0\% | 13.9\% | 46.0\% | 26.5\% | 17.6\% | 14.7\% | 45.6\% | 24.6\% | 16.5\% | 14.2\% |
| BHAR (1) |  | 60.0\% | 30.3\% | 19.3\% | 13.4\% | 49.9\% | 29.8\% | 20.1\% | 14.1\% | 45.9\% | 25.9\% | 16.9\% | 14.7\% | 45.4\% | 24.8\% | 16.6\% | 14.2\% |


| MW | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.7\% | 30.8\% | 20.5\% | 15.4\% | 52.6\% | 30.5\% | 20.4\% | 15.4\% | 46.4\% | 27.8\% | 20.0\% | 15.1\% | 42.6\% | 26.1\% | 18.9\% | 14.8\% |
| CAR (1) |  | 60.7\% | 30.8\% | 20.5\% | 15.4\% | 52.8\% | 30.5\% | 20.4\% | 15.4\% | 46.4\% | 27.8\% | 20.0\% | 15.0\% | 43.2\% | 26.3\% | 18.9\% | 14.8\% |
| BHAR (0) |  | 60.4\% | 28.7\% | 21.0\% | 13.7\% | 52.9\% | 31.4\% | 20.4\% | 15.5\% | 43.6\% | 26.4\% | 19.3\% | 14.8\% | 43.5\% | 27.3\% | 19.8\% | 14.8\% |
| BHAR (1) |  | 60.5\% | 28.7\% | 21.0\% | 13.7\% | 53.1\% | 31.3\% | 20.6\% | 15.6\% | 43.7\% | 26.6\% | 19.3\% | 14.7\% | 44.3\% | 27.9\% | 19.8\% | 14.8\% |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 61.7\% | 30.7\% | 20.7\% | 15.4\% | 53.8\% | 31.1\% | 20.9\% | 15.4\% | 49.6\% | 28.9\% | 20.6\% | 15.4\% | 46.7\% | 27.0\% | 19.3\% | 15.1\% |
| CAR (1) |  | 61.8\% | 30.7\% | 20.8\% | 15.4\% | 53.7\% | 31.2\% | 20.9\% | 15.3\% | 49.6\% | 28.9\% | 20.5\% | 15.3\% | 46.9\% | 27.1\% | 19.3\% | 15.1\% |
| BHAR (0) |  | 61.7\% | 30.8\% | 20.1\% | 14.5\% | 54.1\% | 31.3\% | 20.8\% | 15.3\% | 51.1\% | 28.3\% | 20.0\% | 15.4\% | 46.4\% | 27.0\% | 19.0\% | 15.1\% |
| BHAR (1) |  | 61.8\% | 30.8\% | 20.1\% | 14.5\% | 53.9\% | 31.3\% | 20.8\% | 15.5\% | 51.2\% | 28.3\% | 20.1\% | 15.5\% | 46.6\% | 27.1\% | 19.0\% | 15.1\% |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 62.2\% | 30.7\% | 20.8\% | 15.6\% | 53.6\% | 31.1\% | 20.8\% | 15.6\% | 48.9\% | 28.8\% | 20.7\% | 15.4\% | 45.4\% | 26.8\% | 19.6\% | 15.4\% |
| CAR (1) |  | 62.4\% | 30.7\% | 20.8\% | 15.6\% | 54.0\% | 31.2\% | 20.7\% | 15.5\% | 49.6\% | 29.0\% | 20.7\% | 15.4\% | 45.8\% | 27.1\% | 19.6\% | 15.4\% |
| BHAR (0) |  | 62.5\% | 30.1\% | 20.8\% | 14.9\% | 53.8\% | 31.4\% | 20.6\% | 14.9\% | 48.2\% | 28.3\% | 20.4\% | 15.6\% | 46.5\% | 27.1\% | 19.4\% | 16.0\% |
| BHAR (1) |  | 62.8\% | 30.1\% | 20.8\% | 14.8\% | 54.1\% | 31.5\% | 20.6\% | 15.1\% | 48.8\% | 28.4\% | 20.5\% | 15.5\% | 47.1\% | 27.3\% | 19.4\% | 16.0\% |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 61.6\% | 30.7\% | 20.5\% | 15.4\% | 53.0\% | 31.0\% | 20.6\% | 15.4\% | 47.7\% | 28.5\% | 20.8\% | 15.4\% | 43.8\% | 26.4\% | 19.4\% | 15.4\% |
| CAR (1) |  | 61.8\% | 30.7\% | 20.5\% | 15.4\% | 53.4\% | 31.1\% | 20.6\% | 15.4\% | 48.1\% | 28.6\% | 20.7\% | 15.4\% | 44.1\% | 26.6\% | 19.4\% | 15.4\% |
| BHAR (0) |  | 61.8\% | 29.7\% | 20.2\% | 14.9\% | 53.0\% | 30.6\% | 20.6\% | 15.1\% | 47.9\% | 28.0\% | 20.1\% | 15.3\% | 43.8\% | 25.6\% | 19.2\% | 15.8\% |
| BHAR (1) |  | 62.1\% | 29.8\% | 20.3\% | 14.8\% | 53.2\% | 30.7\% | 20.6\% | 15.2\% | 48.2\% | 28.2\% | 20.2\% | 15.3\% | 44.3\% | 25.7\% | 19.3\% | 15.8\% |


| IVOL $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 59.8\% | 29.7\% | 20.0\% | 14.9\% | 48.6\% | 29.7\% | 19.9\% | 14.9\% | 42.3\% | 26.8\% | 19.9\% | 15.0\% | 38.7\% | 25.1\% | 18.8\% | 15.0\% |
| CAR (1) | 60.3\% | 29.9\% | 20.1\% | 15.0\% | 49.3\% | 29.8\% | 20.0\% | 15.0\% | 42.7\% | 26.9\% | 20.0\% | 15.0\% | 38.9\% | 25.1\% | 18.8\% | 15.0\% |
| BHAR (0) | 60.1\% | 29.3\% | 20.1\% | 14.7\% | 49.4\% | 30.1\% | 20.2\% | 14.4\% | 43.1\% | 27.1\% | 19.4\% | 14.7\% | 39.3\% | 25.1\% | 18.6\% | 15.3\% |
| BHAR (1) | 60.5\% | 29.8\% | 20.1\% | 14.7\% | 49.3\% | 30.1\% | 20.1\% | 14.6\% | 43.1\% | 27.3\% | 19.5\% | 14.8\% | 39.6\% | 25.2\% | 18.6\% | 15.3\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.8\% | 29.0\% | 19.3\% | 14.3\% | 48.8\% | 29.0\% | 18.9\% | 14.2\% | 40.2\% | 25.0\% | 18.6\% | 14.1\% | 35.0\% | 22.8\% | 17.3\% | 14.1\% |
| CAR (1) | 58.4\% | 29.2\% | 19.4\% | 14.3\% | 49.0\% | 29.1\% | 19.0\% | 14.2\% | 40.5\% | 25.1\% | 18.7\% | 14.0\% | 35.3\% | 23.0\% | 17.3\% | 14.1\% |
| BHAR (0) | 57.3\% | 29.0\% | 19.1\% | 15.0\% | 50.0\% | 29.4\% | 18.8\% | 14.2\% | 40.9\% | 24.9\% | 18.5\% | 14.6\% | 34.4\% | 22.9\% | 17.3\% | 14.8\% |
| BHAR (1) | 58.0\% | 29.9\% | 19.0\% | 15.0\% | 50.3\% | 29.6\% | 18.8\% | 14.0\% | 41.0\% | 24.9\% | 18.6\% | 14.5\% | 34.7\% | 23.0\% | 17.3\% | 14.8\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 59.6\% | 29.5\% | 19.7\% | 14.8\% | 46.7\% | 28.7\% | 19.1\% | 14.4\% | 40.5\% | 25.2\% | 19.0\% | 14.3\% | 37.6\% | 23.3\% | 17.7\% | 14.3\% |
| CAR (1) | 59.9\% | 29.6\% | 19.7\% | 14.8\% | 47.2\% | 28.8\% | 19.2\% | 14.4\% | 40.8\% | 25.3\% | 19.0\% | 14.3\% | 37.9\% | 23.4\% | 17.7\% | 14.3\% |
| BHAR (0) | 59.1\% | 29.7\% | 20.2\% | 15.0\% | 47.7\% | 29.1\% | 19.3\% | 14.7\% | 42.7\% | 25.7\% | 18.4\% | 14.6\% | 38.1\% | 23.0\% | 17.5\% | 14.3\% |
| BHAR (1) | 59.4\% | 29.6\% | 20.2\% | 15.3\% | 48.2\% | 29.3\% | 19.5\% | 14.8\% | 42.9\% | 25.9\% | 18.5\% | 14.6\% | 37.5\% | 22.7\% | 17.5\% | 14.3\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.6\% | 28.9\% | 19.3\% | 14.4\% | 46.9\% | 29.0\% | 19.3\% | 14.5\% | 40.2\% | 25.8\% | 19.4\% | 14.6\% | 36.5\% | 23.8\% | 18.1\% | 14.6\% |
| CAR (1) | 57.9\% | 29.1\% | 19.4\% | 14.5\% | 47.2\% | 29.1\% | 19.4\% | 14.5\% | 40.6\% | 25.9\% | 19.4\% | 14.6\% | 36.7\% | 23.9\% | 18.0\% | 14.6\% |
| BHAR (0) | 58.0\% | 28.8\% | 19.1\% | 14.7\% | 47.6\% | 29.6\% | 19.4\% | 14.6\% | 41.5\% | 26.0\% | 18.8\% | 14.6\% | 36.5\% | 23.6\% | 17.9\% | 15.0\% |
| BHAR (1) | 58.2\% | 29.1\% | 19.2\% | 14.7\% | 47.8\% | 29.7\% | 19.4\% | 14.7\% | 41.7\% | 26.2\% | 18.8\% | 14.6\% | 36.7\% | 23.7\% | 17.9\% | 15.0\% |



| IVOL | J = | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.3\% | 28.8\% | 19.3\% | 14.5\% | 47.2\% | 27.8\% | 18.5\% | 14.0\% | 41.2\% | 24.5\% | 17.9\% | 13.3\% | 37.2\% | 22.9\% | 16.7\% | 13.0\% |
| CAR (1) |  | 58.5\% | 29.0\% | 19.3\% | 14.5\% | 47.4\% | 27.8\% | 18.4\% | 13.9\% | 41.3\% | 24.6\% | 17.8\% | 13.3\% | 37.4\% | 22.9\% | 16.7\% | 13.0\% |
| BHAR (0) |  | 58.8\% | 28.1\% | 19.1\% | 13.0\% | 46.8\% | 27.2\% | 17.2\% | 14.2\% | 43.4\% | 23.6\% | 18.9\% | 13.8\% | 36.3\% | 21.9\% | 17.4\% | 13.6\% |
| BHAR (1) |  | 58.9\% | 28.1\% | 19.1\% | 12.9\% | 46.5\% | 27.2\% | 16.9\% | 14.3\% | 43.5\% | 23.7\% | 18.5\% | 13.8\% | 36.7\% | 21.8\% | 17.4\% | 13.5\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.2\% | 30.0\% | 20.1\% | 15.3\% | 49.9\% | 29.9\% | 20.2\% | 15.2\% | 43.3\% | 27.1\% | 20.0\% | 15.1\% | 40.8\% | 26.0\% | 19.2\% | 15.0\% |
| CAR (1) |  | 60.4\% | 30.2\% | 20.2\% | 15.3\% | 50.1\% | 30.0\% | 20.3\% | 15.2\% | 43.3\% | 27.2\% | 20.0\% | 15.0\% | 40.9\% | 26.2\% | 19.2\% | 15.1\% |
| BHAR (0) |  | 60.2\% | 29.1\% | 19.9\% | 15.1\% | 49.1\% | 29.9\% | 20.3\% | 15.1\% | 43.8\% | 26.8\% | 19.5\% | 15.2\% | 40.9\% | 24.9\% | 18.3\% | 14.7\% |
| BHAR (1) |  | 60.4\% | 29.5\% | 20.1\% | 15.1\% | 49.5\% | 30.0\% | 20.4\% | 15.2\% | 44.0\% | 26.9\% | 19.6\% | 15.3\% | 41.2\% | 25.1\% | 18.4\% | 14.7\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.3\% | 28.4\% | 19.1\% | 14.3\% | 45.0\% | 27.5\% | 18.6\% | 13.8\% | 40.8\% | 24.8\% | 18.1\% | 13.7\% | 36.4\% | 23.0\% | 17.1\% | 13.6\% |
| CAR (1) |  | 56.7\% | 28.6\% | 19.1\% | 14.2\% | 45.1\% | 27.5\% | 18.7\% | 13.9\% | 41.2\% | 24.9\% | 18.0\% | 13.7\% | 36.8\% | 23.1\% | 17.0\% | 13.5\% |
| BHAR (0) |  | 55.8\% | 28.7\% | 19.4\% | 14.0\% | 46.2\% | 28.5\% | 19.5\% | 13.8\% | 39.4\% | 24.7\% | 17.4\% | 14.6\% | 35.3\% | 21.3\% | 18.6\% | 14.6\% |
| BHAR (1) |  | 56.7\% | 28.9\% | 19.5\% | 14.1\% | 47.2\% | 28.8\% | 19.6\% | 14.0\% | 38.9\% | 24.7\% | 17.4\% | 14.5\% | 35.2\% | 21.4\% | 18.5\% | 14.6\% |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.9\% | 30.4\% | 20.3\% | 15.3\% | 50.4\% | 30.1\% | 20.4\% | 15.4\% | 43.8\% | 27.2\% | 19.9\% | 14.9\% | 41.2\% | 26.1\% | 19.1\% | 15.0\% |
| CAR (1) |  | 61.4\% | 30.6\% | 20.5\% | 15.4\% | 51.2\% | 30.3\% | 20.5\% | 15.4\% | 44.5\% | 27.4\% | 19.9\% | 14.8\% | 41.9\% | 26.3\% | 19.1\% | 15.0\% |
| BHAR (0) |  | 61.2\% | 30.4\% | 20.0\% | 15.5\% | 49.9\% | 29.7\% | 20.3\% | 15.2\% | 43.5\% | 27.0\% | 20.2\% | 14.7\% | 40.7\% | 25.3\% | 19.0\% | 15.1\% |
| BHAR (1) |  | 61.4\% | 30.6\% | 20.3\% | 15.5\% | 50.2\% | 29.8\% | 20.4\% | 15.3\% | 44.1\% | 27.3\% | 20.2\% | 14.7\% | 41.2\% | 25.4\% | 19.0\% | 15.2\% |


| IVOL $\mathrm{J}=$ |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=3$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.7\% | 29.1\% | 19.5\% | 14.4\% | 49.3\% | 28.9\% | 19.5\% | 14.4\% | 44.3\% | 26.6\% | 19.2\% | 14.3\% | 39.9\% | 24.6\% | 17.9\% | $14.2 \%$ |
| CAR (1) | 57.6\% | 29.2\% | 19.4\% | 14.4\% | 49.3\% | 28.9\% | 19.5\% | 14.5\% | 44.3\% | 26.6\% | 19.2\% | 14.3\% | 40.1\% | 24.6\% | 17.9\% | 14.3\% |
| BHAR (0) | 59.3\% | 29.3\% | 19.6\% | 14.2\% | 49.8\% | 28.6\% | 19.9\% | 13.7\% | 46.2\% | 27.6\% | 19.0\% | 15.0\% | 40.4\% | 25.7\% | 17.3\% | 15.5\% |
| BHAR (1) | 58.5\% | 29.4\% | 19.7\% | 14.2\% | 48.8\% | 28.0\% | 19.9\% | 13.0\% | 46.0\% | 27.7\% | 19.0\% | 15.0\% | 40.4\% | 25.8\% | 16.9\% | 15.5\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 60.5\% | 30.7\% | 20.2\% | 15.0\% | 52.9\% | 30.9\% | 20.3\% | 14.9\% | 46.7\% | 28.1\% | 20.1\% | 14.9\% | 42.9\% | 26.0\% | 19.0\% | 15.0\% |
| CAR (1) | 60.6\% | 30.8\% | 20.2\% | 15.0\% | 53.0\% | 30.9\% | 20.3\% | 14.9\% | 46.8\% | 28.1\% | 20.1\% | 14.9\% | 43.0\% | 26.0\% | 19.0\% | 15.0\% |
| BHAR (0) | 60.6\% | 29.7\% | 19.8\% | 15.2\% | 52.3\% | $30.7 \%$ | 19.8\% | 15.7\% | 46.9\% | 27.7\% | 19.3\% | 15.5\% | 42.5\% | 26.1\% | 18.9\% | 15.5\% |
| BHAR (1) | 60.7\% | 29.8\% | 19.8\% | 15.2\% | 52.3\% | 30.7\% | 19.8\% | 15.8\% | 46.9\% | 27.8\% | 19.4\% | 15.5\% | 42.6\% | 26.1\% | 18.9\% | 15.5\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.9\% | 29.9\% | 20.0\% | 14.8\% | 49.3\% | 29.9\% | 19.6\% | 14.7\% | 42.0\% | 26.5\% | 19.5\% | 14.6\% | 37.5\% | 24.1\% | 18.0\% | 14.4\% |
| CAR (1) | 59.3\% | 30.1\% | 20.0\% | 14.9\% | 49.6\% | 29.9\% | 19.6\% | 14.7\% | 42.3\% | 26.6\% | 19.5\% | 14.6\% | 37.7\% | 24.2\% | 18.0\% | 14.4\% |
| BHAR (0) | 58.3\% | 29.6\% | 19.6\% | 14.7\% | 49.2\% | 30.8\% | 19.7\% | 14.6\% | 42.7\% | 26.2\% | 19.0\% | 14.3\% | 36.9\% | 23.3\% | 17.7\% | 14.8\% |
| BHAR (1) | 58.6\% | 29.8\% | 19.6\% | 14.9\% | 49.1\% | 30.8\% | 19.8\% | 14.6\% | 43.0\% | 26.3\% | 19.2\% | 14.4\% | 37.0\% | 23.4\% | 17.6\% | 14.8\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.9\% | 28.9\% | 19.5\% | 14.6\% | 45.6\% | 28.5\% | 19.2\% | 14.4\% | 41.4\% | 25.5\% | 19.1\% | 14.5\% | 36.5\% | 23.5\% | 17.7\% | 14.2\% |
| CAR (1) | 58.2\% | 28.9\% | 19.6\% | 14.6\% | 45.7\% | 28.5\% | 19.2\% | 14.5\% | 41.5\% | 25.5\% | 19.1\% | 14.5\% | 36.7\% | 23.5\% | 17.7\% | 14.2\% |
| BHAR (0) | 58.0\% | 28.1\% | 19.6\% | 14.7\% | 44.9\% | 28.5\% | 19.9\% | 13.6\% | 40.3\% | 25.2\% | 18.7\% | 14.0\% | 36.6\% | 23.7\% | 18.0\% | 14.7\% |
| BHAR (1) | 58.4\% | 28.4\% | 19.7\% | 14.7\% | 45.1\% | 28.5\% | 19.9\% | 13.8\% | 40.6\% | 25.2\% | 18.6\% | 14.0\% | 36.7\% | 23.8\% | 18.0\% | 14.7\% |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.4\% | 29.9\% | 19.9\% | 14.9\% | 50.0\% | 29.7\% | 19.8\% | 14.9\% | 43.4\% | 26.6\% | 19.4\% | 14.5\% | 40.3\% | 25.4\% | 18.9\% | 14.7\% |
| CAR (1) |  | 59.6\% | 29.9\% | 19.9\% | 14.9\% | 50.1\% | 29.8\% | 19.9\% | 14.9\% | 43.5\% | 26.7\% | 19.4\% | 14.5\% | 40.4\% | 25.4\% | 18.8\% | 14.7\% |
| BHAR (0) |  | 58.2\% | 28.8\% | 20.3\% | 14.4\% | 51.1\% | 29.9\% | 20.2\% | 14.9\% | 43.3\% | 25.4\% | 18.7\% | 14.5\% | 39.8\% | 25.4\% | 18.8\% | 14.5\% |
| BHAR (1) |  | 58.5\% | 28.8\% | 20.4\% | 14.4\% | 51.1\% | 29.9\% | 20.2\% | 14.9\% | 43.1\% | 25.6\% | 18.7\% | 14.6\% | 39.8\% | 25.3\% | 18.8\% | 14.5\% |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.1\% | 28.9\% | 19.6\% | 15.1\% | 47.2\% | 28.8\% | 19.2\% | 14.6\% | 40.0\% | 25.4\% | 19.3\% | 14.5\% | 37.5\% | 23.5\% | 17.9\% | 14.6\% |
| CAR (1) |  | 59.7\% | 28.9\% | 19.7\% | 15.2\% | 47.6\% | 29.0\% | 19.3\% | 14.6\% | 40.2\% | 25.6\% | 19.3\% | 14.5\% | 37.5\% | 23.6\% | 17.8\% | 14.5\% |
| BHAR (0) |  | 59.1\% | 28.7\% | 19.1\% | 14.3\% | 46.2\% | 28.5\% | 19.6\% | 13.8\% | 39.5\% | 24.8\% | 18.5\% | 14.2\% | 37.7\% | 23.7\% | 16.9\% | 15.0\% |
| BHAR (1) |  | 58.8\% | 28.6\% | 20.1\% | 14.5\% | 46.4\% | 28.5\% | 19.9\% | 13.9\% | 40.3\% | 24.9\% | 18.6\% | 14.3\% | 37.9\% | 23.9\% | 17.2\% | 15.0\% |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.3\% | 28.7\% | 19.4\% | 14.6\% | 47.3\% | 27.8\% | 18.6\% | 14.1\% | 42.1\% | 25.7\% | 18.8\% | 14.1\% | 38.3\% | 24.5\% | 17.8\% | 14.0\% |
| CAR (1) |  | 58.5\% | 28.8\% | 19.3\% | 14.5\% | 47.4\% | 27.8\% | 18.7\% | 14.1\% | 42.3\% | 25.7\% | 18.8\% | 14.1\% | 38.6\% | 24.6\% | 17.8\% | 14.0\% |
| BHAR (0) |  | 58.2\% | 29.0\% | 19.5\% | 14.5\% | 47.4\% | 29.2\% | 18.5\% | 14.2\% | 43.8\% | 26.2\% | 18.9\% | 14.5\% | 37.4\% | 24.7\% | 17.2\% | 14.3\% |
| BHAR (1) |  | 58.6\% | 29.7\% | 19.7\% | 14.5\% | 47.1\% | 29.2\% | 18.5\% | 14.2\% | 43.9\% | 26.3\% | 18.9\% | 14.5\% | 37.6\% | 24.7\% | 17.2\% | 14.3\% |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.3\% | 28.6\% | 18.9\% | 14.2\% | 47.5\% | 28.2\% | 18.4\% | 13.6\% | 38.6\% | 24.3\% | 18.0\% | 13.3\% | 35.7\% | 22.1\% | 16.6\% | 13.1\% |
| CAR (1) |  | 57.5\% | 28.7\% | 19.1\% | 14.3\% | 48.1\% | 28.4\% | 18.4\% | 13.6\% | 38.8\% | 24.3\% | 18.0\% | 13.3\% | 35.8\% | 22.1\% | 16.5\% | 13.1\% |
| BHAR (0) |  | 59.1\% | 29.4\% | 19.7\% | 13.7\% | 46.8\% | 28.6\% | 19.5\% | 13.3\% | 39.1\% | 25.0\% | 17.0\% | 14.6\% | 36.8\% | 21.8\% | 15.6\% | 13.5\% |
| BHAR (1) |  | 59.2\% | 29.4\% | 19.7\% | 14.2\% | 47.2\% | 28.7\% | 19.6\% | 13.5\% | 39.2\% | 24.9\% | 16.6\% | 14.6\% | 36.9\% | 21.8\% | 15.6\% | 13.5\% |


| IVOL $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.3\% | 29.2\% | 19.8\% | 14.9\% | 49.3\% | 29.3\% | 19.7\% | 14.7\% | 43.0\% | 26.4\% | 19.3\% | 14.5\% | 38.3\% | 24.2\% | 17.7\% | 14.1\% |
| CAR (1) | 58.5\% | 29.4\% | 19.9\% | 14.9\% | 49.4\% | 29.4\% | 19.8\% | 14.7\% | 43.2\% | 26.4\% | 19.3\% | 14.5\% | 38.5\% | 24.3\% | 17.8\% | 14.1\% |
| BHAR (0) | 57.9\% | 28.5\% | 20.0\% | 14.4\% | 48.7\% | 30.2\% | 19.8\% | 14.7\% | 40.9\% | 24.8\% | 17.7\% | 13.9\% | 38.3\% | 24.9\% | 18.4\% | 14.3\% |
| BHAR (1) | 58.0\% | 28.7\% | 20.0\% | 14.5\% | 49.0\% | 30.3\% | 19.8\% | 14.8\% | 41.5\% | 25.1\% | 17.7\% | 13.9\% | 38.5\% | 25.3\% | 18.5\% | 14.3\% |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 59.2\% | 29.7\% | 20.0\% | 14.9\% | 49.7\% | 29.8\% | 19.9\% | 14.9\% | 44.6\% | 26.9\% | 19.7\% | 14.8\% | 39.5\% | 24.7\% | 18.2\% | 14.6\% |
| CAR (1) | 59.5\% | 29.8\% | 20.0\% | 14.9\% | 49.3\% | 29.8\% | 19.9\% | 14.8\% | 44.8\% | 26.9\% | 19.7\% | 14.8\% | 39.7\% | 24.8\% | 18.2\% | 14.6\% |
| BHAR (0) | 59.0\% | 29.7\% | 19.8\% | 14.7\% | 50.0\% | 30.1\% | 19.7\% | 14.8\% | 45.7\% | 26.8\% | 19.0\% | 15.0\% | 38.9\% | 24.2\% | 17.5\% | 14.5\% |
| BHAR (1) | 59.3\% | 29.8\% | 19.8\% | 14.6\% | 49.4\% | 30.2\% | 19.4\% | 15.0\% | 46.0\% | 26.9\% | 19.0\% | 15.0\% | 39.2\% | 24.2\% | 17.5\% | 14.5\% |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.3\% | 29.3\% | 19.8\% | 14.8\% | 46.8\% | 29.1\% | 19.7\% | 14.7\% | 41.2\% | 26.0\% | 19.5\% | 14.6\% | 36.4\% | 23.9\% | 18.1\% | 14.5\% |
| CAR (1) | 58.9\% | 29.5\% | 19.9\% | 14.9\% | 47.3\% | 29.2\% | 19.7\% | 14.8\% | 41.7\% | 26.2\% | 19.5\% | 14.7\% | 36.8\% | 24.0\% | 18.0\% | 14.5\% |
| BHAR (0) | 58.5\% | 29.1\% | 19.8\% | 14.7\% | 47.2\% | 29.2\% | 19.8\% | 14.5\% | 41.4\% | 25.8\% | 19.0\% | 14.7\% | 36.7\% | 23.8\% | 17.9\% | 15.0\% |
| BHAR (1) | 59.1\% | 29.2\% | 19.9\% | 14.7\% | 47.5\% | 29.4\% | 19.8\% | 14.6\% | 42.2\% | 26.3\% | 19.2\% | 14.8\% | 37.0\% | 23.8\% | 17.9\% | 15.1\% |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 59.5\% | 29.6\% | 19.8\% | 14.8\% | 49.3\% | 29.9\% | 19.8\% | 14.8\% | 42.7\% | 26.6\% | 19.8\% | 14.7\% | 39.0\% | 24.5\% | 18.3\% | 14.8\% |
| CAR (1) | 59.6\% | 29.7\% | 19.8\% | 14.8\% | 49.5\% | 30.0\% | 19.8\% | 14.8\% | 42.9\% | 26.7\% | 19.8\% | 14.7\% | 39.2\% | 24.5\% | 18.3\% | 14.7\% |
| BHAR (0) | 59.6\% | 28.9\% | 19.3\% | 14.5\% | 49.2\% | 29.8\% | 19.7\% | 14.6\% | 42.9\% | 26.3\% | 19.1\% | 14.6\% | 39.3\% | 24.0\% | 18.0\% | 15.2\% |
| BHAR (1) | 59.6\% | 28.9\% | 19.3\% | 14.5\% | 49.1\% | 29.8\% | 19.7\% | 14.7\% | 43.1\% | 26.5\% | 19.1\% | 14.6\% | 39.5\% | 24.0\% | 18.0\% | 15.2\% |

Table 7.8a. Turnover ratios for cross-sectional winner portfolio

| EW | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 54.4\% | 28.0\% | 19.1\% | 14.5\% | 38.1\% | 27.5\% | 18.9\% | 14.4\% | 31.4\% | 22.5\% | 18.6\% | 14.3\% | 27.4\% | 20.0\% | 16.4\% | 14.1\% |
| CAR (1) |  | 54.9\% | 28.2\% | 19.2\% | 14.6\% | 38.4\% | 27.7\% | 19.0\% | 14.5\% | 31.7\% | 22.7\% | 18.7\% | 14.3\% | 27.5\% | 20.1\% | 16.5\% | 14.1\% |
| BHAR (0) |  | 54.6\% | 27.8\% | 19.0\% | 14.1\% | 37.8\% | 27.3\% | 19.0\% | 14.0\% | 31.4\% | 22.3\% | 18.3\% | 14.0\% | 27.4\% | 20.1\% | 16.4\% | 14.3\% |
| BHAR (1) |  | 55.0\% | 28.0\% | 19.1\% | 14.2\% | 38.1\% | 27.5\% | 19.1\% | 14.1\% | 31.6\% | 22.5\% | 18.4\% | 14.0\% | 27.5\% | 20.2\% | 16.5\% | 14.4\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 54.0\% | 28.2\% | 19.0\% | 14.5\% | 38.9\% | 27.7\% | 18.7\% | 14.5\% | $32.1 \%$ | 22.8\% | 18.6\% | 14.5\% | 27.7\% | 20.3\% | 16.6\% | 14.6\% |
| CAR (1) |  | 54.3\% | 28.5\% | 19.1\% | 14.5\% | 39.2\% | 27.9\% | 18.9\% | 14.5\% | 32.4\% | 23.0\% | 18.8\% | 14.6\% | 28.0\% | 20.5\% | 16.7\% | 14.7\% |
| BHAR (0) |  | 53.4\% | 28.8\% | 18.6\% | 14.2\% | 38.7\% | 28.0\% | 18.7\% | 13.8\% | 31.7\% | 22.1\% | 18.5\% | 14.4\% | 27.7\% | 19.9\% | 16.2\% | 15.1\% |
| BHAR (1) |  | 53.8\% | 29.2\% | 18.7\% | 14.3\% | 39.0\% | 28.4\% | 18.8\% | 14.1\% | 32.0\% | 22.3\% | 18.7\% | 14.5\% | 27.9\% | 20.3\% | 16.3\% | 15.3\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 54.0\% | 27.6\% | 18.8\% | 14.2\% | 38.0\% | 26.6\% | 18.1\% | 13.9\% | 31.1\% | 21.9\% | 17.8\% | 13.7\% | 26.6\% | 19.0\% | 15.5\% | 13.3\% |
| CAR (1) |  | 54.5\% | 27.8\% | 18.9\% | 14.3\% | 38.3\% | 26.8\% | 18.2\% | 14.0\% | 31.3\% | 22.0\% | 17.9\% | 13.7\% | 26.9\% | 19.1\% | 15.6\% | 13.4\% |
| BHAR (0) |  | 54.1\% | 27.6\% | 17.9\% | 13.4\% | 37.8\% | 26.6\% | 17.7\% | 13.4\% | 30.9\% | 21.2\% | 17.3\% | 13.2\% | 26.5\% | 19.0\% | 15.2\% | 14.0\% |
| BHAR (1) |  | 54.6\% | 27.9\% | 17.9\% | 13.5\% | 38.2\% | 26.8\% | 17.8\% | 13.6\% | 31.2\% | 21.5\% | 17.5\% | 13.2\% | 26.9\% | 19.1\% | 15.2\% | 14.1\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 53.7\% | 27.9\% | 18.8\% | 14.4\% | 37.6\% | 27.2\% | 18.6\% | 14.2\% | 30.6\% | 22.1\% | 18.2\% | 14.0\% | 26.3\% | 19.3\% | 15.9\% | 13.8\% |
| CAR (1) |  | 54.3\% | 28.2\% | 19.0\% | 14.5\% | 38.0\% | 27.4\% | 18.7\% | 14.3\% | 30.8\% | 22.2\% | 18.3\% | 14.1\% | 26.5\% | 19.4\% | 16.0\% | 13.9\% |
| BHAR (0) |  | 53.5\% | 27.6\% | 18.7\% | 13.8\% | 37.8\% | 27.3\% | 18.7\% | 13.9\% | 30.9\% | 21.8\% | 18.1\% | 14.0\% | 26.6\% | 19.4\% | 16.0\% | 14.0\% |
| BHAR (1) |  | 54.1\% | 28.0\% | 18.8\% | 13.9\% | 38.2\% | 27.5\% | 18.8\% | 14.1\% | 31.2\% | 22.1\% | 18.2\% | 14.1\% | 26.8\% | 19.5\% | 16.1\% | 14.2\% |



| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 55.2\% | 28.0\% | 19.2\% | 14.5\% | 38.9\% | 27.8\% | 18.8\% | 14.4\% | 32.5\% | 23.1\% | 18.9\% | 14.3\% | 28.6\% | 20.6\% | 16.7\% | 14.3\% |
| CAR (1) |  | 55.4\% | 28.0\% | 19.2\% | 14.5\% | 38.9\% | 27.9\% | 18.9\% | 14.4\% | 32.5\% | 23.2\% | 18.9\% | 14.3\% | 28.7\% | 20.7\% | 16.7\% | 14.3\% |
| BHAR (0) |  | 55.2\% | 27.7\% | 18.7\% | 14.1\% | 38.4\% | 27.7\% | 18.7\% | 14.3\% | 32.6\% | 22.8\% | 18.4\% | 14.3\% | 27.9\% | 20.3\% | 16.5\% | 14.8\% |
| BHAR (1) |  | 55.5\% | 27.9\% | 18.8\% | 14.0\% | 38.5\% | 27.8\% | 18.8\% | 14.4\% | 32.6\% | 22.9\% | 18.5\% | 14.4\% | 28.0\% | 20.3\% | 16.5\% | 14.8\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 54.3\% | 27.9\% | 19.0\% | 14.4\% | 38.0\% | 27.3\% | 18.7\% | 14.3\% | 31.2\% | 22.5\% | 18.6\% | 14.2\% | 27.6\% | 20.0\% | 16.5\% | 14.2\% |
| CAR (1) |  | 54.5\% | 27.9\% | 19.0\% | 14.4\% | 38.1\% | 27.4\% | 18.8\% | 14.3\% | 31.3\% | 22.6\% | 18.6\% | 14.2\% | 27.7\% | 20.0\% | 16.5\% | 14.2\% |
| BHAR (0) |  | 54.5\% | 27.5\% | 19.1\% | 13.9\% | 38.1\% | 27.2\% | 18.7\% | 14.0\% | 31.1\% | 22.2\% | 18.2\% | 14.3\% | 27.7\% | 19.6\% | 16.6\% | 14.3\% |
| BHAR (1) |  | 54.7\% | 27.7\% | 19.1\% | 13.9\% | 38.3\% | 27.2\% | 18.8\% | 14.1\% | 31.2\% | 22.4\% | 18.3\% | 14.3\% | 27.7\% | 19.7\% | 16.6\% | 14.3\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.2\% | 28.9\% | 20.1\% | 14.7\% | 40.6\% | 28.4\% | 19.4\% | 14.6\% | 33.6\% | 23.3\% | 18.8\% | 14.3\% | 29.2\% | 20.7\% | 16.7\% | 14.2\% |
| CAR (1) |  | 57.0\% | 29.3\% | 20.3\% | 14.9\% | 41.3\% | 28.8\% | 19.6\% | 14.7\% | 34.0\% | 23.6\% | 19.0\% | 14.4\% | 29.6\% | 20.9\% | 16.8\% | 14.3\% |
| BHAR (0) |  | 56.2\% | 29.2\% | 20.7\% | 13.9\% | 40.8\% | 28.2\% | 19.5\% | 13.2\% | 33.4\% | 22.5\% | 18.0\% | 14.1\% | 28.5\% | 20.8\% | 15.9\% | 14.8\% |
| BHAR (1) |  | 56.7\% | 29.8\% | 20.9\% | 14.1\% | 41.3\% | 28.3\% | 19.8\% | 13.7\% | 33.8\% | 23.1\% | 18.3\% | 14.2\% | 28.9\% | 21.1\% | 15.9\% | 14.9\% |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 55.7\% | 28.2\% | 19.0\% | 14.5\% | 39.6\% | 27.9\% | 18.9\% | 14.4\% | 32.8\% | 23.2\% | 18.8\% | 14.3\% | 29.0\% | 20.4\% | 16.5\% | 14.2\% |
| CAR (1) |  | 55.9\% | 28.3\% | 19.0\% | 14.5\% | 39.9\% | 28.0\% | 19.0\% | 14.4\% | 32.9\% | 23.3\% | 18.9\% | 14.3\% | 29.1\% | 20.5\% | 16.6\% | 14.2\% |
| BHAR (0) |  | 55.7\% | 27.8\% | 18.6\% | 14.1\% | 39.5\% | 27.9\% | 18.9\% | 13.9\% | 32.6\% | 22.5\% | 18.5\% | 14.1\% | 28.8\% | 20.3\% | 16.4\% | 14.3\% |
| BHAR (1) |  | 56.1\% | 28.1\% | 18.7\% | 14.2\% | 39.8\% | 28.0\% | 19.0\% | 14.0\% | 32.8\% | 22.8\% | 18.6\% | 14.1\% | 29.0\% | 20.3\% | 16.5\% | 14.4\% |


| EW J = |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=3$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 54.9\% | 28.2\% | 19.2\% | 14.7\% | 38.7\% | 27.7\% | 18.9\% | 14.6\% | 31.4\% | 22.7\% | 18.6\% | 14.3\% | 27.3\% | 20.0\% | 16.4\% | 14.1\% |
| CAR (1) | 55.3\% | 28.4\% | 19.3\% | 14.7\% | 39.1\% | 27.9\% | 19.1\% | 14.7\% | 31.7\% | 22.9\% | 18.7\% | 14.4\% | 27.6\% | 20.2\% | 16.5\% | $14.1 \%$ |
| BHAR (0) | 54.7\% | 27.8\% | 19.1\% | 13.9\% | 38.8\% | 27.6\% | 18.8\% | 14.3\% | $32.1 \%$ | 22.7\% | 18.6\% | 14.1\% | 27.8\% | 20.1\% | 16.6\% | 14.4\% |
| BHAR (1) | 55.2\% | 28.2\% | 19.3\% | 14.0\% | 39.2\% | 27.8\% | 18.9\% | 14.4\% | $32.4 \%$ | 23.0\% | 18.7\% | 14.2\% | 28.1\% | 20.3\% | 16.7\% | 14.5\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 54.5\% | 27.7\% | 18.4\% | 13.8\% | 39.0\% | 27.6\% | 18.4\% | 13.8\% | $32.1 \%$ | 22.6\% | 18.4\% | 13.8\% | 27.9\% | 19.9\% | 16.1\% | 13.8\% |
| CAR (1) | 54.7\% | 27.8\% | 18.5\% | 13.8\% | 39.1\% | 27.7\% | 18.4\% | 13.8\% | 32.2\% | 22.7\% | 18.4\% | 13.8\% | 28.0\% | 19.9\% | 16.1\% | 13.8\% |
| BHAR (0) | 54.3\% | 27.2\% | 18.1\% | 13.8\% | 38.8\% | 27.7\% | 18.0\% | 13.5\% | 31.9\% | $22.4 \%$ | 17.7\% | 13.8\% | 27.8\% | 19.9\% | 15.7\% | $14.2 \%$ |
| BHAR (1) | 54.4\% | 27.3\% | 18.1\% | 13.8\% | 38.9\% | 27.7\% | 18.1\% | 13.6\% | 32.0\% | 22.6\% | 17.8\% | 13.8\% | 27.9\% | 19.9\% | 15.7\% | 14.2\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 54.9\% | 28.3\% | 19.3\% | 14.4\% | 39.0\% | 27.6\% | 18.9\% | 14.3\% | $32.1 \%$ | 22.7\% | 18.6\% | 14.1\% | 27.3\% | 19.8\% | 16.1\% | 13.7\% |
| CAR (1) | 55.6\% | 28.7\% | 19.4\% | 14.5\% | 39.5\% | 27.9\% | 19.1\% | 14.4\% | 32.5\% | 22.9\% | 18.7\% | 14.2\% | 27.7\% | 20.0\% | 16.2\% | 13.8\% |
| BHAR (0) | 54.4\% | 28.1\% | 18.7\% | 13.9\% | 38.8\% | 27.9\% | 19.0\% | 13.2\% | 31.4\% | 22.3\% | 18.1\% | 13.8\% | 27.3\% | 19.7\% | 15.7\% | 14.2\% |
| BHAR (1) | 54.8\% | 28.4\% | 18.8\% | 14.0\% | 39.2\% | 28.2\% | 19.1\% | 13.4\% | 31.6\% | 22.6\% | 18.2\% | 13.9\% | 27.6\% | 19.8\% | 15.8\% | 14.2\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 54.5\% | 28.1\% | 19.5\% | 14.8\% | 38.1\% | 27.1\% | 18.8\% | 14.6\% | 31.3\% | 22.7\% | 18.6\% | 14.5\% | 27.7\% | 20.2\% | 16.6\% | 14.2\% |
| CAR (1) | 55.4\% | 28.4\% | 19.7\% | 14.9\% | 38.6\% | 27.3\% | 19.0\% | 14.7\% | 31.6\% | 23.0\% | 18.7\% | 14.6\% | 28.0\% | 20.4\% | 16.7\% | 14.3\% |
| BHAR (0) | 54.2\% | 27.5\% | 18.9\% | 14.8\% | 37.6\% | 26.8\% | 18.6\% | 14.5\% | 30.3\% | 22.0\% | 18.2\% | 14.0\% | 27.6\% | 19.8\% | 16.3\% | 13.8\% |
| BHAR (1) | 54.9\% | 27.9\% | 18.9\% | 14.9\% | 38.1\% | 27.0\% | 18.8\% | 14.8\% | 30.7\% | $22.4 \%$ | 18.3\% | 14.1\% | 27.9\% | 19.8\% | 16.4\% | 13.8\% |


| EW J = | $\mathrm{J}=$ | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 55.6\% | 28.5\% | 19.5\% | 15.1\% | 39.9\% | 27.7\% | 18.8\% | 14.8\% | 33.1\% | 23.2\% | 18.8\% | 14.6\% | 29.3\% | 20.9\% | 16.9\% | 14.4\% |
| CAR (1) | 56.3\% | 28.8\% | 19.8\% | 15.2\% | 40.4\% | 28.0\% | 19.0\% | 14.9\% | 33.5\% | 23.5\% | 19.0\% | 14.8\% | 29.6\% | 21.2\% | 17.0\% | 14.5\% |
| BHAR (0) | 56.0\% | 28.3\% | 18.9\% | 14.2\% | 39.4\% | 27.4\% | 18.7\% | 14.3\% | 33.0\% | 22.5\% | 18.3\% | 14.2\% | 29.4\% | 20.9\% | 16.6\% | 14.7\% |
| BHAR (1) | 56.9\% | 28.7\% | 19.1\% | 14.3\% | 39.9\% | 27.7\% | 18.9\% | 14.5\% | 33.3\% | 22.9\% | 18.5\% | 14.3\% | 29.7\% | 21.2\% | 16.7\% | 14.8\% |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 55.5\% | 28.2\% | 19.4\% | 14.8\% | 39.2\% | 28.6\% | 19.6\% | 14.9\% | 32.8\% | 23.6\% | 19.4\% | 14.9\% | 29.2\% | 20.5\% | 16.8\% | 14.6\% |
| CAR (1) | 56.1\% | 28.5\% | 19.6\% | 14.8\% | 39.9\% | 28.9\% | 19.8\% | 15.0\% | 33.3\% | 23.9\% | 19.5\% | 15.0\% | 29.7\% | 20.8\% | 17.0\% | 14.8\% |
| BHAR (0) | 55.9\% | 27.8\% | 19.1\% | 14.4\% | 38.8\% | 28.3\% | 20.0\% | 14.3\% | 32.6\% | $23.4 \%$ | 19.9\% | 15.0\% | 29.2\% | 20.4\% | 16.6\% | 15.0\% |
| BHAR (1) | 56.5\% | 28.1\% | 19.1\% | 14.4\% | 39.7\% | 28.9\% | 19.9\% | 14.4\% | 33.4\% | 23.9\% | 20.2\% | 15.1\% | 29.8\% | 20.9\% | 16.7\% | 15.5\% |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 54.3\% | 27.8\% | 19.1\% | 14.5\% | 38.3\% | 27.5\% | 18.9\% | 14.4\% | 31.5\% | 22.8\% | 18.6\% | 14.3\% | 27.8\% | 20.2\% | 16.5\% | 14.0\% |
| CAR (1) | 54.7\% | 27.9\% | 19.2\% | 14.5\% | 38.5\% | 27.6\% | 18.9\% | 14.5\% | 31.7\% | 22.9\% | 18.7\% | 14.3\% | 28.0\% | 20.3\% | 16.5\% | 14.1\% |
| BHAR (0) | 54.3\% | 27.8\% | 18.7\% | 14.4\% | 38.2\% | 26.9\% | 18.6\% | 14.3\% | 31.4\% | 22.7\% | 18.2\% | 14.6\% | 28.1\% | 20.0\% | 16.4\% | 14.5\% |
| BHAR (1) | 54.6\% | 28.0\% | 18.8\% | 14.5\% | 38.4\% | 27.0\% | 18.8\% | 14.4\% | 31.5\% | 22.9\% | 18.2\% | 14.7\% | 28.2\% | 20.1\% | 16.4\% | 14.5\% |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 54.6\% | 28.0\% | 18.9\% | 14.3\% | 39.3\% | 27.5\% | 18.7\% | 14.1\% | 31.5\% | 22.5\% | 18.3\% | 13.9\% | 27.3\% | 19.6\% | 16.1\% | 13.8\% |
| CAR (1) | 54.9\% | 28.2\% | 19.1\% | 14.3\% | 39.7\% | 27.7\% | 18.8\% | 14.2\% | 31.7\% | 22.7\% | 18.4\% | 14.0\% | 27.5\% | 19.7\% | 16.1\% | 13.8\% |
| BHAR (0) | 55.6\% | 27.8\% | 18.9\% | 14.2\% | 39.4\% | 27.0\% | 18.3\% | 13.9\% | 30.9\% | 21.7\% | 18.0\% | 14.4\% | 27.1\% | 19.4\% | 16.2\% | 14.6\% |
| BHAR (1) | 56.0\% | 28.0\% | 19.0\% | 14.3\% | 39.6\% | 27.3\% | 18.4\% | 14.0\% | 31.3\% | 21.9\% | 18.1\% | 14.4\% | 27.4\% | 19.5\% | 16.3\% | 14.7\% |


| EW | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 55.6\% | 28.8\% | 20.1\% | 15.2\% | 39.8\% | 28.4\% | 19.6\% | 15.0\% | 32.9\% | 23.6\% | 19.1\% | 14.6\% | 28.3\% | 20.7\% | 16.8\% | 14.3\% |
| CAR (1) |  | 56.4\% | 29.2\% | 20.3\% | 15.3\% | 40.4\% | 28.7\% | 19.8\% | 15.1\% | 33.2\% | 23.8\% | 19.3\% | 14.7\% | 28.6\% | 20.9\% | 17.0\% | $14.4 \%$ |
| BHAR (0) |  | 55.0\% | 28.4\% | 19.8\% | 14.9\% | 39.4\% | 27.9\% | 19.7\% | 14.8\% | 32.7\% | 23.0\% | 18.4\% | 14.8\% | 28.6\% | 20.3\% | 16.6\% | 14.4\% |
| BHAR (1) |  | 55.9\% | 28.9\% | 20.0\% | 15.0\% | 39.9\% | 28.3\% | 19.8\% | 14.9\% | 33.0\% | 23.4\% | 18.6\% | 15.0\% | 28.9\% | 20.5\% | 16.7\% | 14.5\% |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 53.8\% | 27.0\% | 18.4\% | 13.8\% | 37.2\% | 26.5\% | 17.9\% | 13.6\% | 30.6\% | 21.6\% | 17.6\% | 13.5\% | 25.9\% | 18.8\% | 15.5\% | 13.2\% |
| CAR (1) |  | 54.0\% | 27.1\% | 18.5\% | 13.8\% | 37.4\% | 26.6\% | 18.0\% | 13.6\% | 30.8\% | 21.7\% | 17.6\% | 13.5\% | 26.1\% | 18.9\% | 15.5\% | $13.2 \%$ |
| BHAR (0) |  | 53.8\% | 26.2\% | 18.0\% | 12.9\% | 36.9\% | 26.6\% | 18.0\% | 13.1\% | 30.3\% | 21.0\% | 17.0\% | 13.4\% | 26.1\% | 18.6\% | 15.2\% | 13.5\% |
| BHAR (1) |  | 54.0\% | 26.3\% | 18.0\% | 12.9\% | 37.1\% | 26.8\% | 18.1\% | 13.2\% | 30.5\% | 21.3\% | 17.0\% | 13.4\% | 26.3\% | 18.7\% | 15.3\% | 13.5\% |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.0\% | 28.6\% | 19.7\% | 14.8\% | 39.5\% | 28.0\% | 19.2\% | 14.6\% | 32.4\% | 22.8\% | 18.5\% | 14.3\% | 27.3\% | 19.7\% | 16.2\% | 13.9\% |
| CAR (1) |  | 56.8\% | 28.9\% | 19.9\% | 14.9\% | 40.0\% | 28.3\% | 19.4\% | 14.7\% | 32.7\% | 22.9\% | 18.7\% | 14.3\% | 27.5\% | 19.9\% | 16.3\% | 14.0\% |
| BHAR (0) |  | 56.2\% | 28.3\% | 19.0\% | 14.1\% | 39.6\% | 27.9\% | 19.3\% | 14.2\% | 32.3\% | 22.4\% | 18.1\% | 14.3\% | 27.5\% | 19.7\% | 16.0\% | 14.2\% |
| BHAR (1) |  | 57.0\% | 28.6\% | 19.2\% | 14.2\% | 40.1\% | 28.2\% | 19.5\% | 14.4\% | 32.6\% | 22.7\% | 18.3\% | 14.4\% | 27.7\% | 19.8\% | 16.1\% | 14.3\% |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 54.3\% | 27.8\% | 19.0\% | 14.6\% | 38.8\% | 27.5\% | 18.9\% | 14.5\% | 31.8\% | $22.7 \%$ | 18.6\% | 14.3\% | 27.9\% | 20.1\% | 16.4\% | 14.1\% |
| CAR (1) |  | 55.0\% | 28.1\% | 19.1\% | 14.7\% | 39.3\% | 27.8\% | 19.0\% | 14.7\% | 32.2\% | 22.9\% | 18.7\% | 14.4\% | 28.1\% | 20.2\% | 16.5\% | 14.2\% |
| BHAR (0) |  | 54.4\% | 27.6\% | 18.7\% | 14.2\% | 38.7\% | 27.4\% | 19.1\% | 14.1\% | 31.9\% | 22.6\% | 18.2\% | 14.3\% | 27.8\% | 19.9\% | 16.3\% | 14.3\% |
| BHAR (1) |  | 55.1\% | 28.0\% | 18.9\% | 14.3\% | 39.2\% | 27.7\% | 19.3\% | 14.3\% | 32.3\% | 23.0\% | 18.4\% | 14.5\% | 28.1\% | 20.1\% | 16.4\% | $14.4 \%$ |


| MW |  |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.3\% | 29.8\% | 20.4\% | 15.5\% | 46.1\% | 29.5\% | 20.0\% | 15.3\% | 38.8\% | 25.5\% | 19.7\% | 15.1\% | 34.8\% | 23.7\% | 18.4\% | 14.9\% |
| CAR (1) |  | 58.8\% | 29.8\% | 20.4\% | 15.4\% | 45.4\% | 29.2\% | 20.0\% | 15.2\% | 38.3\% | 25.3\% | 19.5\% | 15.1\% | 34.3\% | 23.5\% | 18.3\% | 14.8\% |
| BHAR (0) |  | 59.4\% | 29.6\% | 20.0\% | 15.3\% | 45.8\% | 29.5\% | 20.2\% | 15.0\% | 39.0\% | 25.3\% | 19.4\% | 14.9\% | 34.9\% | 23.3\% | 18.1\% | 15.2\% |
| BHAR (1) |  | 59.0\% | 29.6\% | 20.0\% | 15.3\% | 45.4\% | 29.3\% | 20.2\% | 15.0\% | 38.5\% | 25.1\% | 19.3\% | 14.8\% | 34.6\% | 23.0\% | 18.0\% | 15.1\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.7\% | 29.0\% | 19.1\% | 14.6\% | 44.1\% | 28.0\% | 19.0\% | 14.7\% | 36.6\% | 24.0\% | 18.7\% | 14.6\% | 33.9\% | 22.7\% | 17.4\% | 14.5\% |
| CAR (1) |  | 56.4\% | 28.9\% | 19.0\% | 14.6\% | 43.5\% | 27.8\% | 18.9\% | 14.7\% | 36.4\% | 24.1\% | 18.7\% | 14.6\% | 33.8\% | 22.6\% | 17.3\% | 14.5\% |
| BHAR (0) |  | 56.5\% | 28.6\% | 18.7\% | 14.1\% | 44.3\% | 28.2\% | 18.1\% | 14.3\% | 37.0\% | 22.5\% | 18.3\% | 14.1\% | 34.5\% | 23.0\% | 16.9\% | 14.7\% |
| BHAR (1) |  | 56.2\% | 28.7\% | 18.6\% | 14.1\% | 43.8\% | 28.0\% | 18.2\% | 14.3\% | 37.5\% | 23.1\% | 18.2\% | 14.1\% | 34.0\% | 22.7\% | 16.7\% | 14.5\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.8\% | 29.3\% | 19.2\% | 14.7\% | 46.2\% | 28.1\% | 18.7\% | 14.4\% | 37.6\% | 24.1\% | 18.7\% | 14.3\% | 33.8\% | 22.3\% | 17.0\% | 14.0\% |
| CAR (1) |  | 58.6\% | 29.2\% | 19.2\% | 14.7\% | 46.5\% | 28.1\% | 18.8\% | 14.4\% | 37.3\% | 24.2\% | 18.6\% | 14.2\% | 33.8\% | 22.3\% | 17.0\% | 13.9\% |
| BHAR (0) |  | 59.4\% | 28.2\% | 19.2\% | 13.8\% | 44.2\% | 27.7\% | 18.3\% | 14.2\% | 36.9\% | 21.6\% | 17.6\% | 13.3\% | 33.8\% | 22.7\% | 16.6\% | 14.5\% |
| BHAR (1) |  | 59.2\% | 28.4\% | 19.1\% | 14.0\% | 45.4\% | 27.4\% | 18.3\% | 14.5\% | 37.1\% | 22.4\% | 17.7\% | 13.3\% | 34.4\% | 23.0\% | 16.5\% | 14.4\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.4\% | 29.6\% | 19.7\% | 14.9\% | 43.9\% | 28.5\% | 19.3\% | 14.7\% | 35.7\% | 24.0\% | 18.5\% | 14.3\% | 31.4\% | 21.6\% | 16.8\% | 14.1\% |
| CAR (1) |  | 56.7\% | 29.5\% | 19.7\% | 14.9\% | 43.3\% | 28.3\% | 19.2\% | 14.7\% | 35.2\% | 23.7\% | 18.3\% | 14.3\% | 30.9\% | 21.4\% | 16.7\% | 14.0\% |
| BHAR (0) |  | 57.8\% | 29.6\% | 19.2\% | 15.0\% | 44.7\% | 28.9\% | 19.8\% | 14.8\% | 36.5\% | 23.9\% | 18.8\% | 14.4\% | 32.3\% | 21.6\% | 16.9\% | 14.5\% |
| BHAR (1) |  | 57.0\% | 29.6\% | 19.2\% | 14.9\% | 43.8\% | 28.6\% | 19.8\% | 14.9\% | 35.8\% | 23.6\% | 18.5\% | 14.4\% | 31.6\% | 21.2\% | 16.8\% | 14.4\% |



| MW |  |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.9\% | 29.5\% | 20.2\% | 14.9\% | 47.3\% | 29.6\% | 19.6\% | 15.0\% | 41.3\% | 25.8\% | 19.8\% | 14.9\% | 35.6\% | 24.0\% | 18.3\% | 14.6\% |
| CAR (1) |  | 58.7\% | 29.7\% | 20.2\% | 14.9\% | 47.0\% | 29.5\% | 19.6\% | 14.9\% | 40.8\% | 25.8\% | 19.7\% | 14.8\% | 35.4\% | 23.8\% | 18.2\% | 14.6\% |
| BHAR (0) |  | 57.7\% | 28.0\% | 19.8\% | 13.8\% | 45.0\% | 29.3\% | 19.9\% | 14.4\% | 39.4\% | 25.2\% | 19.0\% | 14.7\% | 33.6\% | 22.5\% | 18.9\% | 14.9\% |
| BHAR (1) |  | 57.5\% | 29.0\% | 19.8\% | 13.8\% | 44.7\% | 29.2\% | 20.0\% | 14.4\% | 38.9\% | 25.2\% | 19.0\% | 14.8\% | 33.3\% | 22.3\% | 18.9\% | 14.9\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.8\% | 29.6\% | 19.8\% | 15.0\% | 44.7\% | 29.1\% | 19.8\% | 14.9\% | 37.5\% | 25.4\% | 19.6\% | 14.8\% | 34.1\% | 23.1\% | 18.0\% | 14.8\% |
| CAR (1) |  | 57.1\% | 29.5\% | 19.8\% | 15.0\% | 44.1\% | 29.0\% | 19.8\% | 14.9\% | 37.1\% | 25.2\% | 19.5\% | 14.8\% | 33.6\% | 22.9\% | 17.9\% | 14.7\% |
| BHAR (0) |  | 58.2\% | 28.9\% | 20.0\% | 14.7\% | 44.8\% | 28.9\% | 19.5\% | 14.4\% | 37.9\% | 24.8\% | 19.3\% | 14.8\% | 34.4\% | 22.4\% | 17.7\% | 14.8\% |
| BHAR (1) |  | 57.6\% | 29.0\% | 20.0\% | 14.7\% | 44.3\% | 28.7\% | 19.5\% | 14.6\% | 37.3\% | 24.7\% | 19.1\% | 14.7\% | 34.0\% | 22.3\% | 17.7\% | 14.8\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.7\% | 29.3\% | 20.2\% | 14.2\% | 46.1\% | 28.9\% | 19.5\% | 14.4\% | 40.0\% | 24.6\% | 19.1\% | 14.4\% | 35.2\% | 22.6\% | 17.8\% | 14.4\% |
| CAR (1) |  | 58.5\% | 29.4\% | 20.2\% | 14.1\% | 45.6\% | 28.9\% | 19.5\% | 14.4\% | 39.6\% | 24.5\% | 19.1\% | 14.4\% | 34.8\% | 22.6\% | 17.7\% | 14.3\% |
| BHAR (0) |  | 59.5\% | 29.9\% | 20.5\% | 14.7\% | 45.7\% | 29.1\% | 20.2\% | 13.4\% | 41.0\% | 24.9\% | 17.8\% | 14.6\% | 36.9\% | 23.2\% | 17.2\% | 14.8\% |
| BHAR (1) |  | 59.2\% | 30.4\% | 20.5\% | 14.7\% | 45.2\% | 29.0\% | 20.2\% | 13.8\% | 40.7\% | 24.9\% | 17.8\% | 14.5\% | 36.8\% | 23.1\% | 17.1\% | 14.7\% |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.8\% | 29.2\% | 19.7\% | 15.0\% | 43.9\% | 28.7\% | 19.2\% | 14.6\% | 37.4\% | 25.4\% | 19.3\% | 14.6\% | 33.2\% | 22.8\% | 17.5\% | 14.5\% |
| CAR (1) |  | 57.4\% | 29.2\% | 19.7\% | 14.9\% | 43.4\% | 28.6\% | 19.2\% | 14.6\% | 36.9\% | 25.2\% | 19.3\% | 14.5\% | 32.9\% | 22.8\% | 17.4\% | 14.5\% |
| BHAR (0) |  | 59.7\% | 29.0\% | 18.1\% | 14.3\% | 43.4\% | 28.7\% | 18.2\% | 14.0\% | 37.1\% | 24.5\% | 18.1\% | 13.6\% | 34.6\% | 22.3\% | 18.0\% | 14.6\% |
| BHAR (1) |  | 59.2\% | 29.4\% | 18.0\% | 14.3\% | 42.7\% | 28.5\% | 18.1\% | 14.0\% | 36.4\% | 24.3\% | 18.1\% | 13.6\% | 34.2\% | 22.1\% | 18.0\% | 14.5\% |


| MW $\mathrm{J}=$ |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.1\% | 28.5\% | 19.2\% | 14.3\% | 44.0\% | 28.0\% | 18.8\% | 14.1\% | 36.1\% | 23.3\% | 18.0\% | 13.6\% | 30.4\% | 20.7\% | 15.9\% | 13.0\% |
| CAR (1) | 58.0\% | 28.4\% | 19.3\% | 14.4\% | 43.6\% | 27.9\% | 18.8\% | 14.1\% | 35.5\% | 23.2\% | 18.0\% | 13.6\% | 30.2\% | 20.7\% | 15.9\% | 13.0\% |
| BHAR (0) | 58.2\% | 28.9\% | 19.0\% | 13.7\% | 42.2\% | 27.4\% | 17.6\% | 13.9\% | 35.2\% | 22.0\% | 17.6\% | 13.4\% | 30.3\% | 20.0\% | 14.8\% | 13.3\% |
| BHAR (1) | 58.0\% | 29.0\% | 18.8\% | 13.7\% | 41.8\% | 27.0\% | 17.6\% | 13.9\% | 35.4\% | 21.7\% | 17.5\% | 13.3\% | 29.8\% | 20.1\% | 14.6\% | 13.4\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 56.8\% | 29.2\% | 19.0\% | 14.4\% | 45.0\% | 28.8\% | 19.2\% | 14.5\% | 37.8\% | 24.8\% | 19.2\% | 14.5\% | 33.6\% | 22.5\% | 17.3\% | 14.2\% |
| CAR (1) | 56.4\% | 29.2\% | 19.0\% | 14.4\% | 44.8\% | 28.7\% | 19.2\% | 14.4\% | 37.3\% | 24.7\% | 19.1\% | 14.4\% | 33.4\% | 22.4\% | 17.2\% | 14.2\% |
| BHAR (0) | 56.8\% | 29.2\% | 19.1\% | 14.5\% | 44.8\% | 28.7\% | 19.1\% | 14.5\% | 37.9\% | 24.7\% | 18.5\% | 14.7\% | 33.3\% | 22.5\% | 16.9\% | 14.8\% |
| BHAR (1) | 56.4\% | 29.2\% | 19.1\% | 14.5\% | 44.3\% | 28.5\% | 19.1\% | 14.6\% | 37.5\% | 24.8\% | 18.5\% | 14.7\% | 32.9\% | 22.4\% | 16.8\% | 14.8\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.2\% | 29.3\% | 19.4\% | 14.4\% | 46.1\% | 28.6\% | 19.3\% | 14.1\% | 39.0\% | 24.9\% | 19.0\% | 14.4\% | 34.5\% | 22.4\% | 17.4\% | 14.2\% |
| CAR (1) | 58.0\% | 29.3\% | 19.4\% | 14.4\% | 45.7\% | 28.5\% | 19.2\% | 14.1\% | 38.8\% | 24.8\% | 18.9\% | 14.4\% | 34.4\% | 22.5\% | 17.3\% | 14.2\% |
| BHAR (0) | 57.5\% | 28.9\% | 18.7\% | 14.2\% | 45.0\% | 28.2\% | 19.7\% | 12.9\% | 38.8\% | 23.4\% | 18.6\% | 13.7\% | 33.4\% | 21.2\% | 16.8\% | 14.9\% |
| BHAR (1) | 57.2\% | 28.9\% | 18.6\% | 14.2\% | 44.8\% | 28.1\% | 19.7\% | 13.0\% | 38.7\% | 23.3\% | 18.5\% | 13.7\% | 33.4\% | 21.0\% | 16.7\% | 14.9\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.1\% | 29.6\% | 20.1\% | 15.0\% | 43.6\% | 28.3\% | 19.7\% | 14.9\% | 37.3\% | 25.1\% | 19.5\% | 14.7\% | 33.6\% | 22.9\% | 17.7\% | 14.4\% |
| CAR (1) | 56.7\% | 29.5\% | 20.1\% | 15.0\% | 43.4\% | 28.2\% | 19.6\% | 14.9\% | 37.0\% | 25.0\% | 19.4\% | 14.6\% | 33.2\% | 22.7\% | 17.7\% | 14.4\% |
| BHAR (0) | 57.4\% | 29.4\% | 20.0\% | 14.6\% | 43.5\% | 28.0\% | 19.5\% | 14.7\% | 35.7\% | 24.4\% | 19.3\% | 14.4\% | 33.9\% | 23.3\% | 17.7\% | 13.7\% |
| BHAR (1) | 57.2\% | 29.4\% | 19.9\% | 14.7\% | 43.2\% | 28.0\% | 19.5\% | 14.9\% | 35.6\% | 24.5\% | 19.3\% | 14.4\% | 33.9\% | 23.1\% | 17.6\% | 13.6\% |


| MW $\mathrm{J}=$ |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.5\% | 29.2\% | 19.4\% | 14.6\% | 43.3\% | 27.7\% | 18.6\% | 14.2\% | 37.3\% | 23.9\% | 18.4\% | 14.2\% | 33.0\% | 21.5\% | 16.5\% | 14.0\% |
| CAR (1) | 57.0\% | 29.1\% | 19.4\% | 14.6\% | 42.8\% | 27.5\% | 18.6\% | 14.2\% | 36.9\% | 23.7\% | 18.3\% | 14.2\% | 33.0\% | 21.4\% | 16.4\% | 13.9\% |
| BHAR (0) | 57.7\% | 28.8\% | 19.0\% | 13.8\% | 44.3\% | 28.1\% | 18.4\% | 13.7\% | 36.9\% | 23.4\% | 18.1\% | 13.6\% | 32.6\% | 21.3\% | 16.3\% | 13.9\% |
| BHAR (1) | 57.3\% | 28.8\% | 19.1\% | 13.7\% | 43.8\% | 27.8\% | 18.3\% | 13.7\% | 36.4\% | 23.1\% | 18.0\% | 13.6\% | 32.3\% | 21.1\% | 16.1\% | 13.8\% |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.0\% | 29.7\% | 20.0\% | 15.0\% | 44.6\% | 28.9\% | 19.8\% | 14.8\% | 37.5\% | 25.2\% | 19.2\% | 14.6\% | 34.9\% | 23.2\% | 18.2\% | 14.8\% |
| CAR (1) | 57.6\% | 29.6\% | 19.9\% | 14.9\% | 44.5\% | 28.7\% | 19.8\% | 14.8\% | 37.3\% | 25.1\% | 19.0\% | 14.6\% | 34.5\% | 23.1\% | 18.1\% | 14.7\% |
| BHAR (0) | 59.8\% | 28.4\% | 20.7\% | 15.4\% | 43.5\% | 28.6\% | 19.2\% | 14.6\% | 35.2\% | 25.3\% | 19.1\% | 14.9\% | 35.5\% | 23.5\% | 18.1\% | 15.0\% |
| BHAR (1) | 59.5\% | 28.5\% | 20.7\% | 15.4\% | 43.5\% | 28.3\% | 19.2\% | 14.1\% | 35.1\% | 25.4\% | 18.8\% | 14.8\% | 35.3\% | 22.9\% | 18.0\% | 14.7\% |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.9\% | 29.2\% | 19.5\% | 14.7\% | 44.8\% | 29.1\% | 19.6\% | 14.9\% | 39.6\% | 25.8\% | 19.6\% | 14.7\% | $36.2 \%$ | 23.3\% | 17.7\% | 14.3\% |
| CAR (1) | 57.6\% | 29.2\% | 19.6\% | 14.7\% | 44.5\% | 29.0\% | 19.6\% | 14.9\% | 39.3\% | 25.7\% | 19.5\% | 14.7\% | 36.0\% | 23.1\% | 17.6\% | 14.2\% |
| BHAR (0) | 58.3\% | 29.8\% | 19.2\% | 14.6\% | 44.5\% | 28.8\% | 19.5\% | 14.8\% | 38.5\% | 25.8\% | 19.1\% | 15.0\% | 35.5\% | 23.0\% | 16.6\% | 14.3\% |
| BHAR (1) | 58.0\% | 29.9\% | 19.2\% | 14.6\% | 44.2\% | 28.8\% | 19.5\% | 14.9\% | 38.2\% | 25.7\% | 18.9\% | 15.0\% | 35.2\% | 23.0\% | 16.4\% | 14.2\% |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\overline{\text { CAR (0) }}$ | 59.0\% | 29.9\% | 19.6\% | 14.4\% | 46.8\% | 29.6\% | 19.4\% | 14.3\% | 40.8\% | 26.6\% | 19.6\% | 14.5\% | 35.8\% | 23.0\% | 17.3\% | 14.0\% |
| CAR (1) | 59.0\% | 29.9\% | 19.6\% | 14.3\% | 46.8\% | 29.7\% | 19.4\% | 14.3\% | 41.2\% | 26.6\% | 19.5\% | 14.5\% | 35.9\% | 22.7\% | 17.2\% | 14.0\% |
| BHAR (0) | 60.0\% | 30.2\% | 19.5\% | 14.3\% | 47.3\% | 29.2\% | 18.6\% | 14.7\% | 41.2\% | 26.0\% | 19.4\% | 14.7\% | 36.7\% | 22.3\% | 17.1\% | 14.1\% |
| BHAR (1) | 59.9\% | 30.5\% | 19.5\% | 14.3\% | 46.6\% | 29.1\% | 18.5\% | 14.7\% | 40.7\% | 26.2\% | 19.4\% | 14.7\% | $36.1 \%$ | 22.1\% | 17.0\% | 14.1\% |


| MW | J = | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.5\% | 30.2\% | 19.9\% | 15.0\% | 47.7\% | 29.8\% | 19.5\% | 14.7\% | 38.8\% | 24.7\% | 18.7\% | 14.3\% | 33.8\% | 22.2\% | 17.1\% | 14.2\% |
| CAR (1) |  | 58.1\% | 30.2\% | 19.9\% | 15.0\% | 47.3\% | 29.7\% | 19.5\% | 14.7\% | 38.4\% | 24.5\% | 18.7\% | 14.2\% | 33.4\% | 22.0\% | 17.0\% | 14.1\% |
| BHAR (0) |  | 57.5\% | 29.8\% | 19.5\% | 15.0\% | 48.4\% | 30.3\% | 20.2\% | 14.9\% | 39.7\% | 23.7\% | 18.6\% | 13.9\% | 34.8\% | 22.5\% | 17.2\% | 14.2\% |
| BHAR (1) |  | 57.1\% | 29.7\% | 19.5\% | 14.9\% | 48.2\% | 30.2\% | 20.2\% | 15.0\% | 39.4\% | 23.5\% | 18.5\% | 13.9\% | 34.5\% | 22.3\% | 17.2\% | 14.2\% |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.3\% | 28.4\% | 19.8\% | 14.5\% | 44.7\% | 28.0\% | 19.0\% | 14.3\% | 37.4\% | 23.9\% | 18.3\% | 14.0\% | 32.4\% | 21.4\% | 16.7\% | 13.5\% |
| CAR (1) |  | 59.0\% | 28.4\% | 19.7\% | 14.5\% | 44.2\% | 27.9\% | 19.0\% | 14.3\% | 37.0\% | 23.7\% | 18.2\% | 14.0\% | 32.0\% | 21.2\% | 16.6\% | 13.4\% |
| BHAR (0) |  | 60.3\% | 29.4\% | 19.8\% | 14.2\% | 45.0\% | 27.2\% | 18.9\% | 14.2\% | 37.1\% | 23.3\% | 17.8\% | 14.5\% | 31.7\% | 20.1\% | 16.6\% | 13.2\% |
| BHAR (1) |  | 60.1\% | 29.4\% | 19.9\% | 14.3\% | 44.8\% | 27.1\% | 18.9\% | 14.3\% | 36.8\% | 23.2\% | 17.6\% | 14.5\% | 31.5\% | 20.1\% | 16.5\% | 13.2\% |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.7\% | 30.2\% | 20.1\% | 15.1\% | 47.8\% | 29.8\% | 19.8\% | 15.0\% | 41.8\% | 26.0\% | 19.7\% | 14.8\% | $36.2 \%$ | 23.5\% | 18.0\% | 14.7\% |
| CAR (1) |  | 60.4\% | 30.2\% | 20.1\% | 15.0\% | 47.4\% | 29.7\% | 19.8\% | 15.0\% | 41.5\% | 25.9\% | 19.6\% | 14.8\% | $35.7 \%$ | 23.3\% | 17.9\% | 14.7\% |
| BHAR (0) |  | 61.6\% | 29.0\% | 19.9\% | 14.5\% | 48.3\% | 30.2\% | 20.3\% | 14.9\% | 42.2\% | 25.4\% | 19.3\% | 14.8\% | 36.8\% | 24.0\% | 18.3\% | 14.9\% |
| BHAR (1) |  | 61.2\% | 29.1\% | 19.9\% | 14.5\% | 47.7\% | 30.0\% | 20.3\% | 15.0\% | 41.8\% | 25.3\% | 19.3\% | 14.8\% | 36.4\% | 23.8\% | 18.2\% | 14.9\% |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.3\% | 29.2\% | 19.4\% | 14.7\% | 44.4\% | 28.5\% | 19.2\% | 14.5\% | 36.6\% | 24.4\% | 18.9\% | 14.3\% | 32.7\% | 22.0\% | 17.1\% | 14.1\% |
| CAR (1) |  | 57.8\% | 29.2\% | 19.4\% | 14.6\% | 43.9\% | 28.3\% | 19.2\% | 14.4\% | 36.2\% | 24.2\% | 18.7\% | 14.3\% | 32.3\% | 21.8\% | 17.0\% | 14.0\% |
| BHAR (0) |  | 58.8\% | 29.0\% | 19.2\% | 14.4\% | 44.6\% | 28.4\% | 19.6\% | 14.1\% | 36.6\% | 24.3\% | 18.7\% | 14.2\% | 32.7\% | 21.9\% | 17.0\% | 14.1\% |
| BHAR (1) |  | 58.4\% | 29.0\% | 19.2\% | 14.4\% | 44.0\% | 28.2\% | 19.6\% | 14.1\% | 36.2\% | 24.3\% | 18.6\% | 14.2\% | 32.3\% | 21.7\% | 16.8\% | 14.0\% |


| IVOL $\mathrm{J}=$ | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.4\% | 29.0\% | 19.4\% | 14.8\% | 41.4\% | 27.6\% | 18.9\% | 14.5\% | 34.1\% | 23.3\% | 18.8\% | 14.3\% | 30.1\% | 21.4\% | 17.0\% | $14.1 \%$ |
| CAR (1) | 59.1\% | 28.9\% | 19.6\% | 14.8\% | 41.8\% | 27.6\% | 18.9\% | 14.5\% | 34.4\% | 23.4\% | 18.8\% | 14.3\% | 30.8\% | 21.5\% | 17.0\% | 14.1\% |
| BHAR (0) | 58.8\% | 29.1\% | 19.0\% | 14.4\% | 40.8\% | 27.6\% | 19.3\% | 14.1\% | 34.0\% | $22.9 \%$ | 18.6\% | 14.2\% | 30.1\% | 21.4\% | 17.1\% | 14.5\% |
| BHAR (1) | 59.4\% | 29.0\% | 19.2\% | 14.6\% | 41.4\% | 27.7\% | 19.3\% | 14.2\% | 34.2\% | 23.1\% | 18.6\% | 14.2\% | 30.3\% | 21.4\% | 17.1\% | 14.5\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.7\% | 29.5\% | 19.5\% | 14.6\% | 45.1\% | 28.7\% | 19.0\% | 14.4\% | 37.1\% | 24.0\% | 18.6\% | 14.2\% | 32.6\% | 22.0\% | 17.0\% | 14.2\% |
| CAR (1) | 58.0\% | 29.6\% | 19.5\% | 14.6\% | 45.5\% | 28.8\% | 19.0\% | 14.4\% | 37.5\% | 24.1\% | 18.7\% | 14.2\% | 33.0\% | 22.2\% | 17.1\% | 14.3\% |
| BHAR (0) | 57.4\% | 29.4\% | 19.0\% | 14.2\% | 44.9\% | 29.4\% | 19.4\% | 13.6\% | 36.4\% | 23.6\% | 18.7\% | 14.2\% | $32.4 \%$ | 21.2\% | 16.6\% | 14.7\% |
| BHAR (1) | 57.7\% | 29.3\% | 19.1\% | 14.2\% | 44.5\% | 29.2\% | 19.0\% | 13.8\% | 37.0\% | 23.7\% | 18.7\% | 14.2\% | 32.4\% | 20.8\% | 16.6\% | 14.7\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.5\% | 28.6\% | 19.1\% | 14.3\% | 42.1\% | 27.0\% | 18.0\% | 13.7\% | $34.2 \%$ | 22.4\% | 17.6\% | 13.3\% | 29.1\% | 19.4\% | 15.4\% | 13.0\% |
| CAR (1) | 58.0\% | 28.8\% | 19.2\% | 14.3\% | 42.7\% | 27.1\% | 18.0\% | 13.7\% | 34.8\% | 22.5\% | 17.6\% | 13.3\% | 29.3\% | 19.5\% | 15.4\% | 13.0\% |
| BHAR (0) | 58.3\% | 28.8\% | 18.2\% | 13.6\% | 41.8\% | 27.2\% | 17.5\% | 13.1\% | 34.2\% | 22.0\% | 17.3\% | 12.9\% | 28.8\% | 19.4\% | 14.9\% | 13.6\% |
| BHAR (1) | 58.2\% | 29.1\% | 18.5\% | 13.6\% | 42.6\% | 27.3\% | 17.6\% | 13.4\% | 34.8\% | 22.3\% | 17.3\% | 13.0\% | 29.0\% | 19.5\% | 15.0\% | 13.7\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 55.8\% | 28.4\% | 18.9\% | 14.3\% | 40.7\% | 27.4\% | 18.5\% | 14.0\% | 33.4\% | 23.0\% | 18.2\% | 13.9\% | 29.0\% | 20.3\% | 16.3\% | 13.7\% |
| CAR (1) | 56.0\% | 28.4\% | 18.9\% | 14.2\% | 40.9\% | 27.4\% | 18.5\% | 14.0\% | 33.5\% | 23.0\% | 18.2\% | 13.8\% | 29.0\% | 20.3\% | 16.2\% | 13.7\% |
| BHAR (0) | 55.8\% | 28.2\% | 18.6\% | 13.8\% | 40.9\% | 27.3\% | 18.7\% | 13.7\% | 34.0\% | 22.6\% | 18.0\% | 13.7\% | 29.3\% | 20.5\% | 16.3\% | 13.9\% |
| BHAR (1) | 55.9\% | 28.2\% | 18.6\% | 13.8\% | 41.3\% | 27.4\% | 18.7\% | 13.7\% | 34.0\% | 22.8\% | 18.0\% | 13.7\% | 29.3\% | 20.5\% | 16.3\% | 13.9\% |


| IVOL | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.0\% | 28.7\% | 19.3\% | 14.4\% | 41.8\% | 27.4\% | 18.6\% | 14.1\% | 34.5\% | 23.2\% | 18.2\% | 13.9\% | 29.0\% | 20.2\% | 16.3\% | 13.6\% |
| CAR (1) |  | 57.5\% | 28.8\% | 19.4\% | 14.4\% | 42.3\% | 27.5\% | 18.7\% | 14.1\% | 34.9\% | 23.3\% | 18.3\% | 13.9\% | 29.1\% | 20.3\% | 16.2\% | 13.6\% |
| BHAR (0) |  | 57.1\% | 28.3\% | 18.9\% | 14.1\% | 42.1\% | 27.4\% | 18.5\% | 13.9\% | 34.6\% | 23.2\% | 17.9\% | 14.0\% | 29.2\% | 19.9\% | 16.6\% | 14.0\% |
| BHAR (1) |  | 57.4\% | 28.5\% | 19.0\% | 14.1\% | 43.0\% | 27.5\% | 18.5\% | 13.9\% | 34.8\% | 23.5\% | 18.0\% | 14.1\% | 28.7\% | 19.9\% | 16.7\% | 14.1\% |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.6\% | 28.7\% | 19.0\% | 14.5\% | 42.1\% | 28.0\% | 18.8\% | 14.2\% | 34.3\% | 23.4\% | 18.5\% | 14.0\% | 30.4\% | 20.9\% | 16.4\% | 13.6\% |
| CAR (1) |  | 57.8\% | 28.9\% | 19.1\% | 14.5\% | 42.3\% | 28.1\% | 18.8\% | 14.2\% | 34.3\% | 23.4\% | 18.5\% | 14.0\% | 30.6\% | 21.0\% | 16.4\% | 13.6\% |
| BHAR (0) |  | 57.8\% | 28.5\% | 18.6\% | 14.5\% | 41.8\% | 27.6\% | 19.0\% | 13.5\% | 34.4\% | 22.9\% | 18.0\% | 13.7\% | 30.8\% | 20.4\% | 16.1\% | 13.8\% |
| BHAR (1) |  | 58.1\% | 28.7\% | 18.7\% | 14.5\% | 42.4\% | 27.6\% | 19.0\% | 13.5\% | 34.4\% | 23.0\% | 18.1\% | 13.7\% | 30.8\% | 20.4\% | 16.1\% | 13.8\% |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.5\% | 29.9\% | 20.0\% | 14.9\% | 45.7\% | 28.7\% | 19.1\% | 14.4\% | 37.1\% | 23.9\% | 18.6\% | 14.0\% | 31.7\% | 21.0\% | 16.4\% | 13.8\% |
| CAR (1) |  | 61.4\% | 30.2\% | 20.3\% | 15.0\% | 47.4\% | 29.1\% | 19.4\% | 14.5\% | 38.2\% | 24.3\% | 18.7\% | 14.0\% | 32.3\% | 21.3\% | 16.5\% | 13.8\% |
| BHAR (0) |  | 60.2\% | 29.3\% | 19.7\% | 14.2\% | 45.2\% | 28.8\% | 18.6\% | 13.8\% | 36.4\% | 23.3\% | 18.1\% | 13.6\% | 31.1\% | 20.8\% | 16.2\% | 13.9\% |
| BHAR (1) |  | 61.1\% | 29.3\% | 20.2\% | 14.3\% | 47.6\% | 29.4\% | 19.1\% | 13.8\% | 38.1\% | 24.0\% | 18.2\% | 13.7\% | 31.6\% | 21.2\% | 16.2\% | 13.9\% |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.7\% | 29.2\% | 19.6\% | 14.6\% | 43.6\% | 28.2\% | 18.9\% | 14.3\% | 35.7\% | 23.5\% | 18.4\% | 14.0\% | 30.7\% | 20.9\% | 16.4\% | 13.8\% |
| CAR (1) |  | 59.2\% | 29.2\% | 19.7\% | 14.6\% | 44.5\% | 28.4\% | 19.0\% | 14.3\% | 36.7\% | 23.8\% | 18.5\% | 14.0\% | 31.4\% | 21.0\% | 16.5\% | 13.8\% |
| BHAR (0) |  | 58.8\% | 28.8\% | 19.2\% | 14.1\% | 44.0\% | 28.3\% | 18.8\% | 13.7\% | 35.7\% | 22.8\% | 18.1\% | 13.9\% | 30.0\% | 20.8\% | 16.0\% | 14.0\% |
| BHAR (1) |  | 59.4\% | 28.8\% | 19.2\% | 13.9\% | 44.9\% | 28.3\% | 18.9\% | 13.9\% | 36.6\% | 23.0\% | 18.2\% | 13.9\% | 31.0\% | 20.9\% | 16.1\% | 14.1\% |


| IVOL $\mathrm{J}=$ | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 56.9\% | 28.6\% | 19.2\% | 14.6\% | 42.1\% | 28.1\% | 18.9\% | 14.3\% | 35.1\% | 23.9\% | 19.0\% | 14.3\% | 30.7\% | 21.5\% | 17.0\% | 14.2\% |
| CAR (1) | 57.1\% | 28.6\% | 19.3\% | 14.6\% | 42.3\% | 28.1\% | 18.9\% | 14.3\% | 35.3\% | 23.9\% | 19.0\% | 14.3\% | 31.0\% | 21.5\% | 17.0\% | 14.2\% |
| BHAR (0) | 56.7\% | 28.0\% | 18.8\% | 14.1\% | 41.6\% | 28.1\% | 18.8\% | 14.1\% | 35.4\% | 23.8\% | 18.6\% | 14.3\% | 30.2\% | 21.2\% | 16.7\% | 14.8\% |
| BHAR (1) | 57.0\% | 28.2\% | 18.9\% | 14.1\% | 41.9\% | 28.2\% | 18.8\% | 14.2\% | 35.5\% | 23.9\% | 18.7\% | 14.3\% | 30.3\% | 21.3\% | 16.7\% | 14.8\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.7\% | 28.9\% | 19.4\% | 14.6\% | 42.9\% | 28.3\% | 19.2\% | 14.5\% | 35.9\% | 24.0\% | 19.0\% | 14.4\% | 31.6\% | 21.4\% | 17.1\% | 14.3\% |
| CAR (1) | 58.1\% | 28.9\% | 19.4\% | 14.6\% | 43.3\% | 28.4\% | 19.2\% | 14.5\% | 35.9\% | 24.0\% | 19.0\% | 14.4\% | 31.8\% | 21.5\% | 17.1\% | 14.3\% |
| BHAR (0) | 58.2\% | 28.8\% | 19.4\% | 14.1\% | 43.2\% | 28.3\% | 19.0\% | 14.1\% | 36.3\% | 23.7\% | 18.6\% | 14.4\% | 31.6\% | 20.7\% | 17.0\% | 14.4\% |
| BHAR (1) | 58.5\% | 28.9\% | 19.4\% | 14.1\% | 43.7\% | 28.3\% | 19.0\% | 14.3\% | 35.9\% | 23.5\% | 18.6\% | 14.4\% | 32.0\% | 20.8\% | 17.0\% | 14.4\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.5\% | 29.1\% | 19.9\% | 14.5\% | 44.7\% | 28.7\% | 19.2\% | 14.3\% | 38.4\% | 24.4\% | 18.8\% | 14.0\% | 34.4\% | 22.3\% | 17.1\% | 14.0\% |
| CAR (1) | 58.7\% | 29.2\% | 20.0\% | 14.4\% | 45.2\% | 28.9\% | 19.3\% | 14.3\% | 38.8\% | 24.6\% | 18.8\% | 14.0\% | 34.9\% | 22.4\% | 17.2\% | 14.0\% |
| BHAR (0) | 58.2\% | 29.0\% | 20.1\% | 13.5\% | 44.5\% | 28.4\% | 18.8\% | 13.0\% | 37.5\% | 22.9\% | 18.2\% | 13.3\% | 32.9\% | 23.4\% | 16.5\% | 14.8\% |
| BHAR (1) | 58.8\% | 29.1\% | 20.3\% | 13.4\% | 45.0\% | 28.6\% | 18.8\% | 13.3\% | 37.9\% | 23.2\% | 18.2\% | 13.4\% | 33.2\% | 23.5\% | 16.5\% | 14.8\% |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 58.8\% | 29.3\% | 19.6\% | 14.8\% | 44.0\% | 28.7\% | 19.3\% | 14.6\% | 36.9\% | 24.5\% | 19.2\% | 14.4\% | 32.1\% | 21.6\% | 17.0\% | 14.3\% |
| CAR (1) | 59.2\% | 29.5\% | 19.8\% | 14.9\% | 44.8\% | 28.9\% | 19.4\% | 14.6\% | 37.4\% | 24.6\% | 19.2\% | 14.4\% | 32.4\% | 21.7\% | 17.0\% | 14.3\% |
| BHAR (0) | 58.8\% | 29.0\% | 19.1\% | 14.5\% | 44.4\% | 28.9\% | 19.2\% | 14.0\% | 37.0\% | 23.8\% | 18.7\% | 14.1\% | 32.0\% | 21.5\% | 16.8\% | 14.4\% |
| BHAR (1) | 59.3\% | 29.4\% | 19.4\% | 14.6\% | 44.8\% | 29.1\% | 19.2\% | 14.2\% | 37.3\% | 24.1\% | 18.7\% | 14.2\% | 32.3\% | 21.6\% | 16.9\% | 14.5\% |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.2\% | 28.7\% | 19.1\% | 14.4\% | 42.3\% | 27.8\% | 18.6\% | 14.1\% | 34.3\% | 23.2\% | 18.3\% | 13.7\% | $30.1 \%$ | 20.6\% | 16.2\% | 13.5\% |
| CAR (1) |  | 57.7\% | 28.8\% | 19.2\% | 14.5\% | 42.6\% | 27.8\% | 18.6\% | 14.1\% | 34.6\% | 23.3\% | 18.3\% | 13.8\% | 30.3\% | 20.6\% | 16.2\% | 13.5\% |
| BHAR (0) |  | 57.2\% | 28.4\% | 18.6\% | 13.6\% | 42.3\% | 27.5\% | 18.6\% | 13.8\% | 35.0\% | 23.0\% | 18.4\% | 13.6\% | 30.7\% | 21.1\% | 16.3\% | 13.8\% |
| BHAR (1) |  | 57.8\% | 28.4\% | 18.6\% | 13.6\% | 43.0\% | 27.6\% | 18.6\% | 13.9\% | 35.2\% | 23.2\% | 18.4\% | 13.6\% | 30.8\% | 21.2\% | 16.3\% | 13.9\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.9\% | 28.6\% | 18.9\% | 14.1\% | 42.4\% | 28.3\% | 18.7\% | 14.0\% | 35.0\% | 23.7\% | 18.7\% | 14.0\% | 30.5\% | 21.0\% | 16.6\% | 13.9\% |
| CAR (1) |  | 57.1\% | 28.6\% | 18.9\% | 14.1\% | 42.5\% | 28.4\% | 18.7\% | 14.0\% | 35.1\% | 23.7\% | 18.7\% | 13.9\% | 30.7\% | 21.0\% | 16.6\% | 13.9\% |
| BHAR (0) |  | 56.8\% | 27.9\% | 18.5\% | 14.0\% | 42.3\% | 28.5\% | 18.4\% | 13.7\% | 35.0\% | 23.5\% | 18.1\% | 13.9\% | 30.5\% | 21.0\% | 16.2\% | 14.3\% |
| BHAR (1) |  | 57.1\% | 28.0\% | 18.5\% | 14.1\% | 42.4\% | 28.5\% | 18.4\% | 13.8\% | 35.1\% | 23.6\% | 18.1\% | 14.0\% | 30.6\% | 21.0\% | 16.2\% | 14.3\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.2\% | 28.7\% | 19.2\% | 14.2\% | 42.3\% | 27.7\% | 18.6\% | 13.9\% | 34.6\% | 23.1\% | 18.2\% | 13.6\% | 29.5\% | 20.2\% | 16.0\% | 13.3\% |
| CAR (1) |  | 57.5\% | 28.7\% | 19.2\% | 14.2\% | 42.6\% | 27.8\% | 18.7\% | 13.9\% | 34.8\% | 23.1\% | 18.2\% | 13.6\% | 29.7\% | 20.3\% | 16.0\% | 13.3\% |
| BHAR (0) |  | 57.0\% | 28.6\% | 18.8\% | 13.7\% | 42.2\% | 27.9\% | 18.8\% | 12.9\% | 34.3\% | 22.8\% | 17.7\% | 13.5\% | 29.6\% | 20.0\% | 16.0\% | 13.6\% |
| BHAR (1) |  | 57.5\% | 28.7\% | 18.8\% | 13.9\% | 42.6\% | 28.0\% | 18.7\% | 13.0\% | 34.2\% | 22.9\% | 17.6\% | 13.5\% | 29.5\% | 20.0\% | 15.9\% | 13.6\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.5\% | 28.2\% | 19.4\% | 14.4\% | 41.1\% | 27.2\% | 18.6\% | 14.2\% | 34.6\% | 23.3\% | 18.4\% | 14.0\% | 30.4\% | 20.8\% | 16.4\% | 13.7\% |
| CAR (1) |  | 57.1\% | 28.4\% | 19.5\% | 14.4\% | 41.4\% | 27.3\% | 18.6\% | 14.1\% | 34.7\% | 23.4\% | 18.4\% | 13.9\% | 30.6\% | 20.9\% | 16.4\% | 13.7\% |
| BHAR (0) |  | 56.7\% | 27.6\% | 18.8\% | 14.4\% | 40.6\% | 26.8\% | 18.3\% | 13.9\% | 34.0\% | 22.9\% | 18.0\% | 13.6\% | 30.1\% | 20.8\% | 16.2\% | 13.7\% |
| BHAR (1) |  | 57.4\% | 27.6\% | 18.9\% | 14.4\% | 41.3\% | 27.1\% | 18.5\% | 13.9\% | $34.1 \%$ | 23.1\% | 18.0\% | 13.6\% | 30.3\% | 21.0\% | 16.2\% | 13.7\% |


| IVOL $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.0\% | 28.5\% | 19.1\% | 14.4\% | 42.6\% | 27.4\% | 18.3\% | 14.0\% | 35.4\% | 23.3\% | 18.2\% | 13.9\% | $31.2 \%$ | 21.1\% | 16.3\% | 13.7\% |
| CAR (1) | 57.4\% | 28.6\% | 19.2\% | 14.4\% | 42.7\% | 27.4\% | 18.3\% | 14.0\% | 35.5\% | 23.4\% | 18.2\% | 13.8\% | 31.4\% | 21.2\% | 16.3\% | 13.7\% |
| BHAR (0) | 57.0\% | 28.2\% | 18.6\% | 13.9\% | 42.3\% | 27.0\% | 18.0\% | 13.4\% | 35.0\% | 22.8\% | 17.9\% | 13.4\% | 31.1\% | 20.7\% | 15.9\% | 13.8\% |
| BHAR (1) | 57.2\% | 28.1\% | 18.7\% | 13.8\% | 42.0\% | 26.8\% | 18.1\% | 13.6\% | 35.0\% | 22.9\% | 17.9\% | 13.4\% | 31.2\% | 20.6\% | 15.9\% | 13.8\% |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 60.6\% | 29.9\% | 20.0\% | 14.9\% | 49.0\% | 29.1\% | 19.4\% | 14.5\% | 39.8\% | 24.7\% | 18.7\% | 14.2\% | 34.3\% | 22.0\% | 17.0\% | 14.1\% |
| CAR (1) | 61.1\% | 29.9\% | 19.9\% | 15.2\% | 50.0\% | 29.4\% | 19.5\% | 14.6\% | 41.1\% | 25.1\% | 18.9\% | 14.3\% | 35.3\% | 22.4\% | 17.2\% | $14.2 \%$ |
| BHAR (0) | 61.1\% | 29.2\% | 18.9\% | 15.0\% | 49.9\% | 29.2\% | 20.1\% | 14.3\% | 39.3\% | 24.5\% | 19.0\% | 14.6\% | 34.9\% | 22.0\% | 17.3\% | 14.6\% |
| BHAR (1) | 61.7\% | 29.4\% | 19.6\% | 15.2\% | 51.6\% | 29.7\% | 20.4\% | 14.3\% | 40.7\% | 25.0\% | 19.3\% | 14.5\% | 36.2\% | 22.3\% | 17.6\% | 14.6\% |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 56.9\% | 28.4\% | 19.3\% | 14.5\% | 41.9\% | 27.9\% | 18.9\% | 14.4\% | 35.0\% | 23.6\% | 18.6\% | 14.2\% | 30.5\% | 21.0\% | 16.7\% | 13.9\% |
| CAR (1) | 57.4\% | 28.5\% | 19.3\% | 14.5\% | 42.2\% | 28.0\% | 18.9\% | 14.4\% | $35.1 \%$ | 23.6\% | 18.6\% | 14.2\% | 30.4\% | 20.9\% | 16.6\% | 13.9\% |
| BHAR (0) | 57.1\% | 28.7\% | 18.7\% | 14.4\% | 41.9\% | 27.7\% | 18.9\% | 14.6\% | 34.7\% | 23.4\% | 18.2\% | 14.4\% | 30.7\% | 21.0\% | 16.5\% | 14.3\% |
| BHAR (1) | 57.0\% | 28.4\% | 18.7\% | 14.3\% | 41.6\% | 27.6\% | 18.8\% | 14.3\% | 34.9\% | 23.5\% | 18.1\% | 14.4\% | 30.5\% | 21.0\% | 16.5\% | 14.3\% |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.8\% | 29.1\% | 19.4\% | 14.4\% | 44.6\% | 28.3\% | 18.9\% | 14.2\% | 35.7\% | 23.9\% | 18.6\% | 13.9\% | 31.1\% | 20.8\% | 16.5\% | 13.8\% |
| CAR (1) | 58.2\% | 29.2\% | 19.5\% | 14.4\% | 44.9\% | 28.4\% | 18.9\% | 14.1\% | 36.1\% | 23.9\% | 18.5\% | 13.9\% | 31.3\% | 20.7\% | 16.4\% | 13.8\% |
| BHAR (0) | 58.3\% | 29.3\% | 19.3\% | 14.4\% | 45.3\% | 28.1\% | 18.5\% | 14.0\% | 35.1\% | 23.0\% | 18.1\% | 14.5\% | 30.0\% | 20.1\% | 16.4\% | 14.4\% |
| BHAR (1) | 58.9\% | 29.1\% | 19.6\% | 14.3\% | 45.2\% | 28.2\% | 18.1\% | 14.3\% | 35.3\% | 23.1\% | 18.0\% | 14.5\% | 30.3\% | 20.1\% | 16.3\% | 14.4\% |



Table 7.8b. Turnover ratios for cross-sectional loser portfolio

| EW | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 53.7\% | 26.9\% | 18.7\% | 14.3\% | 39.6\% | 27.5\% | 18.7\% | 14.4\% | 33.4\% | 23.4\% | 19.0\% | 14.5\% | 29.2\% | 21.1\% | 17.1\% | 14.6\% |
| CAR (1) |  | 54.1\% | 27.1\% | 18.8\% | 14.4\% | 39.9\% | 27.7\% | 18.9\% | 14.5\% | 33.7\% | 23.6\% | 19.1\% | 14.6\% | 29.5\% | 21.2\% | 17.2\% | 14.6\% |
| BHAR (0) |  | 53.6\% | 26.7\% | 18.5\% | 14.1\% | 39.7\% | 27.7\% | 18.8\% | 14.0\% | 33.4\% | 23.3\% | 18.7\% | 14.4\% | 29.3\% | 21.1\% | 17.0\% | 14.9\% |
| BHAR (1) |  | 54.0\% | 26.9\% | 18.6\% | 14.2\% | 40.0\% | 28.0\% | 19.0\% | 14.3\% | 33.6\% | 23.6\% | 18.9\% | 14.5\% | 29.5\% | 21.3\% | 17.1\% | 15.0\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 52.3\% | 27.3\% | 18.3\% | 14.2\% | 38.6\% | 27.0\% | 18.2\% | 13.9\% | 31.3\% | 22.4\% | 18.0\% | 13.9\% | 27.5\% | 19.7\% | 15.9\% | 13.7\% |
| CAR (1) |  | 52.9\% | 27.5\% | 18.5\% | 14.3\% | 39.1\% | 27.3\% | 18.4\% | 14.0\% | 31.7\% | 22.7\% | 18.1\% | 13.9\% | 27.9\% | 19.9\% | 16.1\% | 13.8\% |
| BHAR (0) |  | 52.5\% | 28.0\% | 18.2\% | 14.2\% | 38.8\% | 27.4\% | 17.9\% | 13.9\% | 31.7\% | 21.4\% | 17.6\% | 13.8\% | 27.8\% | 19.9\% | 16.1\% | 14.0\% |
| BHAR (1) |  | 53.0\% | 28.3\% | 18.4\% | 14.3\% | 39.4\% | 27.9\% | 18.2\% | 14.2\% | 32.3\% | 21.8\% | 17.8\% | 13.9\% | 28.2\% | 20.3\% | 16.2\% | 14.3\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 52.0\% | 26.4\% | 18.0\% | 13.7\% | 36.6\% | 25.7\% | 17.3\% | 13.5\% | 29.7\% | 20.9\% | 17.1\% | 13.2\% | 26.1\% | 18.3\% | 15.3\% | 13.3\% |
| CAR (1) |  | 52.3\% | 26.6\% | 18.1\% | 13.8\% | 36.9\% | 26.0\% | 17.5\% | 13.6\% | 30.0\% | 21.1\% | 17.2\% | 13.3\% | 26.3\% | 18.5\% | 15.4\% | 13.4\% |
| BHAR (0) |  | 51.9\% | 26.7\% | 18.3\% | 14.0\% | 36.9\% | 25.8\% | 17.3\% | 13.8\% | 30.0\% | 20.5\% | 17.1\% | 13.4\% | 26.1\% | 18.3\% | 15.1\% | 13.4\% |
| BHAR (1) |  | 52.3\% | 27.1\% | 18.4\% | 14.2\% | 37.4\% | 26.0\% | 17.5\% | 14.1\% | 30.3\% | 20.9\% | 17.2\% | 13.5\% | 26.3\% | 18.5\% | 15.4\% | 13.5\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 52.8\% | 26.8\% | 18.4\% | 14.1\% | 38.9\% | 27.2\% | 18.6\% | 14.3\% | $32.2 \%$ | 22.9\% | 18.8\% | 14.5\% | 28.3\% | 20.8\% | 17.1\% | 14.7\% |
| CAR (1) |  | 53.2\% | 27.1\% | 18.5\% | 14.2\% | 39.3\% | 27.5\% | 18.7\% | 14.4\% | 32.6\% | 23.2\% | 18.9\% | 14.6\% | 28.6\% | 21.0\% | 17.2\% | 14.8\% |
| BHAR (0) |  | 52.9\% | 26.7\% | 18.2\% | 14.2\% | 39.4\% | 27.4\% | 18.5\% | 14.4\% | 32.6\% | 23.0\% | 18.6\% | 14.5\% | 28.6\% | 20.9\% | 17.0\% | 15.0\% |
| BHAR (1) |  | 53.3\% | 27.1\% | 18.3\% | 14.4\% | 39.8\% | 27.7\% | 18.7\% | 14.7\% | 33.0\% | 23.5\% | 18.8\% | 14.6\% | 29.0\% | 21.2\% | 17.2\% | 15.1\% |



| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 55.2\% | 27.8\% | 19.0\% | 14.5\% | 40.6\% | 27.9\% | 19.1\% | 14.6\% | $34.2 \%$ | 23.6\% | 19.1\% | 14.6\% | 30.5\% | 21.6\% | 17.5\% | 14.7\% |
| CAR (1) |  | 55.6\% | 28.0\% | 19.1\% | 14.6\% | 40.8\% | 28.2\% | 19.2\% | 14.7\% | 34.4\% | 23.9\% | 19.2\% | 14.7\% | 30.8\% | 21.8\% | 17.6\% | 14.8\% |
| BHAR (0) |  | 55.5\% | 27.6\% | 18.8\% | 14.0\% | 40.5\% | 27.8\% | 19.1\% | 14.4\% | 34.6\% | 23.3\% | 18.9\% | 14.9\% | 30.6\% | 21.7\% | 17.2\% | 15.0\% |
| BHAR (1) |  | 56.0\% | 27.9\% | 19.0\% | 14.2\% | 40.9\% | 28.0\% | 19.2\% | 14.6\% | 34.7\% | 23.7\% | 19.0\% | 14.9\% | 30.9\% | 21.9\% | 17.4\% | 15.1\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 54.5\% | 27.1\% | 18.5\% | 14.2\% | 40.3\% | 27.6\% | 18.7\% | 14.3\% | 34.0\% | 23.7\% | 18.9\% | 14.2\% | 30.2\% | 21.4\% | 17.0\% | 14.3\% |
| CAR (1) |  | 54.8\% | 27.2\% | 18.6\% | 14.2\% | 40.5\% | 27.8\% | 18.8\% | 14.3\% | 34.2\% | 23.8\% | 19.0\% | 14.3\% | 30.4\% | 21.5\% | 17.1\% | 14.3\% |
| BHAR (0) |  | 54.4\% | 26.6\% | 18.4\% | 14.1\% | 40.1\% | 27.4\% | 18.8\% | 14.2\% | $34.1 \%$ | 23.4\% | 18.7\% | 14.2\% | 30.4\% | 21.2\% | 17.1\% | 14.5\% |
| BHAR (1) |  | 54.7\% | 26.8\% | 18.5\% | 14.0\% | 40.4\% | 27.7\% | 18.8\% | 14.4\% | 34.4\% | 23.7\% | 18.8\% | 14.2\% | 30.6\% | 21.3\% | 17.2\% | 14.6\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 53.6\% | 26.8\% | 18.6\% | 14.2\% | 39.4\% | 27.4\% | 18.6\% | 14.2\% | 33.8\% | 23.6\% | 18.9\% | 14.5\% | 29.3\% | 20.9\% | 17.0\% | 14.5\% |
| CAR (1) |  | 54.2\% | 27.0\% | 18.8\% | 14.4\% | 39.8\% | 27.7\% | 18.8\% | 14.4\% | $34.2 \%$ | 23.8\% | 19.1\% | 14.7\% | 29.7\% | 21.1\% | 17.1\% | 14.7\% |
| BHAR (0) |  | 52.8\% | 27.1\% | 18.4\% | 13.7\% | 39.0\% | 27.2\% | 18.7\% | 13.4\% | 34.7\% | 24.3\% | 18.7\% | 15.0\% | 29.2\% | 20.9\% | 17.0\% | 14.4\% |
| BHAR (1) |  | 53.2\% | 27.3\% | 18.6\% | 14.0\% | 39.6\% | 27.5\% | 19.3\% | 13.8\% | 35.2\% | 25.0\% | 19.2\% | 15.2\% | 29.3\% | 20.8\% | 17.2\% | 14.6\% |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 55.6\% | 27.8\% | 19.0\% | 14.4\% | 40.8\% | 28.3\% | 19.2\% | 14.5\% | 34.8\% | $24.2 \%$ | 19.4\% | 14.6\% | 30.6\% | 21.6\% | 17.3\% | 14.6\% |
| CAR (1) |  | 55.9\% | 28.0\% | 19.1\% | 14.5\% | 41.1\% | 28.5\% | 19.3\% | 14.5\% | 35.0\% | 24.3\% | 19.5\% | 14.6\% | 30.8\% | 21.8\% | 17.4\% | 14.6\% |
| BHAR (0) |  | 55.4\% | 27.7\% | 18.5\% | 14.2\% | 40.6\% | 28.2\% | 19.0\% | 14.1\% | 35.0\% | 23.9\% | 19.0\% | 14.6\% | 30.7\% | 21.7\% | 17.2\% | 15.1\% |
| BHAR (1) |  | 55.7\% | 27.9\% | 18.6\% | 14.3\% | 40.9\% | 28.4\% | 19.1\% | 14.3\% | 35.2\% | 24.3\% | 19.1\% | 14.7\% | 30.9\% | 21.9\% | 17.3\% | 15.1\% |


| EW J = |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 54.0\% | 27.1\% | 18.5\% | 14.2\% | 38.9\% | 26.8\% | 18.0\% | 13.9\% | $32.3 \%$ | 22.1\% | 17.7\% | 13.5\% | 27.9\% | 19.5\% | 15.7\% | 13.4\% |
| CAR (1) | 54.5\% | 27.3\% | 18.6\% | 14.3\% | 39.2\% | 27.0\% | 18.2\% | 14.0\% | 32.5\% | $22.2 \%$ | 17.8\% | 13.7\% | 28.2\% | 19.6\% | 15.8\% | 13.6\% |
| BHAR (0) | 53.5\% | 26.6\% | 17.8\% | 13.7\% | 38.9\% | 26.7\% | 17.4\% | 13.7\% | $32.2 \%$ | 21.7\% | 17.2\% | 13.3\% | 28.4\% | 19.3\% | 15.5\% | 13.7\% |
| BHAR (1) | 54.1\% | 26.8\% | 17.9\% | 13.8\% | 39.4\% | 27.0\% | 17.5\% | 14.0\% | 32.6\% | 22.0\% | 17.4\% | 13.4\% | 28.7\% | 19.4\% | 15.6\% | 13.8\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 55.2\% | 27.6\% | 18.3\% | 13.8\% | 40.9\% | 27.9\% | 18.4\% | 13.8\% | 34.2\% | 23.5\% | 18.7\% | 13.9\% | 30.1\% | 21.0\% | 16.8\% | 14.1\% |
| CAR (1) | 55.4\% | 27.7\% | 18.4\% | 13.8\% | 41.1\% | 28.0\% | 18.5\% | 13.8\% | 34.3\% | 23.6\% | 18.7\% | 14.0\% | 30.2\% | 21.1\% | 16.8\% | 14.1\% |
| BHAR (0) | 55.2\% | 26.8\% | 17.8\% | 13.6\% | 40.7\% | 27.8\% | 18.0\% | 13.7\% | 34.3\% | 23.3\% | 18.1\% | 14.0\% | 30.2\% | 21.0\% | 16.5\% | 14.4\% |
| BHAR (1) | 55.4\% | 26.9\% | 17.9\% | 13.6\% | 40.8\% | 27.8\% | 18.1\% | 13.8\% | 34.5\% | 23.6\% | 18.2\% | 14.0\% | 30.3\% | 21.1\% | 16.5\% | 14.4\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 52.3\% | 26.4\% | 18.2\% | 13.9\% | 37.4\% | 26.1\% | 18.0\% | 13.9\% | 30.6\% | 21.7\% | 17.8\% | 13.7\% | 26.9\% | 19.3\% | 15.9\% | 13.8\% |
| CAR (1) | 52.8\% | 26.7\% | 18.4\% | 14.0\% | 37.7\% | 26.4\% | 18.2\% | 14.0\% | 30.9\% | 21.9\% | 18.0\% | 13.8\% | 27.1\% | 19.6\% | 16.1\% | 13.9\% |
| BHAR (0) | 51.8\% | 26.2\% | 17.8\% | 13.5\% | 37.7\% | 25.5\% | 17.4\% | 13.4\% | 30.9\% | 21.4\% | 17.4\% | 13.8\% | 27.3\% | 18.9\% | 16.1\% | 13.8\% |
| BHAR (1) | 52.2\% | 26.5\% | 17.9\% | 13.5\% | 38.0\% | 25.7\% | 17.5\% | 13.5\% | 31.2\% | 21.7\% | 17.5\% | 14.0\% | 27.5\% | 19.0\% | 16.3\% | 13.9\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 52.1\% | 26.9\% | 18.7\% | 14.2\% | 37.8\% | 26.9\% | 18.4\% | 13.9\% | 31.8\% | 22.6\% | 18.0\% | 13.7\% | 27.3\% | 19.7\% | 16.0\% | 13.6\% |
| CAR (1) | 52.7\% | 27.1\% | 18.8\% | 14.3\% | 38.3\% | 27.2\% | 18.6\% | 14.0\% | 32.3\% | 22.8\% | 18.1\% | 13.8\% | 27.7\% | 19.9\% | 16.1\% | 13.7\% |
| BHAR (0) | 52.4\% | 26.1\% | 18.8\% | 13.9\% | 37.3\% | 27.5\% | 18.0\% | 13.9\% | 31.7\% | 21.3\% | 18.0\% | 13.5\% | 27.1\% | 19.2\% | 15.7\% | 13.4\% |
| BHAR (1) | 53.0\% | 26.4\% | 19.1\% | 14.3\% | 37.5\% | 27.5\% | 18.2\% | 14.0\% | 31.9\% | 21.5\% | 17.9\% | 13.6\% | 27.1\% | 19.5\% | 15.8\% | 13.7\% |


| EW J = |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 53.6\% | 27.7\% | 19.0\% | 14.6\% | 39.6\% | 27.5\% | 18.9\% | 14.4\% | 32.8\% | 23.3\% | 19.0\% | 14.6\% | 29.0\% | 21.3\% | 17.3\% | 14.6\% |
| CAR (1) | 54.1\% | 28.1\% | 19.1\% | 14.7\% | 40.0\% | 27.8\% | 19.1\% | 14.5\% | 33.3\% | 23.6\% | 19.1\% | 14.7\% | 29.4\% | 21.5\% | 17.4\% | 14.7\% |
| BHAR (0) | 53.0\% | 27.4\% | 18.4\% | 13.8\% | 39.6\% | 27.0\% | 18.8\% | 13.6\% | 32.6\% | 23.2\% | 18.1\% | 14.1\% | 28.9\% | 21.3\% | 16.6\% | 15.1\% |
| BHAR (1) | 53.5\% | 27.6\% | 18.7\% | 13.8\% | 39.9\% | 27.4\% | 19.0\% | 14.0\% | 32.9\% | 23.6\% | 18.3\% | 14.2\% | 29.3\% | 21.6\% | 16.8\% | 15.2\% |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 54.9\% | 27.6\% | 18.7\% | 14.3\% | 40.5\% | 27.6\% | 18.6\% | 14.3\% | 33.3\% | 23.1\% | 18.5\% | 14.0\% | 29.8\% | 20.7\% | 16.5\% | 14.1\% |
| CAR (1) | 55.4\% | 28.0\% | 18.9\% | 14.5\% | 40.8\% | 27.8\% | 18.8\% | 14.4\% | 33.6\% | 23.3\% | 18.6\% | 14.1\% | 30.0\% | 20.8\% | 16.6\% | 14.2\% |
| BHAR (0) | 54.8\% | 27.6\% | 18.2\% | 14.4\% | 40.5\% | 26.6\% | 18.7\% | 14.1\% | 33.0\% | $22.5 \%$ | 18.0\% | 13.2\% | 29.8\% | 21.0\% | 16.2\% | $14.1 \%$ |
| BHAR (1) | 55.3\% | 27.8\% | 18.2\% | 14.5\% | 40.6\% | 26.7\% | 18.7\% | 14.1\% | 33.1\% | 22.7\% | 18.1\% | 13.3\% | 29.9\% | 21.1\% | 16.3\% | 14.1\% |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 55.0\% | 27.2\% | 18.4\% | 14.2\% | 39.9\% | 27.4\% | 18.7\% | 14.2\% | 33.7\% | 23.5\% | 18.8\% | 14.3\% | 30.2\% | 21.1\% | 17.0\% | 14.3\% |
| CAR (1) | 55.3\% | 27.3\% | 18.5\% | 14.3\% | 40.2\% | 27.6\% | 18.7\% | 14.3\% | 33.9\% | 23.6\% | 18.8\% | 14.3\% | 30.3\% | 21.2\% | 17.0\% | 14.4\% |
| BHAR (0) | 55.2\% | 26.9\% | 17.9\% | 14.0\% | 39.6\% | 27.5\% | 18.6\% | 13.8\% | 33.3\% | 23.1\% | 18.4\% | 14.1\% | 30.1\% | 21.0\% | 16.7\% | 14.7\% |
| BHAR (1) | 55.4\% | 27.0\% | 18.0\% | 14.0\% | 39.8\% | 27.6\% | 18.6\% | 14.0\% | 33.4\% | 23.5\% | 18.5\% | 14.2\% | 30.3\% | 21.1\% | 16.9\% | 14.8\% |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\overline{\text { CAR (0) }}$ | 53.3\% | 27.0\% | 18.1\% | 13.7\% | 38.6\% | 26.6\% | 17.7\% | 13.3\% | $32.1 \%$ | 22.3\% | 17.7\% | 13.2\% | 27.6\% | 19.2\% | 15.4\% | 13.0\% |
| CAR (1) | 53.6\% | 27.1\% | 18.2\% | 13.7\% | 38.8\% | 26.7\% | 17.8\% | 13.4\% | 32.2\% | 22.4\% | 17.8\% | 13.3\% | 27.7\% | 19.3\% | 15.5\% | 13.1\% |
| BHAR (0) | 53.9\% | 26.4\% | 18.0\% | 13.3\% | 38.8\% | 26.1\% | 17.3\% | 13.6\% | 32.0\% | 21.9\% | 17.2\% | 13.5\% | 27.5\% | 18.8\% | 15.0\% | 12.9\% |
| BHAR (1) | 54.2\% | 26.5\% | 18.0\% | 13.3\% | 38.9\% | 26.1\% | 17.3\% | 13.8\% | $32.1 \%$ | 22.2\% | 17.2\% | 13.5\% | 27.6\% | 19.0\% | 15.0\% | 13.0\% |


| EW | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 52.8\% | 27.1\% | 18.8\% | 14.4\% | 39.3\% | 27.2\% | 18.7\% | 14.6\% | 32.4\% | 23.0\% | 18.8\% | 14.6\% | 28.3\% | 20.6\% | 17.0\% | 14.5\% |
| CAR (1) |  | 53.3\% | 27.3\% | 18.9\% | 14.5\% | 39.7\% | 27.5\% | 18.9\% | 14.7\% | 32.7\% | 23.2\% | 19.0\% | 14.7\% | 28.6\% | 20.8\% | 17.2\% | 14.7\% |
| BHAR (0) |  | 52.3\% | 27.1\% | 18.9\% | 14.2\% | 39.0\% | 27.0\% | 18.4\% | 14.4\% | 32.7\% | 23.2\% | 18.4\% | 14.3\% | 28.5\% | 20.4\% | 17.0\% | 14.7\% |
| BHAR (1) |  | 52.8\% | 27.5\% | 19.2\% | 14.4\% | 39.4\% | 27.3\% | 18.7\% | 14.7\% | 33.1\% | 23.7\% | 18.6\% | 14.5\% | 28.9\% | 20.6\% | 17.1\% | 14.8\% |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 52.2\% | 26.4\% | 18.2\% | 13.8\% | 37.4\% | 26.3\% | 17.9\% | 13.7\% | 31.0\% | 21.7\% | 17.7\% | 13.6\% | 26.3\% | 18.9\% | 15.6\% | 13.4\% |
| CAR (1) |  | 52.5\% | 26.5\% | 18.3\% | 13.9\% | 37.7\% | 26.5\% | 18.0\% | 13.7\% | 31.1\% | 21.8\% | 17.8\% | 13.6\% | 26.4\% | 19.0\% | 15.7\% | 13.5\% |
| BHAR (0) |  | 52.2\% | 26.2\% | 18.4\% | 13.6\% | 37.6\% | 26.5\% | 17.7\% | 13.4\% | 31.3\% | 22.0\% | 17.4\% | 13.9\% | 26.1\% | 18.5\% | 15.2\% | 13.3\% |
| BHAR (1) |  | 52.5\% | 26.5\% | 18.5\% | 13.7\% | 37.8\% | 26.6\% | 17.8\% | 13.6\% | 31.4\% | 22.2\% | 17.5\% | 13.9\% | 26.2\% | 18.7\% | 15.3\% | 13.3\% |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 51.8\% | 26.9\% | 18.9\% | 14.6\% | 37.6\% | 27.0\% | 18.9\% | 14.8\% | 31.5\% | 23.0\% | 19.1\% | 14.8\% | 27.8\% | 20.6\% | 17.2\% | 14.9\% |
| CAR (1) |  | 52.4\% | 27.3\% | 19.1\% | 14.8\% | 38.0\% | 27.4\% | 19.2\% | 14.9\% | 32.0\% | 23.4\% | 19.3\% | 15.0\% | 28.2\% | 20.9\% | 17.4\% | 15.1\% |
| BHAR (0) |  | 51.9\% | 26.7\% | 18.8\% | 14.6\% | 37.6\% | 27.0\% | 19.0\% | 14.6\% | 31.6\% | 22.9\% | 18.8\% | 14.8\% | 27.9\% | 20.5\% | 17.0\% | 15.2\% |
| BHAR (1) |  | 52.6\% | 27.1\% | 19.0\% | 14.7\% | 38.2\% | 27.4\% | 19.2\% | 14.9\% | 32.1\% | 23.3\% | 19.1\% | 14.9\% | 28.4\% | 20.9\% | 17.2\% | 15.4\% |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 53.8\% | 27.1\% | 18.4\% | 14.2\% | 39.4\% | 27.4\% | 18.6\% | 14.3\% | 32.8\% | 23.1\% | 18.8\% | 14.4\% | 29.2\% | 20.7\% | 16.9\% | 14.5\% |
| CAR (1) |  | 54.1\% | 27.3\% | 18.6\% | 14.3\% | 39.7\% | 27.6\% | 18.7\% | 14.4\% | 33.1\% | 23.3\% | 18.9\% | 14.5\% | 29.4\% | 20.9\% | 17.0\% | 14.6\% |
| BHAR (0) |  | 53.8\% | 26.3\% | 18.0\% | 13.8\% | 39.2\% | 27.2\% | 18.4\% | 14.1\% | 32.7\% | 22.7\% | 18.4\% | 14.2\% | 29.1\% | 20.5\% | 16.7\% | 14.6\% |
| BHAR (1) |  | 54.1\% | 26.6\% | 18.1\% | 13.9\% | 39.5\% | 27.4\% | 18.5\% | 14.3\% | 33.0\% | 23.0\% | 18.5\% | 14.4\% | 29.3\% | 20.6\% | 16.9\% | 14.7\% |


| MW | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.7\% | 29.2\% | 19.6\% | 14.8\% | 48.4\% | 29.5\% | 19.7\% | 14.9\% | 44.3\% | 26.7\% | 19.7\% | 14.8\% | $39.5 \%$ | 24.5\% | 18.5\% | 14.5\% |
| CAR (1) |  | 60.0\% | 29.2\% | 19.7\% | 14.8\% | 48.6\% | 29.6\% | 19.7\% | 14.9\% | 44.3\% | 26.8\% | 19.7\% | 14.7\% | 39.4\% | 24.7\% | 18.5\% | 14.6\% |
| BHAR (0) |  | 58.8\% | 28.4\% | 19.6\% | 14.1\% | 48.3\% | 30.0\% | 19.4\% | 14.9\% | 43.8\% | 26.3\% | 19.6\% | 14.9\% | 40.4\% | 22.5\% | 18.5\% | 14.3\% |
| BHAR (1) |  | 59.2\% | 28.3\% | 19.6\% | 14.1\% | 48.6\% | $30.1 \%$ | 19.1\% | 15.1\% | 44.1\% | 26.6\% | 19.7\% | 14.8\% | 40.1\% | 23.2\% | 18.6\% | 14.4\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.1\% | 29.6\% | 19.5\% | 14.6\% | 48.3\% | 29.7\% | 19.6\% | 14.5\% | 42.6\% | 26.8\% | 19.8\% | 14.7\% | 38.8\% | 24.6\% | 18.5\% | 14.9\% |
| CAR (1) |  | 59.4\% | 29.7\% | 19.5\% | 14.5\% | 48.7\% | 29.8\% | 19.6\% | 14.5\% | 43.0\% | 26.9\% | 19.8\% | 14.7\% | 39.3\% | 24.8\% | 18.6\% | 14.9\% |
| BHAR (0) |  | 59.4\% | 28.4\% | 19.1\% | 14.2\% | 48.2\% | $30.1 \%$ | 19.4\% | 14.1\% | 42.8\% | 26.5\% | 19.3\% | 14.5\% | 38.3\% | 24.6\% | 18.3\% | 15.2\% |
| BHAR (1) |  | 59.5\% | 28.5\% | 19.1\% | 14.2\% | 48.4\% | 30.2\% | 19.4\% | 14.3\% | 43.2\% | 26.9\% | 19.4\% | 14.5\% | 38.6\% | 24.7\% | 18.4\% | 15.2\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.7\% | 30.6\% | 19.8\% | 14.9\% | 50.7\% | 30.7\% | 20.4\% | 15.0\% | 44.8\% | 27.8\% | 20.5\% | 15.3\% | 43.3\% | 26.2\% | 19.1\% | 15.2\% |
| CAR (1) |  | 60.8\% | 30.7\% | 19.8\% | 14.9\% | 51.0\% | 30.8\% | 20.5\% | 15.0\% | 45.2\% | 27.9\% | 20.5\% | 15.3\% | 43.6\% | 26.4\% | 19.1\% | 15.2\% |
| BHAR (0) |  | 61.4\% | 30.4\% | 19.6\% | 13.9\% | 50.8\% | 31.0\% | 20.0\% | 14.0\% | 47.7\% | 27.9\% | 20.7\% | 15.3\% | 41.8\% | 24.8\% | 18.9\% | 15.0\% |
| BHAR (1) |  | 61.4\% | 30.7\% | 19.7\% | 13.9\% | 51.0\% | 31.2\% | 20.0\% | 14.0\% | 48.1\% | 28.1\% | 20.7\% | 15.2\% | 42.2\% | 24.9\% | 18.9\% | 14.9\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.5\% | 29.9\% | 19.9\% | 14.7\% | 48.0\% | 29.6\% | 19.4\% | 14.4\% | 41.3\% | 26.1\% | 19.0\% | 14.3\% | 38.5\% | 23.6\% | 17.9\% | 14.3\% |
| CAR (1) |  | 59.7\% | 29.9\% | 19.9\% | 14.7\% | 48.4\% | 29.7\% | 19.5\% | 14.4\% | 41.6\% | 26.4\% | 19.0\% | 14.3\% | 38.7\% | 23.7\% | 17.9\% | 14.3\% |
| BHAR (0) |  | 60.2\% | 29.2\% | 20.5\% | 14.3\% | 47.0\% | 29.9\% | 19.7\% | 14.9\% | 42.3\% | 25.3\% | 18.4\% | 14.9\% | 40.8\% | 23.8\% | 18.3\% | 14.5\% |
| BHAR (1) |  | 60.3\% | 29.4\% | 20.6\% | 14.3\% | 47.3\% | 30.0\% | 19.7\% | 14.9\% | 42.4\% | 25.8\% | 18.4\% | 14.8\% | 41.1\% | 23.9\% | 18.3\% | 14.3\% |


| MW | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.4\% | 29.8\% | 19.6\% | 15.0\% | 49.0\% | 29.6\% | 19.9\% | 14.7\% | 43.1\% | 26.9\% | 19.8\% | 14.8\% | 38.0\% | 24.3\% | 18.1\% | 14.6\% |
| CAR (1) |  | 59.8\% | 29.8\% | 19.6\% | 14.9\% | 49.4\% | 29.7\% | 20.0\% | 14.7\% | 43.4\% | 27.0\% | 19.8\% | 14.7\% | 38.4\% | 24.4\% | 18.1\% | 14.6\% |
| BHAR (0) |  | 58.8\% | 29.2\% | 17.6\% | 14.3\% | 48.9\% | 28.9\% | 19.1\% | 13.9\% | 43.7\% | 26.6\% | 19.9\% | 14.7\% | 37.8\% | 24.3\% | 18.4\% | 14.7\% |
| BHAR (1) |  | 59.2\% | 29.4\% | 17.6\% | 14.3\% | 49.2\% | 29.0\% | 19.0\% | 14.1\% | 44.1\% | 26.8\% | 20.0\% | 14.8\% | 38.0\% | 24.3\% | 18.4\% | 14.7\% |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.0\% | 28.8\% | 19.6\% | 15.0\% | 49.7\% | 29.5\% | 19.8\% | 14.8\% | 43.2\% | 26.0\% | 19.5\% | 14.8\% | 39.8\% | 24.5\% | 18.0\% | 14.6\% |
| CAR (1) |  | 58.3\% | 29.0\% | 19.6\% | 14.9\% | 50.0\% | 29.6\% | 19.8\% | 14.8\% | 43.5\% | 26.2\% | 19.5\% | 14.8\% | 40.3\% | 24.6\% | 18.0\% | 14.6\% |
| BHAR (0) |  | 57.1\% | 27.7\% | 20.0\% | 14.1\% | 49.7\% | 29.0\% | 19.0\% | 14.2\% | 43.6\% | 25.3\% | 18.8\% | 15.0\% | 39.5\% | 23.8\% | 18.7\% | 14.8\% |
| BHAR (1) |  | 57.4\% | 28.0\% | 20.0\% | 14.0\% | 50.3\% | 29.0\% | 19.0\% | 14.2\% | 44.4\% | 25.5\% | 18.9\% | 15.0\% | 39.9\% | 23.8\% | 18.8\% | 14.8\% |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 59.5\% | $30.1 \%$ | 19.8\% | 15.2\% | 48.4\% | $30.1 \%$ | 20.3\% | 15.4\% | 43.9\% | 27.7\% | 20.5\% | 15.3\% | 41.5\% | 25.6\% | 19.2\% | 15.2\% |
| CAR (1) |  | 59.8\% | 30.1\% | 19.8\% | 15.1\% | 48.8\% | $30.2 \%$ | 20.3\% | 15.3\% | 44.3\% | 27.8\% | 20.5\% | 15.2\% | 41.8\% | 25.7\% | 19.2\% | 15.2\% |
| BHAR (0) |  | 60.7\% | 29.6\% | 19.2\% | 15.2\% | 48.8\% | 30.4\% | 19.9\% | 14.8\% | 43.3\% | 27.6\% | 19.8\% | 15.5\% | 41.3\% | 26.6\% | 19.5\% | 15.6\% |
| BHAR (1) |  | 60.9\% | 29.9\% | 19.2\% | 15.2\% | 49.0\% | 30.5\% | 19.9\% | 15.0\% | 43.6\% | 27.6\% | 19.9\% | 15.5\% | 41.6\% | 26.8\% | 19.5\% | 15.6\% |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.9\% | 29.6\% | 19.9\% | 14.8\% | 48.4\% | 30.1\% | 20.0\% | 14.6\% | 43.2\% | 27.1\% | 20.1\% | 14.8\% | 40.5\% | 25.1\% | 18.9\% | 14.8\% |
| CAR (1) |  | 59.2\% | 29.6\% | 19.9\% | 14.8\% | 49.0\% | 30.2\% | 20.0\% | 14.6\% | 43.8\% | 27.4\% | 20.1\% | 14.8\% | 41.3\% | 25.3\% | 19.0\% | 14.8\% |
| BHAR (0) |  | 59.1\% | 28.5\% | 19.9\% | 14.2\% | 49.4\% | 30.5\% | 20.1\% | 15.1\% | 43.4\% | 26.9\% | 19.2\% | 14.3\% | 39.6\% | 24.8\% | 18.0\% | 14.9\% |
| BHAR (1) |  | 59.4\% | 28.6\% | 19.8\% | 14.1\% | 49.6\% | 30.6\% | 20.0\% | 15.0\% | 44.1\% | 27.2\% | 19.2\% | 14.3\% | 39.9\% | 24.7\% | 18.1\% | 15.0\% |


| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.7\% | 30.6\% | 20.6\% | 15.5\% | 51.1\% | 31.0\% | 20.6\% | 15.4\% | 47.2\% | 28.6\% | 20.7\% | 15.4\% | 42.1\% | 26.3\% | 19.5\% | 15.3\% |
| CAR (1) |  | 60.9\% | 30.7\% | 20.6\% | 15.5\% | 51.6\% | 31.1\% | 20.6\% | 15.4\% | 47.6\% | 28.8\% | 20.7\% | 15.4\% | 42.6\% | 26.5\% | 19.5\% | 15.3\% |
| BHAR (0) |  | 60.9\% | 30.3\% | 20.1\% | 14.9\% | 51.6\% | 31.1\% | 20.2\% | 14.7\% | 47.1\% | 27.7\% | 20.2\% | 15.3\% | 43.2\% | 26.4\% | 20.0\% | 15.6\% |
| BHAR (1) |  | 61.1\% | 30.4\% | 20.1\% | 14.8\% | 52.1\% | 31.1\% | 20.1\% | 14.8\% | 47.4\% | 27.8\% | 20.4\% | 15.3\% | 43.5\% | 26.5\% | 20.0\% | 15.5\% |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.2\% | 29.6\% | 19.6\% | 14.8\% | 49.5\% | 29.5\% | 19.4\% | 14.8\% | 42.2\% | 25.7\% | 19.7\% | 14.8\% | 38.0\% | 23.6\% | 18.1\% | 14.7\% |
| CAR (1) |  | 60.4\% | 29.6\% | 19.6\% | 14.8\% | 49.7\% | 29.6\% | 19.5\% | 14.8\% | 42.6\% | 25.8\% | 19.7\% | 14.8\% | 38.3\% | 23.7\% | 18.2\% | 14.7\% |
| BHAR (0) |  | 60.6\% | 28.8\% | 20.4\% | 14.6\% | 50.1\% | 29.5\% | 18.2\% | 14.3\% | 42.8\% | 25.7\% | 19.3\% | 14.5\% | 39.3\% | 21.8\% | 18.2\% | 14.1\% |
| BHAR (1) |  | 60.7\% | 28.9\% | 20.3\% | 14.6\% | 50.3\% | 29.6\% | 18.3\% | 14.3\% | 43.2\% | 26.1\% | 19.4\% | 14.6\% | 39.6\% | 21.9\% | 18.2\% | 14.1\% |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 61.3\% | 30.6\% | 20.4\% | 15.2\% | 52.2\% | 30.6\% | 20.3\% | 15.4\% | 46.4\% | 27.8\% | 20.5\% | 15.3\% | 42.7\% | 26.0\% | 19.4\% | 15.4\% |
| CAR (1) |  | 61.5\% | 30.6\% | 20.4\% | 15.2\% | 52.5\% | 30.7\% | 20.3\% | 15.4\% | 47.0\% | 27.9\% | 20.5\% | 15.3\% | 43.2\% | 26.1\% | 19.3\% | 15.4\% |
| BHAR (0) |  | 61.6\% | 31.1\% | 20.3\% | 14.7\% | 52.6\% | 30.2\% | 20.6\% | 15.3\% | 46.0\% | 27.6\% | 20.2\% | 15.3\% | 43.0\% | 25.1\% | 19.4\% | 15.8\% |
| BHAR (1) |  | 61.8\% | 31.1\% | 20.3\% | 14.7\% | 53.1\% | 30.2\% | 20.6\% | 15.3\% | 46.6\% | 27.9\% | 20.2\% | 15.3\% | 43.3\% | 25.2\% | 19.4\% | 15.8\% |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 60.1\% | 29.8\% | 19.9\% | 15.0\% | 48.9\% | 30.2\% | 19.9\% | 15.0\% | 42.2\% | 26.7\% | 20.0\% | 15.0\% | 39.0\% | 24.8\% | 18.6\% | 14.9\% |
| CAR (1) |  | 60.5\% | 29.9\% | 19.9\% | 14.9\% | 49.4\% | 30.3\% | 19.9\% | 15.0\% | 42.7\% | 26.8\% | 20.0\% | 14.9\% | 39.5\% | 24.9\% | 18.6\% | 14.9\% |
| BHAR (0) |  | 60.2\% | 28.9\% | 19.6\% | 14.0\% | 48.8\% | 30.4\% | 20.2\% | 14.2\% | 42.0\% | 25.8\% | 19.7\% | 14.6\% | 39.1\% | 24.6\% | 18.2\% | 15.0\% |
| BHAR (1) |  | 60.6\% | 28.9\% | 19.6\% | 14.0\% | 49.3\% | 30.5\% | 20.2\% | 14.3\% | 42.6\% | 26.1\% | 19.8\% | 14.6\% | 39.7\% | 24.7\% | 18.3\% | 15.0\% |


| IVOL $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 57.3\% | 28.4\% | 19.2\% | 14.4\% | 43.9\% | 28.2\% | 19.0\% | 14.3\% | 37.7\% | 24.8\% | 19.1\% | 14.4\% | 34.0\% | 22.6\% | 17.6\% | 14.4\% |
| CAR (1) | 58.1\% | 28.7\% | 19.4\% | 14.5\% | 44.4\% | 28.4\% | 19.1\% | 14.3\% | 38.2\% | 24.9\% | 19.1\% | 14.4\% | 34.3\% | 22.6\% | 17.5\% | 14.3\% |
| BHAR (0) | 57.2\% | 28.1\% | 18.9\% | 14.1\% | 43.9\% | 28.5\% | 19.0\% | 13.9\% | 37.5\% | 24.5\% | 18.8\% | 14.1\% | 34.1\% | 22.5\% | 17.2\% | 14.6\% |
| BHAR (1) | 57.7\% | 28.5\% | 19.0\% | 14.2\% | 45.4\% | 28.7\% | 19.3\% | 14.0\% | 37.6\% | 24.7\% | 18.8\% | 14.1\% | $34.1 \%$ | 22.6\% | 17.2\% | 14.6\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 56.7\% | 28.8\% | 19.0\% | 14.2\% | 45.7\% | 28.7\% | 18.7\% | 14.0\% | 38.4\% | 24.9\% | 18.7\% | 14.0\% | 34.1\% | 22.1\% | 17.0\% | 14.0\% |
| CAR (1) | 57.4\% | 29.1\% | 19.1\% | 14.3\% | 46.5\% | 28.8\% | 18.8\% | 14.0\% | 38.3\% | 24.8\% | 18.6\% | 14.0\% | 34.3\% | 22.1\% | 17.0\% | 14.0\% |
| BHAR (0) | 56.9\% | 29.5\% | 18.7\% | 14.6\% | 45.8\% | 29.2\% | 18.6\% | 14.2\% | 38.7\% | 24.3\% | 18.5\% | 14.1\% | 34.4\% | 22.0\% | 17.3\% | 14.2\% |
| BHAR (1) | 57.8\% | 30.1\% | 18.9\% | 14.6\% | 46.3\% | 29.2\% | 18.6\% | 14.4\% | 38.2\% | 24.2\% | 18.5\% | 14.2\% | 34.0\% | 22.0\% | 17.3\% | 14.2\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 56.9\% | 28.4\% | 18.9\% | 14.3\% | 42.5\% | 27.5\% | 18.2\% | 13.7\% | 34.6\% | 22.9\% | 17.9\% | 13.4\% | 30.8\% | 20.3\% | 16.1\% | 13.4\% |
| CAR (1) | 57.3\% | 28.5\% | 19.1\% | 14.3\% | 43.1\% | 27.6\% | 18.3\% | 13.7\% | 35.2\% | 23.1\% | 17.9\% | 13.4\% | 30.7\% | 20.2\% | 16.0\% | 13.4\% |
| BHAR (0) | 56.6\% | 28.5\% | 19.2\% | 14.1\% | 42.9\% | 27.6\% | 18.1\% | 13.8\% | 35.4\% | 22.8\% | 17.6\% | 13.7\% | 31.5\% | 20.7\% | 15.9\% | 13.9\% |
| BHAR (1) | 57.2\% | 28.4\% | 19.0\% | 14.3\% | 43.9\% | 28.0\% | 18.2\% | 14.2\% | 36.4\% | 23.4\% | 17.7\% | 14.0\% | 31.3\% | 20.5\% | 15.9\% | 14.1\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 55.8\% | 27.9\% | 18.7\% | 14.0\% | 43.0\% | 27.9\% | 18.7\% | 14.0\% | 36.0\% | 24.1\% | 18.7\% | 14.2\% | 32.0\% | 22.1\% | 17.2\% | 14.2\% |
| CAR (1) | 56.0\% | 28.0\% | 18.8\% | 14.0\% | 43.3\% | 28.0\% | 18.7\% | 14.0\% | 36.5\% | 24.2\% | 18.8\% | 14.2\% | 32.2\% | 22.1\% | 17.2\% | 14.2\% |
| BHAR (0) | 55.6\% | 27.7\% | 18.4\% | 14.0\% | 43.6\% | 28.0\% | 18.6\% | 14.0\% | 36.8\% | 24.4\% | 18.5\% | 14.1\% | 32.7\% | 22.6\% | 17.3\% | 14.5\% |
| BHAR (1) | 56.0\% | 27.9\% | 18.5\% | 14.0\% | 43.8\% | 28.1\% | 18.6\% | 14.1\% | 37.0\% | 24.6\% | 18.6\% | 14.2\% | 32.8\% | 22.6\% | 17.3\% | 14.6\% |



| IVOL | J = | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.5\% | 28.2\% | 19.0\% | 14.4\% | 42.5\% | 28.0\% | 18.9\% | 14.2\% | 36.0\% | 23.9\% | 18.8\% | 14.2\% | 32.0\% | 21.9\% | 17.2\% | 14.2\% |
| CAR (1) |  | 56.8\% | 28.3\% | 19.0\% | 14.4\% | 42.6\% | 28.1\% | 19.0\% | 14.2\% | 36.2\% | 24.0\% | 18.8\% | 14.2\% | 32.2\% | 22.0\% | 17.2\% | 14.2\% |
| BHAR (0) |  | 56.8\% | 27.9\% | 18.9\% | 14.2\% | 42.5\% | 27.9\% | 18.9\% | 14.0\% | 36.6\% | 23.5\% | 18.5\% | 14.1\% | 32.6\% | 22.1\% | 17.0\% | 14.6\% |
| BHAR (1) |  | 57.0\% | 28.0\% | 18.9\% | 14.2\% | 42.5\% | 27.9\% | 18.9\% | 14.0\% | 36.5\% | 23.7\% | 18.5\% | 14.1\% | 32.5\% | 21.9\% | 17.0\% | 14.5\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.1\% | 28.2\% | 19.0\% | 14.4\% | 43.9\% | 28.3\% | 19.0\% | 14.3\% | 37.5\% | 24.8\% | 19.1\% | 14.3\% | 33.5\% | 22.6\% | 17.5\% | 14.3\% |
| CAR (1) |  | 57.4\% | 28.3\% | 19.2\% | 14.4\% | 44.1\% | 28.3\% | 19.1\% | 14.3\% | 37.9\% | 25.0\% | 19.1\% | 14.3\% | 33.7\% | 22.7\% | 17.5\% | 14.3\% |
| BHAR (0) |  | 56.9\% | 27.7\% | 18.8\% | 14.1\% | 43.6\% | 28.1\% | 19.1\% | 14.2\% | 37.4\% | 24.5\% | 18.8\% | 14.2\% | 33.4\% | 22.4\% | 17.5\% | 14.5\% |
| BHAR (1) |  | 57.2\% | 28.0\% | 19.0\% | 14.2\% | 43.9\% | 28.2\% | 19.2\% | 14.3\% | 38.0\% | 24.8\% | 18.9\% | 14.2\% | 33.9\% | 22.5\% | 17.6\% | 14.5\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.1\% | 28.3\% | 19.3\% | 14.5\% | 45.9\% | 29.0\% | 19.3\% | 14.2\% | 40.3\% | 25.6\% | 19.3\% | 14.5\% | 34.4\% | 22.9\% | 17.8\% | 14.4\% |
| CAR (1) |  | 57.4\% | 28.4\% | 19.5\% | 14.6\% | 45.9\% | 29.0\% | 19.3\% | 14.3\% | 40.6\% | 25.8\% | 19.3\% | 14.6\% | 34.5\% | 22.9\% | 17.7\% | 14.4\% |
| BHAR (0) |  | 56.7\% | 28.4\% | 19.0\% | 14.1\% | 45.5\% | 29.2\% | 19.7\% | 13.8\% | 40.7\% | 25.4\% | 19.4\% | 14.6\% | 33.4\% | 22.7\% | 17.6\% | 14.8\% |
| BHAR (1) |  | 57.4\% | 28.7\% | 19.5\% | 14.3\% | 46.2\% | 29.1\% | 19.6\% | 13.9\% | 41.3\% | 25.7\% | 19.4\% | 14.6\% | 33.4\% | 22.9\% | 17.7\% | 14.8\% |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 58.6\% | 29.0\% | 19.5\% | 14.6\% | 44.6\% | 28.8\% | 19.3\% | 14.5\% | 38.8\% | 25.3\% | 19.4\% | 14.5\% | 34.3\% | 23.1\% | 17.7\% | 14.5\% |
| CAR (1) |  | 59.1\% | 29.3\% | 19.7\% | 14.7\% | 45.5\% | 29.0\% | 19.4\% | 14.5\% | 39.6\% | 25.5\% | 19.5\% | 14.5\% | 35.1\% | 23.2\% | 17.7\% | 14.5\% |
| BHAR (0) |  | 58.5\% | 28.9\% | 19.1\% | 14.5\% | 44.3\% | 28.8\% | 19.1\% | 14.1\% | 38.3\% | 25.0\% | 18.9\% | 14.5\% | 34.7\% | 22.6\% | 17.4\% | 14.9\% |
| BHAR (1) |  | 58.8\% | 29.3\% | 19.5\% | 14.6\% | 44.7\% | 28.9\% | 19.1\% | 14.3\% | 39.0\% | 25.2\% | 19.0\% | 14.5\% | 34.9\% | 22.9\% | 17.5\% | 14.9\% |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.1\% | 27.8\% | 18.7\% | 14.1\% | 41.9\% | 27.5\% | 18.3\% | 13.8\% | 35.1\% | 23.2\% | 18.0\% | 13.5\% | 30.6\% | 20.6\% | 16.1\% | 13.4\% |
| CAR (1) |  | 56.5\% | 27.9\% | 18.8\% | 14.1\% | 42.1\% | 27.6\% | 18.3\% | 13.8\% | 35.3\% | 23.2\% | 18.1\% | 13.5\% | 30.6\% | 20.6\% | 16.1\% | 13.4\% |
| BHAR (0) |  | 55.7\% | 27.5\% | 18.1\% | 13.7\% | 41.9\% | 27.3\% | 17.9\% | 13.6\% | 35.3\% | 22.7\% | 17.6\% | 13.3\% | 31.4\% | 20.5\% | 15.9\% | 13.7\% |
| BHAR (1) |  | 56.3\% | 27.6\% | 18.4\% | 13.6\% | 42.0\% | 27.4\% | 17.9\% | 13.7\% | 35.3\% | 22.8\% | 17.6\% | 13.2\% | 31.3\% | 20.5\% | 16.0\% | 13.7\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.3\% | 28.5\% | 18.8\% | 14.0\% | 43.8\% | 28.6\% | 18.8\% | 14.0\% | 36.8\% | 24.6\% | 19.0\% | 14.1\% | 32.5\% | $22.1 \%$ | 17.2\% | 14.2\% |
| CAR (1) |  | 57.4\% | 28.6\% | 18.9\% | 14.1\% | 43.9\% | 28.6\% | 18.8\% | 14.0\% | 36.8\% | 24.6\% | 19.0\% | 14.1\% | 32.6\% | 22.1\% | 17.2\% | 14.2\% |
| BHAR (0) |  | 57.3\% | 27.7\% | 18.3\% | 13.7\% | 43.6\% | $28.4 \%$ | 18.6\% | 13.9\% | 36.9\% | 24.3\% | 18.5\% | 14.1\% | 32.6\% | $22.1 \%$ | 16.9\% | 14.5\% |
| BHAR (1) |  | 57.5\% | 27.8\% | 18.4\% | 13.8\% | 43.6\% | 28.4\% | 18.6\% | 13.9\% | 36.9\% | 24.5\% | 18.5\% | 14.1\% | 32.7\% | $22.1 \%$ | 16.9\% | 14.5\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.4\% | 28.0\% | 18.8\% | 14.1\% | 42.5\% | 27.6\% | 18.5\% | 13.9\% | 36.0\% | 23.8\% | 18.4\% | 13.8\% | $31.7 \%$ | 21.4\% | 16.6\% | 13.8\% |
| CAR (1) |  | 56.6\% | 28.1\% | 18.9\% | 14.1\% | 42.8\% | 27.7\% | 18.5\% | 13.9\% | 36.4\% | 23.9\% | 18.4\% | 13.8\% | 32.0\% | 21.5\% | 16.6\% | 13.8\% |
| BHAR (0) |  | 55.8\% | 27.4\% | 18.4\% | 13.7\% | 42.9\% | 27.3\% | 18.3\% | 13.5\% | 36.4\% | 23.5\% | 18.0\% | 13.6\% | 31.8\% | 21.1\% | 16.7\% | 13.8\% |
| BHAR (1) |  | 56.2\% | 27.7\% | 18.7\% | 13.7\% | 43.2\% | 27.3\% | 18.4\% | 13.6\% | 36.6\% | 23.8\% | 17.8\% | 13.7\% | 31.9\% | 21.0\% | 16.7\% | 13.8\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 55.7\% | 28.0\% | 18.9\% | 14.1\% | 41.6\% | 27.6\% | 18.4\% | 13.6\% | 35.0\% | 23.6\% | 17.9\% | 13.5\% | 30.5\% | 20.8\% | 16.3\% | 13.4\% |
| CAR (1) |  | 55.9\% | 28.1\% | 18.9\% | 14.1\% | 41.8\% | 27.7\% | 18.5\% | 13.6\% | 35.2\% | 23.6\% | 17.9\% | 13.5\% | 30.7\% | 20.8\% | 16.2\% | 13.4\% |
| BHAR (0) |  | 56.0\% | 27.2\% | 18.8\% | 13.8\% | 41.1\% | 28.0\% | 18.5\% | 13.5\% | 35.1\% | 22.7\% | 17.8\% | 13.5\% | 30.4\% | 20.5\% | 16.1\% | 13.5\% |
| BHAR (1) |  | 56.3\% | 27.5\% | 19.0\% | 13.8\% | 41.2\% | 28.0\% | 18.4\% | 13.7\% | 35.4\% | 22.9\% | 17.8\% | 13.6\% | 30.5\% | 20.6\% | 16.1\% | 13.6\% |



| IVOL | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 55.7\% | 28.0\% | 18.9\% | 14.1\% | 42.6\% | 27.8\% | 18.6\% | 14.1\% | 35.3\% | 23.8\% | 18.6\% | 14.0\% | 31.0\% | 21.5\% | 16.9\% | 14.0\% |
| CAR (1) |  | 56.0\% | 28.2\% | 19.0\% | 14.1\% | 42.8\% | 27.9\% | 18.7\% | 14.1\% | 35.6\% | 23.9\% | 18.6\% | 14.0\% | 31.2\% | 21.5\% | 16.9\% | 14.0\% |
| BHAR (0) |  | 54.9\% | 27.5\% | 18.9\% | 13.9\% | 42.2\% | 27.5\% | 18.2\% | 13.8\% | 35.5\% | 24.2\% | 18.2\% | 13.9\% | 31.1\% | 21.2\% | 16.8\% | 14.3\% |
| BHAR (1) |  | 55.0\% | 27.8\% | 18.9\% | 13.9\% | 42.6\% | 27.6\% | 18.2\% | 13.9\% | 35.8\% | 24.4\% | 18.3\% | 13.9\% | 31.3\% | 21.2\% | 16.8\% | 14.3\% |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.0\% | 27.9\% | 18.9\% | 14.2\% | 42.1\% | 27.7\% | 18.5\% | 13.9\% | 35.7\% | 23.5\% | 18.3\% | 13.8\% | 30.4\% | 20.7\% | 16.4\% | 13.7\% |
| CAR (1) |  | 56.3\% | 28.0\% | 19.0\% | 14.2\% | 42.3\% | 27.7\% | 18.6\% | 13.9\% | 35.8\% | 23.5\% | 18.3\% | 13.8\% | 30.4\% | 20.7\% | 16.4\% | 13.7\% |
| BHAR (0) |  | 55.8\% | 27.9\% | 19.0\% | 14.0\% | 42.6\% | 27.7\% | 18.1\% | 13.5\% | 35.8\% | 23.8\% | 18.0\% | 13.9\% | 30.1\% | 20.1\% | 16.0\% | 13.6\% |
| BHAR (1) |  | 56.0\% | 27.8\% | 19.0\% | 13.9\% | 43.0\% | 27.8\% | 18.2\% | 13.6\% | 36.2\% | 24.2\% | 17.9\% | 14.0\% | 30.2\% | 20.2\% | 16.1\% | 13.6\% |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 56.8\% | 28.5\% | 19.3\% | 14.5\% | 43.7\% | 28.1\% | 19.0\% | 14.3\% | 37.4\% | 24.6\% | 18.9\% | 14.2\% | 32.3\% | 21.9\% | 17.1\% | 14.1\% |
| CAR (1) |  | 57.5\% | 28.8\% | 19.5\% | 14.6\% | 44.3\% | 28.2\% | 19.0\% | 14.3\% | 38.1\% | 24.8\% | 18.9\% | 14.2\% | 32.7\% | 21.9\% | 17.1\% | 14.1\% |
| BHAR (0) |  | 57.0\% | 28.2\% | 19.3\% | 14.3\% | 43.9\% | 28.0\% | 19.1\% | 14.0\% | 37.5\% | 24.4\% | 18.5\% | 14.1\% | 32.5\% | 1.9\% | 1.5\% | 1.8\% |
| BHAR (1) |  | 57.5\% | 28.4\% | 19.4\% | 14.4\% | 44.2\% | 28.2\% | 19.2\% | 14.0\% | 38.4\% | 25.0\% | 18.7\% | 14.1\% | 32.8\% | 21.9\% | 16.8\% | 14.5\% |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 57.5\% | 28.6\% | 19.0\% | 14.4\% | 44.8\% | 28.8\% | 19.1\% | 14.3\% | 37.9\% | 24.9\% | 19.1\% | 14.3\% | 34.0\% | 22.6\% | 17.4\% | 14.3\% |
| CAR (1) |  | 57.7\% | 28.6\% | 19.1\% | 14.4\% | 45.0\% | 28.9\% | 19.1\% | 14.3\% | 38.2\% | 25.0\% | 19.1\% | 14.3\% | 34.3\% | 22.7\% | 17.4\% | 14.3\% |
| BHAR (0) |  | 57.4\% | 27.6\% | 18.6\% | 13.9\% | 44.4\% | 28.6\% | 19.0\% | 14.0\% | 37.5\% | 24.4\% | 18.6\% | 14.1\% | 33.2\% | 22.1\% | 17.0\% | 14.3\% |
| BHAR (1) |  | 57.5\% | 27.7\% | 18.6\% | 13.8\% | 44.2\% | 28.6\% | 19.0\% | 14.1\% | 37.5\% | 24.6\% | 18.6\% | 14.1\% | 33.3\% | 22.1\% | 17.0\% | 14.4\% |

Table 7.9a. Break-even transaction costs for time-series momentum strategy


| EW | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.1\% | 2.1\% | 3.0\% | 3.8\% | 1.9\% | 2.6\% | 3.8\% | 4.3\% | 2.2\% | 3.4\% | 3.9\% | 4.4\% | 2.5\% | 3.8\% | 4.4\% | 4.8\% |
| CAR (1) |  | 1.3\% | 2.3\% | 3.2\% | 3.7\% | 1.7\% | 2.6\% | 3.5\% | 3.8\% | 2.4\% | 3.4\% | 3.7\% | 4.0\% | 2.6\% | 3.7\% | 4.1\% | 4.4\% |
| BHAR (0) |  | 1.0\% | 1.8\% | 1.9\% | 3.0\% | 1.7\% | 2.7\% | 3.9\% | 5.9\% | 2.5\% | 3.0\% | 4.4\% | 4.5\% | 2.4\% | 3.6\% | 3.1\% | 3.6\% |
| BHAR (1) |  | 1.3\% | 2.2\% | 2.3\% | 3.6\% | 1.6\% | 2.8\% | 3.1 \% | 5.3\% | 2.6\% | 3.3\% | 4.2\% | 4.3\% | 2.5\% | 3.9\% | 3.4\% | 3.6\% |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.8\% | 1.0\% | 1.7\% | $2.1 \%$ | 1.4\% | 2.0\% | 2.8\% | 3.1\% | 1.9\% | 2.8\% | 2.9\% | $2.7 \%$ | 2.2\% | 2.6\% | 2.4\% | 2.2\% |
| CAR (1) |  | 0.9\% | 1.2\% | 1.9\% | 2.3\% | 1.4\% | 2.2\% | 2.6\% | 3.0\% | 1.8\% | 2.5\% | 2.4\% | 2.3\% | 2.0\% | 2.1\% | 2.0\% | 1.9\% |
| BHAR (0) |  | 0.7\% | -0.2\% | 2.8\% | 3.2\% | 1.2\% | 2.0\% | 0.6\% | 2.5\% | 1.5\% | 2.0\% | 2.7\% | 1.1\% | 2.3\% | 4.4\% | 3.1\% | 4.0\% |
| BHAR (1) |  | 1.0\% | -0.3\% | 3.0\% | 3.6\% | 1.1\% | 2.4\% | 0.5\% | $2.1 \%$ | 1.5\% | 2.1 \% | 1.8\% | 1.4\% | 1.9\% | 3.4\% | 2.8\% | 3.8\% |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.1\% | 0.6\% | 1.1\% | 1.6\% | 0.5\% | 1.2\% | 2.0\% | 2.4\% | 0.8\% | 1.8\% | 2.1 \% | 2.4\% | 1.2\% | 2.1\% | 2.3\% | 2.3\% |
| CAR (1) |  | 0.7\% | 1.3\% | 1.8\% | 2.1\% | 1.1\% | 1.7\% | 2.4\% | 2.6\% | 1.5\% | 2.1\% | 2.3\% | 2.5\% | 1.7\% | 2.2\% | 2.3\% | 2.2\% |
| BHAR (0) |  | -0.1\% | 0.4\% | 1.6\% | 0.5\% | 0.6\% | 1.1\% | 1.7\% | 1.7\% | 0.8\% | 1.8\% | 2.4\% | $2.7 \%$ | 1.2\% | 1.8\% | 2.4\% | 2.0\% |
| BHAR (1) |  | 0.7\% | 1.1\% | 2.2\% | 1.5\% | 1.2\% | 1.6\% | 2.0\% | 1.8\% | 1.4\% | 2.0\% | 2.4\% | 1.9\% | 1.5\% | 1.8\% | 2.4\% | 1.9\% |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.9\% | 1.7\% | 2.2\% | 2.6\% | 1.3\% | 1.9\% | 2.6\% | 2.6\% | 1.8\% | 2.5\% | $2.7 \%$ | 2.9\% | 2.3\% | 2.9\% | 3.1\% | 3.0\% |
| CAR (1) |  | 1.2\% | 1.9\% | 2.3\% | 2.6\% | 1.3\% | 2.0\% | 2.5\% | 2.3\% | 2.0\% | 2.5\% | 2.5\% | 2.6\% | 2.2\% | 2.7\% | 2.7\% | 2.5\% |
| BHAR (0) |  | 1.0\% | 1.8\% | 2.8\% | 2.0\% | 1.3\% | 2.2\% | 2.6\% | 3.2\% | 1.9\% | 2.3\% | 3.0\% | 3.3\% | 2.1\% | 2.3\% | 3.0\% | 2.7\% |
| BHAR (1) |  | 1.4\% | 1.9\% | 2.7\% | 2.3\% | 1.2\% | 2.2\% | 2.5\% | 2.3\% | 1.7\% | 1.9\% | 2.4\% | 2.9\% | 1.8\% | 1.8\% | 1.8\% | 2.1\% |


| EW | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.4\% | 0.7\% | 0.3\% | 0.0\% | 0.7\% | 0.9\% | 0.6\% | -0.2\% | 0.4\% | 0.5\% | 0.1\% | -0.5\% | $0.1 \%$ | -0.2\% | -0.9\% | -1.5\% |
| CAR (1) |  | 0.4\% | 0.6\% | 0.4\% | -0.1\% | $0.9 \%$ | 0.6\% | 0.5\% | -0.5\% | 0.2\% | 0.3\% | -0.3\% | -0.7\% | 0.3\% | -0.2\% | -1.1\% | -1.4\% |
| BHAR (0) |  | 0.6\% | 2.0\% | 2.0\% | 4.5\% | 1.2\% | 2.0\% | 0.6\% | 0.2\% | 1.4\% | 2.1 \% | -1.2\% | 3.7\% | 0.4\% | -1.4\% | 1.2\% | -2.6\% |
| BHAR (1) |  | 0.9\% | 2.5\% | 2.2\% | 5.4\% | 1.3\% | 1.6\% | 0.8\% | -0.6\% | 1.6\% | 2.6\% | -0.5\% | 3.4\% | 0.8\% | -1.4\% | 1.5\% | -3.3\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.6\% | 1.1\% | 1.0\% | 1.0\% | 0.9\% | 1.2\% | 1.1\% | 0.9\% | 1.1\% | 1.1\% | 0.9\% | 0.5\% | 0.9\% | 0.6\% | $0.1 \%$ | -0.5\% |
| CAR (1) |  | 0.6\% | 1.0\% | 0.8\% | 0.4\% | 0.9\% | 1.1\% | 0.8\% | 0.5\% | 0.9\% | $0.7 \%$ | 0.5\% | 0.0\% | 0.3\% | 0.1 \% | -0.4\% | -1.0\% |
| BHAR (0) |  | 0.2\% | 0.5\% | 0.1\% | 0.5\% | 1.3\% | 1.6\% | 1.3\% | 1.8\% | 0.9\% | 1.1\% | 1.1\% | 0.5\% | 0.8\% | 0.8\% | 0.8\% | -1.3\% |
| BHAR (1) |  | 0.0\% | 0.0\% | 0.0\% | 0.0\% | 0.8\% | 1.3\% | 0.9\% | 0.6\% | 0.5\% | 0.0\% | 0.8\% | 0.0\% | -0.2\% | -0.2\% | -0.5\% | -1.9\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.0\% | 0.1 \% | 0.3\% | 1.0\% | 0.3\% | 0.6\% | 1.2\% | 1.8\% | 1.0\% | 1.6\% | 2.3\% | 3.1\% | 1.7\% | 2.2\% | 2.4\% | 2.3\% |
| CAR (1) |  | 0.4\% | 0.4\% | 0.8\% | 1.5\% | 0.4\% | 0.7\% | 1.4\% | 1.7\% | 0.9\% | 1.7\% | 2.5\% | 2.9\% | $2.1 \%$ | 2.2\% | 2.3\% | $2.1 \%$ |
| BHAR (0) |  | 0.4\% | -2.1\% | -1.6\% | 0.7\% | 0.0\% | 1.0\% | -2.2\% | 7.1\% | 0.9\% | 1.7\% | 3.8\% | 3.0\% | $2.1 \%$ | 2.6\% | 2.1 \% | 1.7\% |
| BHAR (1) |  | 0.1\% | -1.6\% | -1.8\% | 2.4\% | 0.0\% | 0.9\% | -1.1\% | 5.4\% | 0.7\% | 2.2\% | 3.2\% | 2.4\% | 2.4\% | 1.7\% | 2.6\% | 1.9\% |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.4\% | -0.4\% | -0.8\% | -0.8\% | -0.1\% | -0.2\% | -0.3\% | -0.4\% | 0.0\% | 0.2\% | 0.4\% | 0.2\% | 0.5\% | 0.8\% | 0.8\% | 0.2\% |
| CAR (1) |  | -0.1\% | -0.2\% | -0.4\% | -0.5\% | 0.2\% | 0.2\% | 0.0\% | -0.1\% | 0.1\% | 0.3\% | 0.4\% | 0.0\% | 0.8\% | 1.0\% | 0.8\% | 0.2\% |
| BHAR (0) |  | -0.3\% | -0.7\% | -1.0\% | -1.8\% | 0.1\% | 0.1\% | -0.6\% | 0.5\% | 0.0\% | 0.3\% | 0.1 \% | 1.9\% | 0.7\% | 1.7\% | 0.8\% | 2.1 \% |
| BHAR (1) |  | -0.3\% | -0.5\% | -0.7\% | -1.0\% | 0.0\% | -0.1\% | -0.5\% | 0.5\% | 0.0\% | 0.4\% | -0.1\% | 2.1\% | 1.4\% | 1.9\% | 0.7\% | 2.3\% |


| EW J = |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.2\% | 2.0\% | 2.9\% | 3.7\% | 1.6\% | 2.8\% | 3.5\% | 4.0\% | 2.2\% | 3.5\% | 4.3\% | 4.6\% | 2.6\% | 3.9\% | 4.3\% | 4.5\% |
| CAR (1) | 1.2\% | 2.0\% | 2.9\% | 3.7\% | 1.5\% | 2.6\% | 3.4\% | 3.5\% | 2.2\% | 3.5\% | 3.8\% | 4.1\% | 2.3\% | 3.6\% | 3.8\% | 3.9\% |
| BHAR (0) | 1.0\% | 0.6\% | 1.8\% | 1.5\% | 1.6\% | 2.1 \% | 3.3\% | 1.9\% | 2.0\% | 2.7\% | 3.9\% | 3.2\% | 2.5\% | 3.1\% | 3.5\% | 3.9\% |
| BHAR (1) | 0.9\% | 0.5\% | 2.6\% | 2.0\% | 1.2\% | 2.0\% | 3.2\% | 1.2\% | 1.9\% | 2.7\% | 3.5\% | 3.5\% | $2.1 \%$ | 3.0\% | 3.1\% | 3.5\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.2\% | 0.1\% | 0.1\% | 0.5\% | 0.2\% | 0.2\% | 0.5\% | 0.5\% | 0.2\% | 0.5\% | 0.6\% | 0.4\% | 0.5\% | 0.5\% | 0.4\% | 0.2\% |
| CAR (1) | 0.2\% | 0.1\% | 0.3\% | 0.5\% | 0.1\% | 0.3\% | 0.6\% | 0.3\% | 0.4\% | 0.6\% | 0.6\% | 0.2\% | 0.4\% | 0.4\% | 0.3\% | 0.0\% |
| BHAR (0) | 0.2\% | 0.4\% | 0.7\% | 1.4\% | 0.4\% | 0.5\% | 0.7\% | 2.2\% | 0.3\% | 0.9\% | 0.9\% | 0.8\% | 0.6\% | 0.7\% | 0.6\% | 0.0\% |
| BHAR (1) | 0.1\% | 0.4\% | 0.6\% | 1.8\% | 0.3\% | 0.3\% | 0.7\% | 1.4\% | 0.3\% | 0.9\% | 0.7\% | 0.1\% | 0.4\% | 0.4\% | 0.0\% | -0.3\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.6\% | 2.7\% | 3.5\% | 4.4\% | 2.0\% | 2.6\% | 3.6\% | 4.0\% | 2.4\% | 3.4\% | 4.1 \% | 4.6\% | 2.6\% | 3.8\% | 4.3\% | 4.5\% |
| CAR (1) | 1.5\% | 2.6\% | 3.3\% | 4.1\% | 1.8\% | 2.6\% | 3.2\% | 3.5\% | 2.3\% | 3.1\% | 3.6\% | 4.1\% | 2.2\% | 3.5\% | 3.7\% | 4.0\% |
| BHAR (0) | 1.7\% | 2.4\% | 2.5\% | 5.2\% | 1.9\% | 2.7\% | 4.0\% | 7.0\% | 2.5\% | 4.5\% | 4.2\% | 5.8\% | 2.5\% | 4.4\% | 4.2\% | 4.3\% |
| BHAR (1) | 1.5\% | 2.1\% | 1.9\% | 5.2\% | 1.9\% | 2.8\% | 4.1 \% | 6.6\% | 2.8\% | 4.1\% | 3.9\% | 5.3\% | 2.0\% | 3.6\% | 3.9\% | 3.3\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.7\% | 1.7\% | 1.9\% | 2.5\% | 2.2\% | 2.6\% | 3.4\% | 3.7\% | 2.4\% | 3.4\% | 3.6\% | 4.1\% | $2.9 \%$ | 3.4\% | 3.6\% | 3.7\% |
| CAR (1) | 1.1\% | 1.8\% | 2.2\% | 2.3\% | 2.1 \% | 2.5\% | 3.3\% | 3.3\% | 2.5\% | 3.2\% | 3.4\% | 3.8\% | $2.7 \%$ | 2.9\% | 3.2\% | 3.2\% |
| BHAR (0) | 0.7\% | 1.9\% | 1.5\% | 0.7\% | 1.8\% | 2.5\% | 1.7\% | 3.1\% | 2.3\% | 2.9\% | 4.2\% | 4.3\% | 3.4\% | 4.6\% | $3.7 \%$ | 4.0\% |
| BHAR (1) | 1.1\% | 1.7\% | 1.4\% | 0.3\% | 2.0\% | 2.1 \% | 1.9\% | 1.9\% | 2.8\% | 3.2\% | 4.2\% | 4.5\% | 2.9\% | 3.3\% | $2.7 \%$ | 3.6\% |



|  | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.9\% | 2.2\% | 2.5\% | 3.1\% | 1.9\% | 2.8\% | 3.5\% | 3.8\% | 2.5\% | 3.6\% | 3.7\% | 3.7\% | 3.1\% | 3.8\% | 4.0\% | 3.8\% |
| CAR (1) |  | 1.3\% | 2.4\% | 2.6\% | 3.0\% | 2.2\% | 2.9\% | 3.5\% | 3.6\% | 2.7\% | 3.1\% | 3.3\% | 3.1\% | 3.0\% | 3.4\% | 3.5\% | 3.3\% |
| BHAR (0) |  | 0.8\% | 2.0\% | 1.8\% | 2.9\% | 1.8\% | 2.7\% | 2.5\% | 3.0\% | 2.6\% | 3.9\% | 3.8\% | 2.7\% | 2.9\% | 3.7\% | 5.2\% | 5.5\% |
| BHAR (1) |  | 1.2\% | 2.3\% | 2.4\% | 2.9\% | 2.3\% | 3.0\% | 2.3\% | 2.6\% | 2.8\% | 3.6\% | 4.0\% | 2.3\% | 3.5\% | 3.9\% | 4.8\% | 6.3\% |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.9\% | 1.8\% | 2.4\% | 3.0\% | 1.6\% | 2.5\% | 3.3\% | 3.4\% | 2.2\% | 3.2\% | 3.1\% | 3.1\% | 2.3\% | 2.8\% | 2.8\% | 2.5\% |
| CAR (1) |  | 1.1\% | 2.0\% | 2.4\% | 2.8\% | 1.8\% | 2.5\% | 3.0\% | 3.1\% | 2.0\% | 2.7\% | 2.5\% | 2.5\% | 2.0\% | 2.3\% | 2.2\% | 1.9\% |
| BHAR (0) |  | 0.7\% | 1.9\% | 2.0\% | 4.9\% | 1.5\% | 3.0\% | 2.4\% | 4.9\% | 2.1\% | 3.6\% | 4.1\% | 3.4\% | 2.3\% | 2.5\% | 2.6\% | 3.4\% |
| BHAR (1) |  | 1.0\% | 2.2\% | 1.6\% | 4.8\% | 1.8\% | 3.0\% | 2.4\% | 4.5\% | 2.1\% | 3.0\% | 3.4\% | 2.9\% | 2.1\% | 2.5\% | 1.3\% | 3.4\% |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.2\% | 2.2\% | 2.7\% | 3.5\% | 2.0\% | 2.5\% | 3.4\% | 3.9\% | 2.3\% | 3.1\% | 3.4\% | 3.8\% | 2.8\% | 3.4\% | 3.5\% | 3.4\% |
| CAR (1) |  | 1.3\% | 2.1\% | 2.6\% | 3.3\% | 1.8\% | 2.3\% | 3.1\% | 3.4\% | 2.1\% | 2.8\% | 3.1\% | 3.2\% | 2.5\% | 3.0\% | 3.0\% | 2.9\% |
| BHAR (0) |  | 1.1\% | 2.5\% | 3.4\% | 3.5\% | 2.1 \% | 2.9\% | 2.6\% | 4.4\% | 2.3\% | 3.0\% | 3.5\% | 3.7\% | 2.7\% | 3.6\% | 3.6\% | 3.1\% |
| BHAR (1) |  | 1.4\% | 2.4\% | 3.0\% | 3.4\% | 1.8\% | 2.6\% | 2.4\% | 3.6\% | 2.2\% | 2.6\% | 2.9\% | 2.7\% | 2.6\% | 3.0\% | 2.8\% | 2.5\% |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.2\% | 0.5\% | 0.6\% | 0.6\% | 0.6\% | 0.8\% | 0.9\% | 0.6\% | 0.8\% | 1.0\% | 0.7\% | 0.2\% | 0.7\% | 0.6\% | 0.2\% | -0.4\% |
| CAR (1) |  | 0.3\% | 0.6\% | 0.7\% | 0.4\% | 0.7\% | 0.8\% | 0.8\% | 0.3\% | 0.9\% | 0.8\% | 0.5\% | -0.2\% | 0.5\% | 0.3\% | -0.2\% | -0.8\% |
| BHAR (0) |  | 0.2\% | 1.1\% | 0.8\% | 1.1\% | 0.5\% | 0.7\% | 0.5\% | 0.9\% | 0.8\% | 1.1\% | 1.0\% | 0.3\% | 0.8\% | 0.7\% | 0.4\% | -0.2\% |
| BHAR (1) |  | 0.4\% | 1.0\% | 0.9\% | 0.6\% | 0.6\% | 0.6\% | 0.2\% | 0.0\% | 0.9\% | 0.8\% | 0.4\% | -0.2\% | 0.4\% | 0.1\% | -0.2\% | -0.8\% |


| MW $\mathrm{J}=$ | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.4\% | 2.5\% | 3.5\% | 3.9\% | 2.3\% | 3.5\% | 4.3\% | 4.5\% | 2.9\% | 4.0\% | 4.2\% | 4.1 \% | 2.7\% | 3.3\% | 3.2\% | 2.8\% |
| CAR (1) | 1.5\% | 2.5\% | 3.4\% | 3.5\% | 2.2\% | 3.5\% | 3.8\% | 3.9\% | 2.9\% | 3.6\% | 3.7\% | 3.3\% | 2.1 \% | 2.8\% | 2.3\% | 1.9\% |
| BHAR (0) | 1.4\% | 1.7\% | 3.1\% | 3.1\% | 2.1 \% | 3.5\% | 3.7\% | 2.8\% | 3.2\% | 4.4\% | 3.4\% | 5.2\% | 2.2\% | 2.8\% | $2.1 \%$ | 3.2\% |
| BHAR (1) | 1.5\% | 1.6\% | 2.9\% | 3.4\% | 2.1 \% | 3.6\% | 2.8 \% | 2.0\% | 2.7\% | 3.2\% | 2.8\% | 4.6\% | 1.5\% | 2.5\% | 1.1\% | 1.4\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.3\% | 0.7\% | 1.4\% | 1.8\% | 1.1\% | 1.9\% | 2.9\% | 3.0\% | 1.5\% | 2.6\% | 2.5\% | 2.2\% | 1.4\% | 2.0\% | 1.7\% | 1.0\% |
| CAR (1) | 0.4\% | 0.9\% | 1.5\% | 1.7\% | 1.1\% | 2.1\% | 2.7\% | 2.5\% | 2.0\% | 2.3\% | 2.3\% | 1.8\% | 1.1\% | 1.7\% | 1.2\% | 0.4\% |
| BHAR (0) | 0.3\% | 1.6\% | 2.9\% | 2.6\% | 0.8\% | 1.3\% | 1.2\% | 2.1 \% | 1.5\% | 3.1\% | 1.9\% | 4.5\% | 1.2\% | 0.8\% | 1.8\% | -1.8\% |
| BHAR (1) | 0.8\% | 1.0\% | 3.3\% | 2.4\% | 0.9\% | 1.5\% | 1.9\% | 1.7\% | 1.4\% | 1.8\% | 1.6\% | 2.6\% | 0.5\% | 0.4\% | 0.4\% | -2.0\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.8\% | 1.4\% | 2.2\% | 2.8\% | 1.2\% | 1.8\% | $2.7 \%$ | 3.1 \% | 1.4\% | 2.2\% | 2.5\% | 2.7\% | 1.9\% | 3.1\% | 3.4\% | 3.6\% |
| CAR (1) | 0.9\% | 1.3\% | 2.4\% | 2.6\% | 1.0\% | 1.7\% | 2.5\% | 2.6\% | 1.4\% | 2.1\% | 2.3\% | 2.4\% | 2.1 \% | 2.8\% | 3.2\% | 3.3\% |
| BHAR (0) | 0.9\% | 2.2\% | -0.1\% | 4.2\% | 0.6\% | 0.1\% | 1.8\% | $\mathbf{3 . 1 \%}$ | 0.3\% | 2.4\% | 2.3\% | 4.2\% | 1.6\% | 2.1\% | 0.5\% | 1.5\% |
| BHAR (1) | 0.8\% | 1.5\% | 0.8\% | 4.8\% | 1.0\% | 0.5\% | 1.5\% | 3.0\% | 1.2\% | 2.8\% | 2.2\% | 3.9\% | 1.3\% | 2.5\% | 0.7\% | 2.1\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.5\% | 2.6\% | 3.7\% | 4.8\% | 2.3\% | 3.4\% | 4.8\% | 5.8\% | 3.2\% | 4.5\% | 5.3\% | 5.5\% | 2.9\% | 4.5\% | 5.0\% | 4.9\% |
| CAR (1) | 1.6\% | 2.4\% | 4.0\% | 4.4\% | 2.2\% | 3.5\% | 4.8\% | $5.1 \%$ | 3.1\% | 4.2\% | 4.8\% | 4.6\% | 2.9\% | 4.2\% | 4.5\% | 4.3\% |
| BHAR (0) | 1.3\% | 1.9\% | 3.6\% | 3.2\% | 2.1 \% | 4.2\% | 7.8\% | 4.2\% | 3.6\% | 4.4\% | 6.0\% | 4.6\% | 3.4\% | 5.6\% | 4.9\% | 5.1\% |
| BHAR (1) | 1.5\% | 1.9\% | 4.4\% | 3.0\% | 2.2\% | 4.3\% | 6.6\% | 2.3\% | 3.2\% | 4.2\% | $5.1 \%$ | 3.7\% | 3.0\% | 4.5\% | 4.1\% | 3.8\% |


| MW $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.1\% | 2.2\% | 2.9\% | 3.5\% | 1.8\% | 2.6\% | 3.7\% | 4.2\% | 2.0\% | 3.2\% | 3.7\% | 4.4\% | 2.0\% | 3.2\% | 3.9\% | 4.7\% |
| CAR (1) | 1.2\% | 2.0\% | 2.9\% | 3.2\% | 1.5\% | 2.6\% | 3.3\% | 3.7\% | 2.2\% | 3.3\% | 3.6\% | 4.3\% | 2.1\% | 3.2\% | 3.8\% | 4.7\% |
| BHAR (0) | 0.6\% | 1.6\% | 0.5\% | 3.3\% | 1.8\% | 1.8\% | 2.4\% | $5.1 \%$ | 2.1\% | 2.9\% | 3.6\% | 3.3\% | 1.6\% | 2.6\% | 1.5\% | 3.9\% |
| BHAR (1) | 1.0\% | 1.8\% | 0.9\% | 3.8\% | 1.6\% | 2.4\% | 2.0\% | 4.4\% | 2.4\% | 3.8\% | 3.8\% | 3.3\% | 1.8\% | 3.5\% | 2.2\% | 4.9\% |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.8\% | 1.7\% | 3.5\% | 4.1\% | 1.7\% | 3.5\% | 5.6\% | 6.5\% | 2.3\% | 4.2\% | 5.2\% | 6.0\% | 3.1\% | 4.4\% | 5.2\% | 5.7\% |
| CAR (1) | 0.7\% | 2.3\% | 3.7\% | 4.4\% | 2.1\% | 4.0\% | 5.6\% | 6.7\% | 2.5\% | 4.1\% | 4.9\% | 5.7\% | 2.7\% | 4.1 \% | 4.8\% | 5.6\% |
| BHAR (0) | 0.5\% | 0.4\% | 4.7\% | 6.9\% | 1.2\% | 3.6\% | 4.5\% | 5.3\% | 2.2\% | 3.1 \% | 3.1\% | 1.0\% | 2.5\% | 7.0\% | 5.8\% | 9.4\% |
| BHAR (1) | 0.8\% | 1.3\% | 5.3\% | 7.5\% | 1.5\% | 3.7\% | 4.3\% | 4.6\% | 1.9\% | 3.6\% | 2.4\% | 1.3\% | 2.8\% | 6.2\% | 6.0\% | 9.8\% |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | -0.3\% | 0.3\% | 0.4\% | 0.8\% | -0.1\% | 0.3\% | 0.9\% | 1.2\% | 0.0\% | 0.5\% | 0.8\% | 1.0\% | -0.1\% | 0.6\% | 0.9\% | 0.9\% |
| CAR (1) | 0.2\% | 0.6\% | 0.8\% | 1.1\% | 0.4\% | 0.7\% | 1.2\% | 1.4\% | 0.6\% | 0.8\% | 1.1\% | 1.2\% | 0.3\% | 0.8\% | 1.0\% | 1.0\% |
| BHAR (0) | -0.4\% | 0.1 \% | 0.7\% | 0.3\% | 0.0\% | 0.2\% | -0.9\% | 0.9\% | 0.0\% | 0.2\% | 0.7\% | 2.9\% | -0.3\% | 0.8\% | 1.3\% | 0.6\% |
| BHAR (1) | 0.2\% | 0.4\% | 0.6\% | 2.0\% | 0.3\% | 0.3\% | -1.0\% | 0.6\% | 0.7\% | 0.4\% | 1.5\% | 2.1\% | -0.1\% | 0.4\% | 1.2\% | 0.3\% |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.2\% | 2.4\% | 3.6\% | 4.0\% | 1.5\% | 2.6\% | 3.7\% | 3.6\% | 1.8\% | 3.2\% | 3.0\% | 3.4\% | 2.0\% | 2.8\% | 3.3\% | 3.3\% |
| CAR (1) | 1.2\% | 2.6\% | 3.5\% | 3.7\% | 1.5\% | 2.7\% | 3.3\% | 3.3\% | 2.0\% | 3.0\% | 2.7\% | 3.0\% | 1.9\% | $2.7 \%$ | 2.8\% | 2.7\% |
| BHAR (0) | 1.1\% | 2.5\% | 4.5\% | 2.1\% | 1.4\% | 2.8\% | 4.0\% | 4.8\% | 1.8\% | 3.3\% | 1.0\% | 4.8\% | 1.4\% | 2.2\% | 4.7\% | 1.7\% |
| BHAR (1) | 1.3\% | $2.7 \%$ | 3.7\% | 2.3\% | 1.3\% | $2.7 \%$ | 3.2\% | 3.7\% | 1.8\% | 3.0\% | 1.0\% | 4.3\% | 1.6\% | 2.0\% | 3.8\% | 1.3\% |


| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  | 12 |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.4\% | 0.1\% | -0.3\% | -0.4\% | 0.2\% | 0.0\% | 0.2\% | 0.1\% | -0.1\% | 0.0\% | 0.2\% | 0.4\% | 0.0\% | 0.2\% | 0.2\% | -0.2\% |
| CAR (1) |  | 0.2\% | 0.2\% | -0.1\% | -0.4\% | 0.2\% | -0.1\% | 0.4\% | -0.2\% | -0.2\% | 0.2\% | 0.2\% | 0.5\% | 0.3\% | 0.5\% | 0.2\% | 0.0\% |
| BHAR (0) |  | 0.4\% | 1.9\% | 2.3\% | 4.7\% | 0.4\% | 1.5\% | 0.5\% | 0.9\% | 0.6\% | 1.6\% | -0.9\% | 5.9\% | -0.1\% | -1.0\% | 1.7\% | -0.3\% |
| BHAR (1) |  | 0.7\% | 3.0\% | 2.9\% | 6.1\% | 1.2\% | 1.4\% | 1.9\% | -0.6\% | 0.8\% | 2.9\% | -0.4\% | 5.9\% | 1.0\% | -0.4\% | 2.2\% | -0.4\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.2\% | 2.2\% | 2.5\% | 3.0\% | 1.7\% | 2.3\% | 2.8\% | 2.8\% | 2.0\% | 2.6\% | 2.6\% | 2.6\% | 2.0\% | 2.3\% | 2.2\% | 2.2\% |
| CAR (1) |  | 1.2\% | 2.2\% | 2.6\% | 2.8\% | 1.7\% | 2.3\% | 2.3\% | 2.4\% | 2.1\% | 2.1\% | 2.3\% | 2.3\% | 1.5\% | 1.8\% | 1.7\% | 1.8\% |
| BHAR (0) |  | $0.7 \%$ | 2.2\% | 0.8\% | 2.0\% | 2.1 \% | 2.2\% | 2.4\% | 0.7\% | 1.6\% | 2.3\% | 3.4\% | 3.3\% | 1.6\% | 2.7\% | 2.8\% | 3.3\% |
| BHAR (1) |  | 0.8\% | 1.9\% | 0.4\% | 2.0\% | 1.3\% | 1.5\% | 2.2\% | -0.8\% | 1.4\% | 1.4\% | 3.0\% | 3.8\% | 0.9\% | 1.3\% | 0.8\% | 1.7\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.1\% | 1.9\% | 1.6\% | 2.0\% | 1.5\% | 2.4\% | 3.2\% | $4.1 \%$ | 1.8\% | 2.5\% | 3.5\% | 4.6\% | 2.0\% | 2.5\% | 3.2\% | 3.6\% |
| CAR (1) |  | 1.2\% | 1.3\% | 1.3\% | 2.1\% | 1.6\% | 2.0\% | 3.1\% | 3.7\% | 1.2\% | 2.3\% | 3.3\% | 4.3\% | 2.1\% | 2.6\% | 3.5\% | 3.3\% |
| BHAR (0) |  | 1.2\% | -1.3\% | -1.6\% | -1.2\% | 1.1\% | 4.0\% | -2.1\% | 13.6\% | 1.6\% | 2.3\% | 6.3\% | 4.9\% | 2.5\% | 2.8\% | 4.9\% | 3.5\% |
| BHAR (1) |  | 0.6\% | -1.6\% | -3.4\% | 0.0\% | 1.5\% | 3.7\% | 0.6\% | 11.2\% | 0.9\% | 2.4\% | 5.7\% | 2.6\% | 2.1 \% | 1.8\% | 4.6\% | $3.9 \%$ |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.3\% | 0.7\% | 0.9\% | 0.9\% | 1.1\% | 1.7\% | 2.3\% | 2.5\% | 1.7\% | 2.3\% | 3.0\% | 2.9\% | 1.8\% | 2.7\% | 2.9\% | 2.4\% |
| CAR (1) |  | 0.2\% | 0.7\% | 1.1\% | 0.9\% | 1.2\% | 2.0\% | 2.2\% | 2.1\% | 1.6\% | 2.3\% | 2.7\% | 2.5\% | 2.1 \% | 2.8\% | 2.6\% | 2.2\% |
| BHAR (0) |  | 0.1\% | -0.3\% | 1.0\% | 0.3\% | 1.7\% | 2.4\% | 1.6\% | 3.4\% | 2.2\% | 3.3\% | 3.0\% | 6.8\% | 2.0\% | 3.6\% | 3.4\% | 6.3\% |
| BHAR (1) |  | -0.3\% | -0.1\% | 2.1\% | 0.9\% | 1.2\% | 2.8\% | 1.3\% | 3.6\% | 2.0\% | 3.1\% | 2.9\% | 6.2\% | $2.7 \%$ | 4.0\% | 3.1\% | 7.3\% |



| MW |  |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.4\% | 1.6\% | 2.5\% | 3.3\% | 0.7\% | 1.6\% | 2.4\% | 2.7\% | 0.4\% | 1.2\% | 1.8\% | 1.3\% | 1.1\% | 1.5\% | 1.6\% | 1.5\% |
| CAR (1) |  | 0.7\% | 1.8\% | 3.0\% | 3.2\% | 0.8\% | 2.0\% | 2.7\% | 2.2\% | 0.8\% | 1.4\% | 1.6\% | 1.0\% | 0.8\% | 1.1\% | 1.2\% | 0.9\% |
| BHAR (0) |  | 0.1\% | 0.3\% | -0.3\% | 0.4\% | 0.5\% | 1.0\% | 2.2\% | 4.5\% | 1.4\% | 1.5\% | 2.1 \% | 3.1\% | 1.8\% | 3.1 \% | 2.5\% | 4.7\% |
| BHAR (1) |  | 0.6\% | 1.5\% | 0.7\% | 0.8\% | 1.1\% | 1.9\% | 2.0\% | 3.8\% | 1.4\% | 1.9\% | 2.1 \% | 2.5\% | 1.4\% | 2.3\% | 3.2\% | 3.8\% |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.1\% | 0.9\% | 1.9\% | 2.2\% | 0.4\% | 0.8\% | 1.9\% | 1.5\% | 0.0\% | 1.0\% | 0.6\% | 0.3\% | 0.4\% | 0.5\% | 0.8\% | 1.1\% |
| CAR (1) |  | 0.7\% | 1.8\% | 2.3\% | 2.8\% | 0.6\% | 1.5\% | 2.0\% | 2.1\% | 0.4\% | 1.0\% | 0.9\% | 0.6\% | 0.4\% | 0.8\% | 1.1\% | 0.8\% |
| BHAR (0) |  | 0.4\% | 1.2\% | 3.2\% | 5.1\% | 0.8\% | 2.6\% | 3.3\% | 6.0\% | -0.7\% | 0.6\% | 2.5\% | 1.9\% | 0.5\% | 0.3\% | -0.8\% | -0.3\% |
| BHAR (1) |  | 0.7\% | 2.2\% | 3.0\% | 4.8\% | 2.0\% | 3.6\% | 4.4\% | 6.2\% | -0.1\% | 1.2\% | 3.3\% | 1.1\% | 0.7\% | -0.2\% | -0.7\% | -1.7\% |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.8\% | 2.0\% | 2.6\% | 3.2\% | 1.0\% | 1.8\% | 2.5\% | 3.2\% | 1.4\% | 2.1\% | 2.6\% | 3.0\% | 1.6\% | 2.3\% | 2.8\% | 3.1\% |
| CAR (1) |  | 0.8\% | $2.1 \%$ | 2.5\% | 2.8\% | 1.3\% | 1.8\% | 2.5\% | 2.8\% | 1.2\% | 2.1\% | 2.4\% | 2.6\% | 1.4\% | 2.1 \% | 2.6\% | 2.7\% |
| BHAR (0) |  | 0.6\% | 1.9\% | 3.2\% | -0.1\% | 1.4\% | 1.1\% | 2.9\% | 2.2\% | 1.5\% | 0.8\% | 1.3\% | -0.7\% | 1.3\% | 2.0\% | 3.7\% | 2.3\% |
| BHAR (1) |  | 0.3\% | 0.0\% | 2.8\% | -1.3\% | 0.8\% | 0.8\% | 3.8\% | 2.3\% | 0.5\% | 1.4\% | 1.5\% | -1.4\% | 1.0\% | 1.6\% | 2.2\% | 1.5\% |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.2\% | -0.1\% | 0.5\% | 1.4\% | -0.5\% | -0.5\% | 0.5\% | 0.9\% | -0.9\% | -0.2\% | 0.5\% | 0.5\% | 0.5\% | 0.7\% | 1.0\% | 1.2\% |
| CAR (1) |  | -0.2\% | 0.2\% | 0.9\% | 1.5\% | -0.4\% | 0.0\% | 0.9\% | 0.9\% | -0.3\% | 0.3\% | $0.7 \%$ | 1.0\% | 0.4\% | 0.6\% | 1.0\% | 1.2\% |
| BHAR (0) |  | -0.2\% | -2.1\% | -0.2\% | 0.2\% | -0.9\% | -1.7\% | -0.8\% | -1.4\% | -1.3\% | -0.7\% | 1.0\% | -1.1\% | 0.5\% | 2.2\% | 0.0\% | 1.5\% |
| BHAR (1) |  | -0.3\% | -1.3\% | -0.2\% | 0.8\% | -0.4\% | -1.1\% | -0.1\% | -1.5\% | -0.3\% | -0.3\% | 1.0\% | 0.1\% | 0.2\% | 1.1\% | 0.2\% | 1.3\% |



| IVOL J = |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.4\% | 1.2\% | 1.7\% | 2.1\% | 1.3\% | 1.8\% | 2.2\% | 1.9\% | 1.9\% | 2.5\% | 2.4\% | 2.2\% | 1.8\% | 1.9\% | 1.8\% | 1.2\% |
| CAR (1) | 0.8\% | 1.7\% | 2.2\% | 2.2\% | 1.4\% | 1.8\% | 2.0\% | 1.6\% | 2.0\% | 2.4\% | 2.1 \% | 1.7\% | 1.5\% | 1.5\% | 1.2\% | 0.7\% |
| BHAR (0) | 0.7\% | 1.0\% | 1.9\% | 0.6\% | 1.2\% | 1.3\% | 1.0\% | 0.4\% | 1.8\% | 2.1\% | 2.2\% | 2.7\% | 1.3\% | 1.0\% | 1.2\% | 1.3\% |
| BHAR (1) | 0.8\% | 0.8\% | 1.4\% | 1.4\% | 1.3\% | 1.7\% | 1.6\% | 0.5\% | 1.7\% | 1.8\% | 2.1 \% | 1.9\% | 1.3\% | 1.0\% | 0.3\% | 0.0\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.7\% | 1.4\% | 2.1\% | 2.7\% | 1.0\% | 1.8\% | 3.0\% | 3.6\% | 1.7\% | 2.7\% | 3.3\% | 3.5\% | 2.3\% | 3.1\% | 3.4\% | 3.1\% |
| CAR (1) | 0.9\% | 1.6\% | 2.1\% | 2.5\% | 1.1\% | 1.8\% | 2.8\% | 3.1 \% | 1.8\% | 2.6\% | 3.0\% | 3.2\% | 2.0\% | 2.6\% | 2.8\% | 2.4\% |
| BHAR (0) | 0.9\% | 1.7\% | 2.4\% | 2.9\% | 1.2\% | 1.8\% | 1.5\% | 4.3\% | 1.7\% | 2.5\% | 2.7\% | 4.7\% | 2.2\% | 2.5\% | 3.8\% | 0.7\% |
| BHAR (1) | 1.4\% | 1.7\% | 3.4\% | 2.6\% | 1.4\% | 1.8\% | 2.2\% | 4.6\% | 1.3\% | 1.4\% | 2.6\% | 3.9\% | 2.0\% | 2.4\% | 2.2\% | 1.4\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.6\% | 1.5\% | 1.9\% | 2.5\% | 1.4\% | $2.1 \%$ | 3.0\% | 3.4\% | 1.7\% | 2.8\% | 3.2\% | 3.7\% | 2.3\% | 3.2\% | 3.7\% | 4.0\% |
| CAR (1) | 0.9\% | 1.4\% | 2.0\% | 2.5\% | 1.6\% | 2.0\% | 2.8\% | 3.3\% | 1.9\% | 2.7\% | 3.1 \% | 3.6\% | 2.4\% | 3.1\% | 3.5\% | 3.7\% |
| BHAR (0) | 0.5\% | 0.8\% | 1.6\% | 1.4\% | 1.3\% | 1.7\% | 2.4\% | 4.0\% | 1.6\% | 3.3\% | 3.7\% | 4.7\% | 2.0\% | 2.8\% | 3.4\% | 2.4\% |
| BHAR (1) | 0.7\% | 0.9\% | 1.5\% | 2.2\% | 1.6\% | 1.5\% | 2.1 \% | $3.7 \%$ | 1.7\% | 3.4\% | 3.5\% | 3.6\% | 1.9\% | 3.0\% | 3.1\% | 2.6\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.2\% | 1.9\% | 2.7\% | 3.3\% | 2.1 \% | 2.8\% | 3.9\% | 4.1 \% | 2.5\% | 3.3\% | 3.5\% | 3.3\% | 2.6\% | 3.1\% | 3.1\% | 2.7\% |
| CAR (1) | 1.2\% | 2.0\% | 2.9\% | 3.1\% | 2.0\% | 2.8\% | 3.6\% | 3.4\% | 2.5\% | 3.1\% | 3.1 \% | 2.6\% | 2.3\% | 2.6\% | 2.5\% | 1.8\% |
| BHAR (0) | 1.2\% | 1.6\% | 2.9\% | 2.0\% | 2.1 \% | 3.0\% | 3.9\% | 1.8\% | 2.6\% | 3.3\% | 3.4\% | 3.1\% | 2.7\% | 3.0\% | 3.2\% | 2.7\% |
| BHAR (1) | 1.2\% | 1.8\% | 3.3\% | 2.6\% | 2.0\% | 2.8\% | 3.6\% | 1.9\% | 2.6\% | 3.2\% | 3.0\% | 2.7\% | 2.4\% | 2.4\% | 2.8\% | 2.0\% |


| IVOL $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.0\% | 2.1\% | 3.0\% | 3.9\% | 1.8\% | 2.5\% | 3.8\% | 4.4\% | 2.0\% | 3.3\% | 3.9\% | 4.4\% | 2.4\% | 3.8\% | 4.4\% | 4.9\% |
| CAR (1) | 1.1\% | 2.1 \% | 3.0\% | 3.7\% | 1.6\% | 2.5\% | 3.5\% | 3.9\% | 2.1\% | 3.2\% | 3.6\% | 4.0\% | 2.5\% | 3.7\% | 4.1\% | 4.5\% |
| BHAR (0) | 0.8\% | 1.6\% | 1.5\% | 2.6\% | 1.5\% | 2.7\% | 3.6\% | 5.9\% | 2.3\% | 2.9\% | 4.4\% | 4.9\% | 2.2\% | 3.6\% | 2.8\% | 3.8\% |
| BHAR (1) | 1.1\% | 2.2\% | 1.8\% | 4.0\% | 1.5\% | 2.8\% | 3.2\% | 5.3\% | 2.5\% | 3.4\% | 4.4\% | 4.4\% | 2.4\% | 4.1 \% | 3.2\% | 3.8\% |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.8\% | 1.2\% | 2.0\% | 2.6\% | 1.5\% | 2.2\% | 3.1 \% | 3.6\% | 1.9\% | 3.0\% | 3.2\% | 3.1\% | 2.4\% | 2.9\% | 2.7\% | 2.7\% |
| CAR (1) | 1.0\% | 1.5\% | 2.3\% | 2.7\% | 1.5\% | 2.4\% | 2.8\% | 3.4\% | 2.0\% | 2.7\% | 2.7\% | 2.6\% | 2.1\% | 2.3\% | 2.2\% | 2.2\% |
| BHAR (0) | 0.8\% | 0.2\% | 2.4\% | 3.7\% | 1.3\% | 2.1 \% | 1.0\% | 2.3\% | 1.6\% | 2.0\% | 2.8\% | 1.5\% | 2.5\% | 4.8\% | 3.6\% | 5.2\% |
| BHAR (1) | 1.1\% | 0.3\% | 3.0\% | 3.8\% | 1.2\% | 2.2\% | $0.7 \%$ | $2.1 \%$ | 1.6\% | 2.1 \% | 2.1\% | 1.7\% | 2.0\% | 3.8\% | 3.3\% | 5.0\% |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.1\% | 0.8\% | 1.0\% | 1.7\% | 0.9\% | 1.4\% | 2.2\% | 2.5\% | 1.3\% | 2.1\% | 2.5\% | 2.8\% | 1.6\% | 2.4\% | 2.6\% | 2.6\% |
| CAR (1) | 0.5\% | 1.0\% | 1.2\% | 1.7\% | 1.0\% | 1.4\% | 2.1 \% | 2.2\% | 1.7\% | 2.1 \% | 2.4\% | 2.6\% | 1.7\% | 2.4\% | 2.4\% | 2.5\% |
| BHAR (0) | 0.3\% | 0.3\% | 1.5\% | 0.0\% | 0.9\% | 0.9\% | 2.4\% | 0.2\% | 1.2\% | 2.2\% | 3.0\% | 3.0\% | 1.6\% | 2.2\% | 3.0\% | 2.5\% |
| BHAR (1) | 0.3\% | 0.8\% | 2.0\% | 1.4\% | 1.1\% | 1.3\% | 2.5\% | 2.2\% | 1.7\% | 2.2\% | 2.9\% | 2.0\% | 1.7\% | 2.1\% | 2.6\% | 2.4\% |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.0\% | 1.7\% | 2.2\% | 2.9\% | 1.4\% | 2.2\% | 3.2\% | 3.5\% | 2.0\% | 3.0\% | 3.5\% | 3.7\% | 2.5\% | 3.4\% | 3.8\% | 3.9\% |
| CAR (1) | 1.2\% | 1.8\% | 2.3\% | 2.8\% | 1.4\% | 2.2\% | 3.0\% | 3.1 \% | 2.1 \% | 2.9\% | 3.2\% | 3.4\% | 2.4\% | 3.2\% | 3.4\% | 3.4\% |
| BHAR (0) | 0.9\% | 1.7\% | 2.8\% | 1.3\% | 1.2\% | 2.5\% | 3.3\% | 4.4\% | 2.0\% | 2.9\% | 3.2\% | 4.0\% | 2.2\% | 2.6\% | 3.7\% | 3.9\% |
| BHAR (1) | 1.3\% | 2.0\% | 4.0\% | 3.1\% | 1.2\% | 2.6\% | 3.0\% | 3.5\% | 2.0\% | 2.6\% | 2.8\% | 3.8\% | 2.1\% | 2.5\% | 2.7\% | 3.5\% |


| IVOL |  |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.5\% | 0.8\% | 0.5\% | 0.1\% | 0.9\% | 1.1\% | 1.0\% | 0.3\% | 0.9\% | 0.9\% | 0.4\% | -0.2\% | 0.6\% | 0.1\% | -0.8\% | -1.6\% |
| CAR (1) |  | 0.4\% | 0.7\% | 0.4\% | -0.1\% | 1.0\% | 0.9\% | 0.9\% | -0.2\% | 0.5\% | 0.6\% | -0.1\% | -0.7\% | 0.5\% | -0.2\% | -1.3\% | -1.8\% |
| BHAR (0) |  | 0.5\% | 2.3\% | 1.7\% | 3.8\% | 1.3\% | 2.1\% | 0.8\% | 0.6\% | 1.9\% | 2.2\% | -0.7\% | 4.3\% | 0.9\% | -1.1\% | 1.1\% | -2.5\% |
| BHAR (1) |  | 0.9\% | 2.9\% | 2.0\% | 5.4\% | 1.5\% | 1.9\% | 1.4\% | -0.7\% | 2.0\% | 2.9\% | 0.0\% | 3.9\% | 1.4\% | -1.1\% | 0.9\% | -2.5\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.8\% | 1.2\% | 1.2\% | 1.1\% | 1.2\% | 1.6\% | 1.6\% | 1.6\% | 1.4\% | 1.5\% | 1.3\% | 1.0\% | 1.2\% | 1.0\% | 0.6\% | 0.1 \% |
| CAR (1) |  | 0.7\% | 1.2\% | 1.1\% | 0.8\% | 1.2\% | 1.5\% | 1.3\% | 1.1\% | 1.3\% | 1.1\% | 0.9\% | 0.5\% | 0.7\% | 0.5\% | 0.0\% | -0.4\% |
| BHAR (0) |  | 0.3\% | 0.4\% | 0.2\% | 0.5\% | 1.6\% | 2.2\% | 1.7\% | 2.1\% | 1.1\% | 1.3\% | 1.5\% | 1.2\% | 1.0\% | 1.4\% | 1.5\% | -0.1\% |
| BHAR (1) |  | 0.3\% | -0.1\% | 0.6\% | 0.1\% | 1.3\% | 2.0\% | 1.2\% | 1.1\% | 0.9\% | 0.3\% | 1.3\% | 0.8\% | 0.2\% | 0.6\% | 0.4\% | -0.6\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.4\% | 0.6\% | 0.9\% | 1.7\% | 0.4\% | 0.8\% | 1.5\% | 1.8\% | 1.5\% | 2.2\% | 2.8\% | $3.7 \%$ | 1.9\% | 2.5\% | 3.0\% | 3.0\% |
| CAR (1) |  | 0.4\% | 0.3\% | 0.7\% | 1.5\% | 0.5\% | 0.9\% | 1.7\% | 1.8\% | 1.3\% | 2.1\% | 2.8\% | 3.3\% | 2.0\% | 2.4\% | 2.8\% | 2.7\% |
| BHAR (0) |  | 0.8\% | -2.2\% | -1.3\% | 1.0\% | -0.1\% | 1.4\% | -2.0\% | 5.8\% | 1.4\% | 2.1\% | 3.7\% | 3.0\% | 2.4\% | 3.1\% | 2.7\% | 1.9\% |
| BHAR (1) |  | 0.2\% | -2.0\% | -1.8\% | 2.2\% | 0.1\% | 1.1\% | -1.3\% | 4.9\% | 1.1\% | 2.2\% | 3.1 \% | 1.6\% | 2.2\% | 1.9\% | 2.0\% | 1.5\% |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.2\% | -0.3\% | -0.8\% | -1.0\% | 0.2\% | -0.1\% | -0.3\% | -0.3\% | 0.4\% | 0.4\% | 0.5\% | 0.2\% | 0.6\% | 1.1\% | 1.0\% | 0.4\% |
| CAR (1) |  | 0.0\% | -0.1\% | -0.7\% | -0.8\% | 0.4\% | 0.1\% | -0.3\% | -0.4\% | 0.3\% | 0.3\% | 0.2\% | -0.1\% | 1.0\% | 1.2\% | 1.0\% | 0.3\% |
| BHAR (0) |  | -0.1\% | -0.9\% | -1.0\% | -1.0\% | 0.3\% | 0.0\% | -0.5\% | 0.7\% | 0.5\% | 0.6\% | 0.6\% | 2.1\% | 0.9\% | 2.1\% | 1.2\% | 2.5\% |
| BHAR (1) |  | 0.0\% | -0.5\% | -1.3\% | -0.9\% | 0.3\% | 0.3\% | -0.5\% | -0.3\% | 0.2\% | 0.3\% | 0.3\% | 2.1\% | 1.8\% | 2.5\% | 0.8\% | $2.7 \%$ |



| IVOL $\mathrm{J}=$ | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.7\% | 1.7\% | 2.4\% | 2.9\% | 1.1\% | 1.9\% | 2.5\% | 2.5\% | 1.3\% | 2.0\% | 2.0\% | 1.3\% | 1.7\% | 2.0\% | 1.7\% | 1.1\% |
| CAR (1) | 0.6\% | 1.7\% | 2.5\% | 2.7\% | 1.3\% | 2.2\% | 2.6\% | 1.9\% | 1.3\% | 1.7\% | 1.5\% | 0.4\% | 1.2\% | 1.3\% | 0.9\% | 0.2\% |
| BHAR (0) | 0.6\% | 1.9\% | 1.6\% | 1.8\% | 0.9\% | 1.5\% | 1.2\% | 3.3\% | 2.4\% | 2.4\% | 2.4\% | 2.7\% | 2.2\% | 3.5\% | 2.6\% | 3.1\% |
| BHAR (1) | 0.7\% | 2.3\% | 1.5\% | 1.0\% | 1.6\% | 1.8\% | 1.0\% | 2.2\% | 2.0\% | 2.0\% | 1.9\% | 1.3\% | 1.6\% | $2.7 \%$ | 2.5\% | 2.3\% |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | -0.1\% | 0.8\% | 0.8\% | 0.8\% | 0.5\% | 1.0\% | 1.4\% | 1.3\% | 0.3\% | 0.9\% | 0.9\% | 0.7\% | 0.2\% | 0.3\% | 0.5\% | 0.1\% |
| CAR (1) | 0.4\% | 1.1\% | 0.7\% | 0.9\% | 0.8\% | 1.3\% | 1.3\% | 1.3\% | 0.7\% | 1.0\% | 1.0\% | 0.7\% | 0.3\% | 0.4\% | 0.4\% | -0.1\% |
| BHAR (0) | 0.0\% | 1.7\% | 2.8\% | 2.9\% | 0.8\% | 1.3\% | 3.5\% | 4.5\% | -0.2\% | 0.9\% | 1.6\% | 2.2\% | 0.0\% | -0.4\% | 1.0\% | -1.1\% |
| BHAR (1) | 0.4\% | 2.3\% | 3.9\% | 3.4\% | 1.5\% | 2.4\% | 4.2\% | 2.5\% | 0.3\% | 1.9\% | 1.7\% | 1.5\% | 0.0\% | -1.0\% | 0.6\% | -1.8\% |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.0\% | 2.3\% | 2.7\% | 2.8\% | 1.3\% | 2.3\% | 2.8\% | 3.0\% | 1.7\% | 2.6\% | 2.9\% | 3.1\% | 1.8\% | 2.5\% | 2.9\% | 3.0\% |
| CAR (1) | 1.1\% | 2.3\% | 2.6\% | 2.5\% | 1.4\% | 2.2\% | 2.6\% | 2.4\% | 1.5\% | 2.3\% | 2.6\% | 2.5\% | 1.5\% | 2.4\% | 2.6\% | 2.5\% |
| BHAR (0) | 0.7\% | 1.6\% | 2.8\% | 0.4\% | 1.5\% | 1.9\% | 2.3\% | 2.3\% | 1.9\% | 2.1\% | 2.9\% | 2.5\% | 1.6\% | 3.1 \% | 4.5\% | 4.3\% |
| BHAR (1) | 1.0\% | 0.9\% | 3.1\% | -0.1\% | 1.1\% | 2.0\% | 3.7\% | 2.8\% | 1.0\% | 2.2\% | 3.4\% | 2.1\% | 1.5\% | 3.2\% | 3.5\% | 3.7\% |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.1\% | 0.5\% | 1.1\% | 1.9\% | 0.0\% | 0.3\% | 1.6\% | 1.8\% | 0.2\% | 0.9\% | 1.7\% | 1.5\% | 1.2\% | 1.5\% | 2.0\% | 1.8\% |
| CAR (1) | 0.1\% | 0.5\% | 1.2\% | 1.9\% | 0.0\% | 0.8\% | 1.8\% | 1.7\% | 0.5\% | 1.3\% | 1.5\% | 1.4\% | 0.7\% | 1.2\% | 1.5\% | 1.2\% |
| BHAR (0) | 0.3\% | -1.2\% | 0.2\% | 0.9\% | -0.1\% | 0.1\% | 1.2\% | -0.7\% | 0.6\% | 1.0\% | 2.6\% | 1.0\% | 1.3\% | 2.9\% | 1.6\% | 1.6\% |
| BHAR (1) | 0.1\% | -0.5\% | 0.6\% | 1.7\% | 0.0\% | 0.7\% | 2.0\% | -1.3\% | 0.9\% | 0.9\% | 2.3\% | 0.7\% | 0.3\% | 1.8\% | 0.7\% | 0.9\% |



Table 7.9b. Break-even transaction costs for cross-sectional momentum strategy

| EW J = | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.2\% | 0.6\% | 0.7\% | 0.8\% | 0.6\% | 0.8\% | 0.9\% | 0.6\% | 0.7\% | 1.0\% | 0.6\% | 0.0\% | 0.9\% | 0.6\% | 0.0\% | -0.7\% |
| CAR (1) | 0.7\% | 1.0\% | 1.1\% | 0.8\% | 0.9\% | 1.0\% | 0.9\% | 0.3\% | 1.1\% | 1.0\% | 0.5\% | -0.3\% | 0.8\% | 0.3\% | -0.4\% | -1.1\% |
| BHAR (0) | 0.2\% | 0.8\% | 0.2\% | -0.2\% | 0.7\% | 0.7\% | -0.1\% | 0.1\% | 0.7\% | 0.8\% | 0.6\% | 0.1\% | 0.9\% | 0.5\% | 0.1\% | -0.1\% |
| BHAR (1) | 0.8\% | 0.8\% | 0.1\% | -0.5\% | 1.1\% | 0.9\% | -0.1\% | -0.5\% | 1.0\% | 0.5\% | 0.5\% | -0.2\% | 0.8\% | 0.1\% | -0.7\% | -0.8\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.8\% | 1.3\% | 2.0\% | 2.5\% | 1.3\% | 1.8\% | 2.7\% | 3.2\% | 1.9\% | 2.5\% | 2.9\% | 3.0\% | 2.2\% | 2.7\% | 2.8\% | 2.5\% |
| CAR (1) | 0.9\% | 1.4\% | 2.1\% | 2.5\% | 1.5\% | 1.9\% | 2.7\% | 3.0\% | 2.1\% | 2.5\% | 2.7\% | 2.6\% | 2.1 \% | 2.5\% | 2.5\% | 2.1\% |
| BHAR (0) | 0.8\% | 0.9\% | 1.6\% | 0.8\% | 1.2\% | 1.4\% | 2.6\% | 3.9\% | 1.8\% | 3.2\% | 3.1\% | 4.1\% | 2.1 \% | 2.3\% | 2.6\% | 1.1\% |
| BHAR (1) | 0.9\% | 0.9\% | 1.3\% | 0.9\% | 1.5\% | 1.6\% | 2.6\% | 3.3\% | 2.0\% | 2.8\% | 3.2\% | 3.5\% | 2.0\% | 2.2\% | 1.7\% | 0.8\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.8\% | 1.7\% | 2.4\% | 3.1\% | 1.8\% | 2.5\% | 3.7\% | 4.1\% | 2.3\% | 3.4\% | 3.6\% | 4.0\% | 3.1\% | 3.9\% | 4.0\% | 3.8\% |
| CAR (1) | 1.0\% | 1.8\% | 2.6\% | 3.0\% | 1.9\% | 2.7\% | 3.6\% | 3.8\% | 2.6\% | 3.3\% | 3.5\% | 3.7\% | 3.0\% | 3.6\% | 3.6\% | 3.4\% |
| BHAR (0) | 0.9\% | 1.3\% | 1.7\% | 1.9\% | 1.7\% | 2.5\% | 3.2\% | 4.5\% | 2.5\% | 3.7 \% | 4.0\% | 4.9\% | 3.2\% | 3.9\% | 4.5\% | 2.9\% |
| BHAR (1) | 0.9\% | 1.0\% | 2.0\% | 1.6\% | 1.7\% | 2.6\% | 3.0\% | 4.0\% | 2.6\% | 3.3\% | 3.8\% | 3.7\% | 3.0\% | 3.5\% | 3.8\% | 2.6\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.6\% | 0.9\% | 1.6\% | 2.2\% | 1.0\% | 1.5\% | 2.3\% | 2.1\% | 1.6\% | 2.2\% | 2.1 \% | 1.4\% | 2.2\% | 2.0\% | 1.4\% | 0.4\% |
| CAR (1) | 0.8\% | 1.2\% | 2.0\% | 2.0\% | 1.3\% | 1.8\% | 2.3\% | 1.7\% | 2.0\% | 2.2\% | 1.8\% | 0.8\% | 1.9\% | 1.5\% | 0.8\% | -0.3\% |
| BHAR (0) | 0.6\% | 0.6\% | 1.5\% | 2.0\% | 0.7\% | 1.1\% | 1.5\% | 2.2\% | 1.4\% | 1.8\% | 1.7\% | 1.5\% | 2.1\% | 1.6\% | 1.5\% | 0.2\% |
| BHAR (1) | 0.8\% | 0.8\% | 2.0\% | 1.7\% | 1.3\% | 1.7\% | 1.6\% | 1.5\% | 1.8\% | 1.8\% | 1.3\% | 1.4\% | 1.7\% | 1.3\% | 1.0\% | -0.3\% |


| EW | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.1\% | 2.1\% | 2.8\% | 3.7\% | 2.1\% | 2.8\% | 3.9\% | 4.4\% | 2.9\% | 3.8\% | 4.0\% | 4.2\% | 3.7\% | 4.3\% | 4.3\% | 4.0\% |
| CAR (1) |  | 1.2\% | 2.1 \% | 2.9\% | 3.5\% | 2.2\% | 2.8\% | 3.7\% | 4.0\% | 2.9\% | 3.7\% | 3.7\% | 3.7\% | 3.4\% | 3.8\% | 3.7\% | 3.3\% |
| BHAR (0) |  | 1.1\% | 1.9\% | 2.0\% | 3.7\% | 2.0\% | 2.4\% | 3.2\% | 5.3\% | 2.7\% | 3.1\% | 4.3\% | 3.4\% | 3.8\% | 4.4\% | 4.3\% | 3.2\% |
| BHAR (1) |  | 1.1\% | 1.8\% | 2.5\% | 3.5\% | 2.2\% | 2.4\% | 3.3\% | 4.8\% | 2.8\% | 3.3\% | 3.9\% | 2.9\% | 3.3\% | 3.6\% | 3.7\% | 2.3\% |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.7\% | 1.3\% | 2.1\% | 2.3\% | 1.4\% | 2.0\% | $2.9 \%$ | 2.8\% | 1.9\% | 2.4\% | 2.4\% | 2.2\% | 1.8\% | 1.9\% | 1.9\% | 1.6\% |
| CAR (1) |  | 0.9\% | 1.5\% | 2.2\% | 2.2\% | 1.5\% | 2.1\% | $2.7 \%$ | 2.4\% | 1.9\% | 2.2\% | 2.0\% | 1.7\% | 1.7\% | 1.6\% | 1.6\% | 1.3\% |
| BHAR (0) |  | 0.4\% | 0.5\% | 2.3\% | 1.6\% | 1.3\% | 2.0\% | $2.1 \%$ | 4.8\% | 1.7\% | 1.9\% | 1.9\% | 1.5\% | 1.6\% | 2.4\% | 2.5\% | 2.4\% |
| BHAR (1) |  | 1.0\% | 0.7\% | $2.7 \%$ | 1.6\% | 1.5\% | 2.2\% | 1.9\% | 3.8\% | 1.8\% | 1.5\% | 1.4\% | 1.2\% | 1.5\% | 1.8\% | 1.5\% | 1.8\% |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.1\% | 0.7\% | 1.2\% | 1.8\% | 0.6\% | 1.3\% | 2.1 \% | 2.4\% | 1.0\% | 1.9\% | 2.2 \% | 2.3\% | 1.5\% | 2.1\% | 2.1\% | 1.9\% |
| CAR (1) |  | 0.6\% | 1.3\% | 1.9\% | 2.2\% | 1.3\% | 1.7\% | 2.4\% | 2.5\% | 1.7\% | 2.2\% | 2.3\% | 2.2\% | 1.9\% | 2.2\% | 2.1\% | 1.8\% |
| BHAR (0) |  | -0.1\% | 0.0\% | 1.5\% | -0.3\% | 0.6\% | 1.4\% | 1.1\% | 1.9\% | 0.9\% | 1.4\% | 2.4\% | 2.2\% | 1.4\% | 2.2\% | 2.7\% | 1.8\% |
| BHAR (1) |  | 0.5\% | 0.4\% | 1.9\% | 0.2\% | 1.2\% | 1.7\% | 1.5\% | 1.8\% | 1.4\% | 1.5\% | 2.5\% | 1.3\% | 1.7\% | 2.2\% | 2.4\% | 1.9\% |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.7\% | 1.5\% | 2.1\% | 2.7\% | 1.5\% | 2.0\% | 2.9\% | 3.0\% | 2.0\% | 2.6\% | 2.6\% | 2.7\% | 2.5\% | 2.7\% | 2.7\% | 2.5\% |
| CAR (1) |  | 1.1\% | 1.7\% | 2.3\% | 2.7\% | 1.7\% | 2.1\% | 2.8\% | 2.7\% | 2.1\% | 2.5\% | 2.4\% | 2.4\% | 2.4\% | 2.4\% | 2.4\% | 2.2\% |
| BHAR (0) |  | 0.7\% | 1.1\% | 2.2\% | 1.2\% | 1.5\% | 2.3\% | 2.8\% | 3.4\% | 2.0\% | 2.5\% | 2.8\% | 2.4\% | 2.6\% | 3.0\% | 2.7\% | 2.2\% |
| BHAR (1) |  | 1.1\% | 1.0\% | 2.4\% | 0.9\% | 1.6\% | 2.2\% | 2.7\% | 2.7\% | 2.1\% | 2.2\% | 2.2\% | 1.6\% | 2.3\% | 2.4\% | 2.0\% | 2.0\% |



|  | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.7\% | 1.5\% | 2.3\% | 3.0\% | 1.4\% | 2.1 \% | 3.1\% | 3.5\% | 2.2\% | 3.1\% | 3.3\% | 3.6\% | 2.7\% | 3.3\% | 3.4\% | 3.3\% |
| CAR (1) |  | 0.8\% | 1.7\% | 2.4\% | 2.9\% | 1.5\% | 2.2\% | 3.0\% | 3.3\% | 2.3\% | 3.0\% | 3.0\% | 3.2\% | 2.5\% | 3.0\% | 3.0\% | 2.9\% |
| BHAR (0) |  | 0.7\% | 1.3\% | 2.7\% | 2.7\% | 1.3\% | 2.1 \% | 2.8\% | 3.0\% | 2.0\% | 2.7\% | 3.4\% | 2.9\% | 2.3\% | 3.0\% | 3.6\% | 3.0\% |
| BHAR (1) |  | 0.8\% | 1.3\% | 3.0\% | 2.7\% | 1.4\% | 2.1 \% | 2.8\% | 2.7\% | 2.3\% | 2.6\% | 2.9\% | 2.2\% | 2.3\% | 2.8\% | 3.2\% | 2.8\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.1\% | -0.4\% | -0.4\% | -0.1\% | -0.5\% | -0.5\% | -0.3\% | -0.5\% | -0.5\% | -0.4\% | -0.5\% | -0.9\% | -0.2\% | -0.6\% | -0.9\% | -1.2\% |
| CAR (1) |  | 0.0\% | -0.3\% | -0.1\% | 0.0\% | -0.3\% | -0.2\% | 0.0\% | -0.5\% | -0.1\% | -0.1\% | -0.4\% | -0.9\% | -0.1\% | -0.6\% | -1.0\% | -1.3\% |
| BHAR (0) |  | -0.2\% | 0.1\% | -0.2\% | 0.7\% | -0.3\% | -0.5\% | -0.4\% | 0.9\% | -0.3\% | -0.2\% | 0.2\% | -0.4\% | -0.2\% | -0.5\% | -0.9\% | -1.4\% |
| BHAR (1) |  | -0.1\% | 0.0\% | -0.3\% | 0.8\% | -0.4\% | -1.0\% | -0.2\% | 0.3\% | -0.3\% | 0.1\% | -0.1\% | -0.8\% | -0.3\% | -1.0\% | -1.5\% | -1.6\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.9\% | 1.8\% | 2.6\% | 3.3\% | 1.9\% | 2.5\% | 3.5\% | 3.9\% | 2.3\% | 3.2\% | 3.5\% | 3.9\% | 3.0\% | 3.5\% | 3.8\% | 3.8\% |
| CAR (1) |  | 1.0\% | 1.9\% | 2.7\% | 3.1\% | 1.9\% | 2.6\% | 3.3\% | 3.6\% | 2.5\% | 3.1\% | 3.3\% | 3.6\% | 2.8\% | 3.2\% | 3.4\% | 3.5\% |
| BHAR (0) |  | 1.1\% | 1.6\% | 2.9\% | 2.0\% | 1.9\% | 2.6\% | 2.9\% | 5.3\% | 2.3\% | 2.7\% | 3.8\% | 4.4\% | 2.7\% | 3.4\% | 3.8\% | 3.5\% |
| BHAR (1) |  | 1.1\% | 1.6\% | 2.4\% | 1.8\% | 1.8\% | 2.4\% | 2.7\% | 4.5\% | 2.5\% | 2.6\% | 3.7\% | 3.6\% | 2.4\% | 3.0\% | 3.4\% | 3.4\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.0\% | 2.1\% | 2.4\% | 3.1\% | 2.0\% | 2.6\% | 3.4\% | 3.7\% | 2.4\% | 3.0\% | 3.1\% | 3.4\% | 2.9\% | 3.3\% | 3.2\% | 3.0\% |
| CAR (1) |  | 1.2\% | 2.2\% | 2.6\% | 3.1\% | 2.2\% | 2.6\% | 3.3\% | 3.4\% | 2.5\% | 2.9\% | 2.9\% | 3.0\% | 2.7\% | 3.0\% | 2.9\% | 2.5\% |
| BHAR (0) |  | 0.9\% | 2.2\% | 1.5\% | 0.8\% | 2.3\% | 2.8\% | 3.2\% | 3.2\% | 2.9\% | 3.5\% | 4.1 \% | 4.5\% | 3.1\% | 3.9\% | 3.1\% | 3.9\% |
| BHAR (1) |  | 1.4\% | 2.2\% | 1.5\% | 1.1\% | 2.4\% | 2.6\% | 3.2\% | 2.3\% | 2.9\% | 3.4\% | 3.6\% | 4.2\% | 2.8\% | 3.2\% | 2.4\% | 3.7\% |




| MW $\mathrm{J}=$ | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.1\% | 2.3\% | 3.0\% | 3.3\% | 1.8\% | 2.7\% | 3.4\% | 3.4\% | 2.1\% | 2.8\% | 2.7\% | 2.2\% | 2.2\% | 2.5\% | 2.2\% | 1.7\% |
| CAR (1) | 1.2\% | 2.3\% | 2.9\% | 2.8\% | 1.9\% | 2.6\% | 3.0\% | 2.8\% | 2.0\% | 2.4\% | 2.3\% | 1.5\% | 1.9\% | 2.2\% | 1.7\% | 1.0\% |
| BHAR (0) | 1.3\% | 2.6\% | 2.4\% | 2.9\% | 2.0\% | 3.0\% | 1.6\% | 2.6\% | 2.3\% | 2.9\% | 2.5\% | 2.9\% | 2.3\% | 2.5\% | 0.8\% | 2.3\% |
| BHAR (1) | 1.5\% | 2.4\% | 2.0\% | 2.7\% | 2.0\% | 2.9\% | 1.3\% | 1.7\% | 1.7\% | 2.2\% | 1.8\% | 2.2\% | 1.7\% | 1.8\% | 0.3\% | 1.0\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.2\% | 0.4\% | 0.7\% | 1.0\% | 0.7\% | 1.1\% | 1.5\% | 1.6\% | 1.1\% | 1.2\% | 1.4\% | 1.1\% | 1.0\% | 1.2\% | 1.0\% | 0.6\% |
| CAR (1) | -0.1\% | 0.2\% | 0.6\% | 0.8\% | 0.8\% | 1.2\% | 1.4\% | 1.4\% | 1.0\% | 0.9\% | 1.2\% | 0.7\% | 0.6\% | 0.8\% | 0.6\% | 0.2\% |
| BHAR (0) | -0.1\% | 0.3\% | 0.3\% | -0.6\% | 0.6\% | 0.1\% | 0.6\% | 1.5\% | 1.4\% | 2.4\% | 1.6\% | 2.5\% | 1.3\% | 1.6\% | 1.2\% | 1.7\% |
| BHAR (1) | -0.3\% | -0.1\% | 0.3\% | -0.2\% | 0.7\% | 0.7\% | 1.1\% | 1.5\% | 1.3\% | 1.9\% | 1.8\% | 1.6\% | 0.6\% | 1.0\% | -0.2\% | 0.4\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.2\% | 0.9\% | 1.4\% | 1.9\% | 1.2\% | 2.2\% | 3.1 \% | 3.1\% | 1.5\% | 2.3\% | 2.4\% | 2.2\% | 1.5\% | 2.2\% | 1.9\% | 1.5\% |
| CAR (1) | 0.4\% | 0.9\% | 1.6\% | 1.9\% | 1.2\% | 2.2\% | 2.9\% | 2.5\% | 1.5\% | 2.2\% | 2.2\% | 1.8\% | 1.7\% | 1.9\% | 1.7\% | 1.3\% |
| BHAR (0) | 0.3\% | 1.4\% | -1.2\% | 2.4\% | 1.2\% | 1.8\% | 3.3\% | 3.5\% | 1.4\% | 3.8\% | 4.1\% | 3.8\% | 1.3\% | 1.5\% | 2.9\% | 0.4\% |
| BHAR (1) | 0.4\% | 1.0\% | -0.6\% | 3.2\% | 1.1\% | 2.3\% | 3.3\% | 2.6\% | 1.4\% | 3.6\% | 3.7\% | 2.6\% | 1.3\% | 1.6\% | 2.3\% | 0.5\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.3\% | 2.4\% | 3.6\% | 4.4\% | 2.0\% | 3.1\% | 4.4\% | 5.0\% | 2.6\% | 4.0\% | 4.5\% | 4.2\% | 2.4\% | 3.2\% | 3.3\% | 2.5\% |
| CAR (1) | 1.3\% | 2.3\% | 3.8\% | 4.0\% | 1.9\% | 3.0\% | 4.1\% | 4.2\% | 2.9\% | 3.8\% | 4.2\% | 3.4\% | 2.3\% | 2.9\% | 2.7\% | 1.8\% |
| BHAR (0) | 1.3\% | 1.8\% | 3.5\% | 2.0\% | 1.8\% | 3.0\% | 4.7\% | 4.3\% | 2.6\% | 3.1\% | 4.1 \% | 2.8\% | 2.3\% | 3.6\% | 3.1 \% | 2.8\% |
| BHAR (1) | 1.4\% | 1.5\% | 3.7\% | 1.6\% | 1.9\% | 2.9\% | 4.2\% | 2.5\% | 2.7\% | 2.7\% | 3.2\% | 2.6\% | 1.8\% | 2.6\% | 2.0\% | 1.7\% |



| MW | $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.4\% | 1.1\% | 1.2\% | 1.4\% | 1.1\% | 1.3\% | 1.8\% | 1.5\% | 0.9\% | 1.3\% | 1.4\% | 1.4\% | 0.7\% | 1.2\% | 1.0\% | 0.8\% |
| CAR (1) |  | 0.4\% | 1.1\% | 1.0\% | 1.1\% | 1.1\% | 1.3\% | 1.5\% | 1.2\% | 0.8\% | 1.2\% | 1.1\% | 1.0\% | 0.6\% | 0.8\% | 0.6\% | 0.5\% |
| BHAR (0) |  | 0.9\% | 2.3\% | 1.7\% | 4.4\% | 1.1\% | 2.0\% | 1.0\% | 2.7\% | 1.6\% | 1.1\% | 2.2\% | -0.5\% | 0.9\% | 0.8\% | -0.4\% | -2.1\% |
| BHAR (1) |  | 0.5\% | 2.2\% | 0.3\% | 4.9\% | 1.4\% | 1.6\% | 1.7\% | 2.0\% | 1.3\% | 0.9\% | 0.7\% | -1.8\% | 1.1\% | 0.5\% | -0.8\% | -2.1\% |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.9\% | 1.5\% | 1.7\% | 1.7\% | 1.1\% | 1.5\% | 1.6\% | 1.6\% | 1.0\% | 1.3\% | 1.3\% | 0.8\% | 0.7\% | 0.6\% | 0.2\% | -0.3\% |
| CAR (1) |  | 0.7\% | 1.4\% | 1.4\% | 1.4\% | 1.3\% | 1.5\% | 1.5\% | 1.3\% | 0.9\% | 1.1\% | 1.0\% | 0.3\% | 0.7\% | 0.6\% | 0.0\% | -0.4\% |
| BHAR (0) |  | 0.8\% | 0.6\% | 1.0\% | -0.1\% | 1.4\% | 2.0\% | 2.1\% | 0.0\% | 1.1\% | 1.1\% | 1.3\% | -0.4\% | 0.9\% | 1.3\% | 0.2\% | 1.2\% |
| BHAR (1) |  | 0.4\% | 0.5\% | 0.1\% | -0.6\% | 1.1\% | 1.4\% | 1.5\% | -1.0\% | 0.6\% | 0.6\% | 0.3\% | 0.1\% | 0.6\% | 0.8\% | -0.8\% | 0.8\% |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.9\% | 1.5\% | 0.7\% | 1.3\% | 1.4\% | 1.4\% | 1.3\% | 1.6\% | 0.6\% | 0.9\% | 1.0\% | 1.3\% | 0.9\% | 0.5\% | 0.5\% | 0.4\% |
| CAR (1) |  | 1.1\% | 1.1\% | 0.6\% | 0.9\% | 1.3\% | 1.0\% | 0.9\% | 1.2\% | 0.4\% | 0.5\% | 0.7\% | 0.7\% | 0.0\% | -0.1\% | 0.0\% | -0.5\% |
| BHAR (0) |  | 0.7\% | -2.2\% | -2.2\% | -2.8\% | 0.9\% | 2.1\% | -2.2\% | 8.5\% | 0.1\% | -0.1\% | 2.4\% | 3.6\% | 0.8\% | 0.3\% | 2.3\% | 0.5\% |
| BHAR (1) |  | 0.2\% | -2.2\% | -3.3\% | -2.0\% | 0.8\% | 1.2\% | -0.7\% | 6.8\% | -0.1\% | -0.6\% | 1.1\% | 0.9\% | -0.7\% | -0.3\% | 0.0\% | -0.7\% |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.7\% | 1.4\% | 1.9\% | 2.0\% | 1.1\% | 1.7\% | 1.9\% | 1.6\% | 1.6\% | 1.8\% | 1.7\% | 1.4\% | 1.3\% | 1.4\% | 1.2\% | 0.5\% |
| CAR (1) |  | 0.6\% | 1.3\% | 1.9\% | 1.5\% | 1.5\% | 1.9\% | 1.7\% | 1.4\% | 1.7\% | 1.5\% | 1.4\% | 0.7\% | 1.0\% | 1.0\% | 0.7\% | -0.2\% |
| BHAR (0) |  | 0.1\% | 0.4\% | 1.6\% | -0.1\% | 0.7\% | 1.6\% | 0.8\% | 3.1\% | 1.8\% | 2.6\% | 3.0\% | 5.8\% | 1.3\% | 1.5\% | 2.0\% | 1.7\% |
| BHAR (1) |  | 0.3\% | 0.6\% | 1.9\% | 0.2\% | 1.7\% | 2.1\% | 1.6\% | 2.5\% | 2.0\% | 2.0\% | 2.6\% | 4.8\% | 1.1\% | 1.3\% | 1.3\% | 2.1\% |


| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.2\% | 1.1\% | 1.5\% | 2.3\% | 0.8\% | 1.5\% | 2.3\% | 3.1\% | 1.1\% | 2.3\% | 3.0\% | 3.7\% | 1.9\% | 2.9\% | 3.4\% | 4.0\% |
| CAR (1) |  | 0.5\% | 1.4\% | 2.0\% | 2.6\% | 1.0\% | 1.6\% | 2.4\% | 3.1\% | 1.6\% | 2.4\% | 2.9\% | 3.8\% | 1.9\% | 2.8\% | 3.4\% | 3.9\% |
| BHAR (0) |  | 0.4\% | 0.7\% | 3.0\% | 2.9\% | 1.0\% | 1.2\% | 1.7\% | 3.4\% | 1.4\% | 1.2\% | 2.9\% | 1.0\% | 1.7\% | 3.2\% | 4.9\% | 4.9\% |
| BHAR (1) |  | 0.4\% | 1.1\% | 3.8\% | 3.5\% | 0.8\% | 0.9\% | 1.5\% | 3.6\% | 1.4\% | 1.8\% | 2.1\% | 0.5\% | 1.7\% | 3.1\% | 4.5\% | 4.7\% |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.1\% | -0.3\% | 0.0\% | 0.1\% | -0.3\% | -0.3\% | 0.0\% | -0.1\% | -0.3\% | -0.1\% | -0.1\% | -0.3\% | -0.2\% | -0.4\% | -0.5\% | -0.7\% |
| CAR (1) |  | -0.1\% | -0.1\% | 0.2\% | 0.1\% | -0.1\% | 0.1\% | 0.3\% | -0.1\% | 0.1\% | 0.2\% | 0.0\% | -0.3\% | -0.1\% | -0.4\% | -0.5\% | -0.7\% |
| BHAR (0) |  | -0.1\% | 0.1\% | -0.4\% | 0.9\% | 0.0\% | -0.3\% | -0.2\% | 1.2\% | -0.1\% | 0.1\% | 0.5\% | 0.7\% | 0.0\% | 0.1\% | -1.2\% | -0.4\% |
| BHAR (1) |  | -0.1\% | -0.6\% | -1.4\% | 0.8\% | -0.1\% | -0.5\% | -0.3\% | 0.8\% | -0.2\% | 0.1\% | 0.1\% | -0.2\% | -0.3\% | -0.7\% | -1.9\% | -1.4\% |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.3\% | 0.1\% | 0.6\% | 1.1\% | 0.2\% | 0.4\% | 1.2\% | 1.3\% | 0.2\% | 0.6\% | 0.7\% | 0.6\% | 0.2\% | 0.3\% | 0.4\% | 0.3\% |
| CAR (1) |  | 0.2\% | 0.0\% | 0.6\% | 0.8\% | 0.1\% | 0.6\% | 1.1\% | 1.0\% | 0.4\% | 0.6\% | 0.7\% | 0.4\% | 0.2\% | 0.2\% | 0.2\% | 0.3\% |
| BHAR (0) |  | 0.4\% | 0.0\% | -0.2\% | -0.2\% | 0.0\% | -0.1\% | 0.3\% | 3.0\% | 0.0\% | 0.1\% | 1.1\% | 1.1\% | 0.1\% | 0.5\% | 0.4\% | 0.4\% |
| BHAR (1) |  | 0.2\% | -0.7\% | -0.8\% | 0.4\% | -0.2\% | -0.3\% | 0.1\% | 1.5\% | 0.1\% | -0.3\% | 0.9\% | -0.1\% | 0.2\% | -0.1\% | 0.2\% | 0.1\% |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.4\% | 2.3\% | 2.6\% | 3.2\% | 1.6\% | 2.2\% | 2.9\% | 3.0\% | 1.7\% | 2.3\% | 2.6\% | 2.8\% | 1.9\% | 2.5\% | 2.9\% | 2.8\% |
| CAR (1) |  | 1.0\% | 1.8\% | 2.3\% | 2.5\% | 1.3\% | 1.9\% | 2.6\% | 2.3\% | 1.5\% | 2.1\% | 2.3\% | 2.4\% | 1.7\% | 2.3\% | 2.5\% | 2.2\% |
| BHAR (0) |  | 1.1\% | 2.8\% | 1.4\% | 2.1\% | 1.6\% | 1.9\% | 3.1\% | 1.2\% | 2.2\% | 2.9\% | 3.4\% | 2.5\% | 1.6\% | 3.2\% | 2.8\% | 4.2\% |
| BHAR (1) |  | 0.7\% | 1.5\% | 0.3\% | 1.4\% | 1.0\% | 1.0\% | 2.5\% | -0.1\% | 2.0\% | 2.5\% | 2.9\% | 1.7\% | 1.9\% | 2.6\% | 2.1 \% | 4.2\% |



| MW | J = | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.2\% | 1.6\% | 1.5\% | 1.7\% | 1.1\% | 1.3\% | 1.5\% | 1.6\% | 0.8\% | 0.9\% | 0.8\% | 0.3\% | 0.5\% | 0.4\% | -0.2\% | -0.7\% |
| CAR (1) |  | 1.0\% | 1.2\% | 1.3\% | 1.1\% | 1.0\% | 1.2\% | 1.3\% | 1.2\% | 0.9\% | 0.9\% | 0.5\% | -0.1\% | 0.2\% | 0.0\% | -0.7\% | -0.8\% |
| BHAR (0) |  | 1.2\% | 0.3\% | 2.6\% | -1.6\% | 1.1\% | 2.0\% | 2.2\% | 1.2\% | 0.9\% | 0.4\% | 0.6\% | -0.9\% | 0.2\% | 0.2\% | -1.2\% | 0.3\% |
| BHAR (1) |  | 1.1\% | 0.2\% | 2.5\% | -1.0\% | 0.9\% | 1.6\% | 1.9\% | 0.5\% | 0.7\% | 0.5\% | -0.1\% | -1.2\% | 0.0\% | -0.4\% | -1.5\% | 0.3\% |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.3\% | 0.9\% | 1.3\% | 2.1 \% | 0.6\% | 1.0\% | 1.7\% | 1.8\% | 0.9\% | 1.5\% | 1.7\% | 1.6\% | 1.3\% | 1.8\% | 1.7\% | 1.7\% |
| CAR (1) |  | 0.5\% | 1.1\% | 1.6\% | 2.0\% | 0.6\% | 1.3\% | 1.7\% | 1.5\% | 1.1\% | 1.5\% | 1.6\% | 1.3\% | 1.0\% | 1.5\% | 1.4\% | 1.4\% |
| BHAR (0) |  | 0.1\% | 0.3\% | 0.2\% | 0.5\% | 0.4\% | 1.3\% | 1.2\% | 3.5\% | 0.8\% | 1.1\% | 2.0\% | 1.8\% | 1.2\% | 3.0\% | 2.4\% | 2.3\% |
| BHAR (1) |  | 0.2\% | 0.0\% | 0.4\% | 0.7\% | 0.6\% | 1.5\% | 0.7\% | 3.0\% | 0.7\% | 1.0\% | 1.4\% | 0.6\% | 0.8\% | 2.2\% | 2.3\% | 1.8\% |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.1\% | 0.6\% | 1.0\% | 1.9\% | 0.3\% | 0.8\% | 1.8\% | $2.1 \%$ | 0.6\% | 1.4\% | 2.0\% | 1.8\% | 0.7\% | 1.5\% | 1.7\% | 1.4\% |
| CAR (1) |  | 0.1\% | 0.7\% | 1.3\% | 1.9\% | 0.5\% | 1.1\% | 2.0\% | 1.9\% | 0.8\% | 1.6\% | 1.9\% | 1.4\% | 0.9\% | 1.6\% | 1.5\% | 1.0\% |
| BHAR (0) |  | -0.1\% | 0.1\% | 0.3\% | 0.0\% | 0.4\% | 0.7\% | 1.2\% | 3.2\% | 0.7\% | 1.6\% | 2.0\% | 2.2\% | 0.6\% | 1.3\% | 1.9\% | 1.2\% |
| BHAR (1) |  | -0.1\% | 0.1\% | 0.3\% | 0.9\% | 0.4\% | 0.8\% | 1.5\% | 2.4\% | 1.0\% | 1.8\% | 1.8\% | 1.3\% | 0.8\% | 1.1\% | 0.9\% | 0.3\% |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.2\% | 0.0\% | 0.5\% | 0.7\% | 0.0\% | 0.5\% | 1.0\% | 1.1\% | 0.5\% | 1.0\% | 1.1\% | 0.9\% | 0.5\% | 0.7\% | 0.6\% | 0.5\% |
| CAR (1) |  | -0.1\% | 0.3\% | 0.8\% | 0.7\% | 0.3\% | 0.9\% | 1.2\% | 1.0\% | 0.8\% | 1.1\% | 1.1\% | 0.8\% | 0.5\% | 0.7\% | 0.5\% | 0.4\% |
| BHAR (0) |  | -0.4\% | -0.1\% | -0.7\% | 0.8\% | 0.1\% | 0.4\% | -0.2\% | 2.5\% | 0.6\% | 0.8\% | 1.5\% | 0.9\% | 0.6\% | 1.2\% | 0.7\% | 1.0\% |
| BHAR (1) |  | -0.1\% | -0.6\% | -0.7\% | 0.6\% | 0.2\% | 0.7\% | -0.2\% | 1.7\% | 0.8\% | 0.7\% | 1.0\% | 0.2\% | 0.3\% | 0.7\% | 0.3\% | 0.3\% |


| IVOL $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.5\% | 1.4\% | 1.9\% | 2.2\% | 1.4\% | 1.8\% | 2.2\% | 1.9\% | 1.8\% | 2.3\% | 1.9\% | 1.4\% | 1.9\% | 1.9\% | 1.2\% | 0.6\% |
| CAR (1) | 0.7\% | 1.5\% | 2.0\% | 1.9\% | 1.5\% | 1.8\% | 2.0\% | 1.4\% | 1.9\% | $2.1 \%$ | 1.5\% | 0.9\% | 1.6\% | 1.4\% | 0.7\% | -0.1\% |
| BHAR (0) | 0.4\% | 1.2\% | 1.3\% | 1.1\% | 1.5\% | 1.2\% | 0.8\% | 0.8\% | 1.9\% | 2.4\% | 2.5\% | 1.6\% | 1.8\% | 1.6\% | 1.0\% | 1.3\% |
| BHAR (1) | 0.8\% | 1.4\% | 1.4\% | 1.9\% | 1.7\% | 1.6\% | 1.3\% | 1.1\% | 1.9\% | 2.1\% | 1.8\% | 0.9\% | 1.5\% | 1.0\% | -0.1\% | 0.3\% |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.8\% | 1.3\% | 2.0\% | 2.6\% | 1.1\% | 1.8\% | 2.8\% | 3.6\% | 1.8\% | 2.7\% | 3.3\% | 3.6\% | 2.1 \% | 2.9\% | 3.1 \% | 3.0\% |
| CAR (1) | 0.6\% | 1.0\% | 1.7\% | 2.2\% | 1.2\% | 1.8\% | 2.7\% | 3.1\% | 1.8\% | 2.5\% | 3.0\% | 3.0\% | 1.9\% | 2.5\% | 2.7\% | 2.4\% |
| BHAR (0) | 0.6\% | 0.8\% | 1.8\% | 2.0\% | 1.2\% | 1.5\% | 2.1\% | 4.0\% | 1.9\% | 2.9\% | 2.9\% | 4.0\% | 2.0\% | 2.5\% | 2.8\% | 1.9\% |
| BHAR (1) | 0.6\% | 0.5\% | 1.7\% | 1.0\% | 1.2\% | 2.1\% | 2.8\% | 3.9\% | 1.6\% | 2.4\% | 2.8\% | 3.4\% | 1.9\% | 2.5\% | 2.2\% | 1.5\% |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.7\% | 1.4\% | 2.0\% | 2.7\% | 1.5\% | 2.4\% | 3.5\% | 4.0\% | 2.0\% | 3.1\% | 3.5\% | 3.9\% | 2.7\% | 3.6\% | 3.8\% | 3.8\% |
| CAR (1) | 0.8\% | 1.4\% | 2.0\% | 2.5\% | 1.6\% | 2.5\% | 3.4\% | 3.8\% | 2.3\% | 3.0\% | 3.3\% | 3.6\% | 2.7\% | 3.4\% | 3.5\% | 3.4\% |
| BHAR (0) | 0.6\% | 0.8\% | 0.7\% | 1.7\% | 1.4\% | 2.3\% | 3.2\% | 4.5\% | 2.2\% | 3.5\% | 4.0\% | 4.8\% | 2.8\% | 3.3\% | 4.4\% | 2.8\% |
| BHAR (1) | 0.7\% | 1.2\% | 1.8\% | 1.7\% | 1.5\% | 2.4\% | 3.0\% | 4.1 \% | 2.3\% | 3.1\% | 3.9\% | 3.3\% | 2.6\% | 3.1\% | 3.8\% | 2.3\% |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.0\% | 1.5\% | 2.2\% | 2.9\% | 1.6\% | 2.2\% | 3.2\% | 3.2\% | 2.2\% | 2.9\% | 2.9\% | 2.4\% | 2.6\% | 2.6\% | 2.1 \% | 1.3\% |
| CAR (1) | 0.9\% | 1.5\% | 2.4\% | 2.4\% | 1.6\% | 2.2\% | 3.0\% | 2.5\% | 2.3\% | 2.7\% | 2.4\% | 1.6\% | 2.2\% | 2.0\% | 1.4\% | 0.4\% |
| BHAR (0) | 1.0\% | 0.9\% | 2.3\% | 2.3\% | 1.4\% | 2.1\% | 2.4\% | 3.5\% | 1.9\% | 2.6\% | 2.6\% | 2.6\% | 2.4\% | 2.3\% | 2.2\% | 1.0\% |
| BHAR (1) | 0.9\% | 0.8\% | 2.4\% | 1.6\% | 1.5\% | 2.5\% | 2.2\% | 2.6\% | 2.0\% | 2.2\% | 2.0\% | 2.3\% | 1.9\% | 1.7\% | 1.7\% | 0.4\% |






| IVOL $\mathrm{J}=$ |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.0\% | 1.8\% | 2.3\% | 3.1\% | 1.8\% | 2.3\% | 3.0\% | 3.3\% | 2.3\% | 2.9\% | 2.9\% | 2.9\% | 2.5\% | 2.6\% | 2.3\% | 2.2\% |
| CAR (1) | 1.0\% | 1.8\% | 2.3\% | 2.9\% | 1.7\% | 2.2\% | 2.7\% | 2.7\% | 2.3\% | 2.7\% | 2.5\% | 2.4\% | 2.1 \% | 2.2\% | 1.8\% | 1.8\% |
| BHAR (0) | 1.3\% | 1.6\% | 3.0\% | 1.5\% | 2.0\% | 2.7\% | 3.4\% | 3.3\% | 2.4\% | 2.6\% | 2.9\% | 2.5\% | 2.4\% | 3.1\% | 2.4\% | 2.9\% |
| BHAR (1) | 1.2\% | 1.3\% | 2.1\% | 2.6\% | 2.0\% | 2.6\% | 3.6\% | 2.8\% | 2.3\% | 2.8\% | 2.8\% | 2.0\% | 2.2\% | 2.6\% | 1.8\% | 2.6\% |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.8\% | 1.4\% | 1.8\% | 2.6\% | 1.3\% | 1.7\% | 2.5\% | 2.9\% | 1.6\% | 2.3\% | 2.6\% | 2.7\% | 2.2\% | 2.7\% | 2.7\% | 2.5\% |
| CAR (1) | 0.7\% | 1.2\% | 1.8\% | 2.2\% | 1.2\% | 1.6\% | 2.3\% | 2.5\% | 1.6\% | 2.2\% | 2.4\% | 2.3\% | 2.0\% | 2.4\% | 2.3\% | 2.0\% |
| BHAR (0) | 0.8\% | 1.3\% | 1.4\% | 2.5\% | 1.3\% | 1.9\% | 2.2\% | 4.5\% | 1.7\% | 2.1\% | 3.0\% | 3.0\% | 2.3\% | 3.3\% | 3.2\% | 2.6\% |
| BHAR (1) | 0.6\% | 0.8\% | 1.2\% | 2.2\% | 1.1\% | 1.5\% | 1.8\% | 3.8\% | 1.4\% | 1.8\% | 2.6\% | 1.9\% | 1.9\% | 2.8\% | 2.5\% | 2.4\% |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 1.1\% | 2.1\% | 2.7\% | 3.6\% | 2.0\% | 2.6\% | 3.6\% | 4.2\% | 2.4\% | 3.3\% | 3.5\% | 3.6\% | 3.0\% | 3.6\% | 3.4\% | 3.2\% |
| CAR (1) | 1.1\% | 2.0\% | 2.6\% | 3.3\% | 1.8\% | 2.4\% | 3.3\% | 3.5\% | 2.2\% | 3.0\% | 3.0\% | 3.0\% | $2.7 \%$ | 3.1\% | 2.8\% | 2.5\% |
| BHAR (0) | 1.0\% | 1.8\% | 3.1\% | 2.7\% | 1.9\% | 2.4\% | 2.7\% | 4.9\% | 2.2\% | 2.9\% | 3.7\% | 3.7\% | 2.7\% | 41.4\% | 41.7\% | 22.6\% |
| BHAR (1) | 1.2\% | 1.3\% | 3.0\% | 2.5\% | 1.7\% | 2.3\% | 2.7\% | 4.3\% | 2.2\% | 2.7\% | 3.4\% | 3.0\% | 2.5\% | 2.9\% | 2.8\% | 1.9\% |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | -0.2\% | -0.1\% | 0.1\% | 0.1\% | -0.1\% | 0.3\% | 0.5\% | 0.2\% | 0.3\% | 0.5\% | 0.3\% | -0.2\% | 0.1 \% | 0.1\% | -0.3\% | -0.8\% |
| CAR (1) | -0.1\% | 0.2\% | 0.4\% | 0.1\% | 0.2\% | 0.6\% | 0.5\% | 0.1\% | 0.5\% | 0.5\% | 0.2\% | -0.4\% | 0.1 \% | 0.0\% | -0.5\% | -0.9\% |
| BHAR (0) | -0.3\% | -0.1\% | -0.2\% | 0.0\% | 0.0\% | 0.5\% | -0.5\% | 1.5\% | 0.3\% | 0.3\% | 0.8\% | 0.1\% | 0.3\% | 0.6\% | 0.3\% | -0.6\% |
| BHAR (1) | -0.1\% | -0.1\% | -0.3\% | -0.1\% | 0.2\% | 0.5\% | -0.6\% | 0.5\% | 0.4\% | 0.1\% | 0.1 \% | -0.6\% | 0.0\% | 0.1\% | -0.4\% | -1.1\% |

## Table 8.1. Risk-adjusted return (intercept in the three-factor model) of time-series momentum strategy

This table reports the average monthly risk-adjusted returns (Fama-French alpha) after accounting for the transaction costs for 16 ( $\mathrm{J} \times \mathrm{H}$ ) time-series momentum strategies across the 24 stock markets along with an indication of significant level based on the Newey-West adjusted t -statistics. The results all relate to an implementation in which the cut-offs for selecting the stocks to be included in the cross-sectional momentum portfolios were set at $16 \%$.

We run the three-factor regression model, $M R_{i}-R f_{i}=\alpha_{i}+\beta 1_{i}\left(R m_{i}-R f_{i}\right)+\beta 2_{i} S M B_{i}+\beta 3_{i} H M L_{i}$ where $M R_{i}$ is momentum return after accounting for the transaction costs at month t (from Chapter seven), $R f_{i}$ is the risk-free rate at month $\mathrm{t}, R m_{i}$ is market-weighted index at month $\mathrm{t}, S M B_{i}$ is 'small minus big' at month t , which is calculated by the market average return for the smallest $30 \%$ of stocks minus the market average return of the largest $30 \%$ of stocks in that month. $H M L_{i}$ is 'high minus low' at month t , which is calculated as the market average return for $50 \%$ of stocks with the highest book-to-market ratio minus market average return for $50 \%$ of stocks with the lowest book-to-market ratio.

Panel A. The time-series momentum using equal-weighted return






| EW | $\mathrm{J}=$ |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.40\% | -0.10\% | -0.02\% | 0.14\% | -0.26\% | 0.21\% | 0.41\% | 0.33\% | 0.30\% | 0.65\% | 0.47\% | 0.26\% | 0.80\% | 0.68\% | 0.44\% | 0.22\% |
|  |  | -3.4736 | -0.2902 | -0.0646 | 0.5567 | -0.5222 | 0.4870 | 1.0689 | 0.9789 | 0.5894 | 1.4494 | 1.1339 | 0.6984 | 1.6473 | 1.4267 | 1.0073 | 0.5745 |
| CAR (1) |  | -0.85\% | 0.01\% | 0.03\% | 0.08\% | 0.00\% | 0.30\% | 0.41\% | 0.24\% | 0.46\% | 0.38\% | 0.28\% | 0.04\% | 0.57\% | 0.39\% | 0.25\% | 0.02\% |
|  |  | -2.2186 | 0.0278 | 0.1070 | 0.3368 | -0.0067 | 0.7065 | 1.1058 | 0.7205 | 0.9458 | 0.8649 | 0.6948 | 0.1069 | 1.1721 | 0.8181 | 0.5975 | 0.0523 |
| BHAR (0) |  | -1.64\% | -0.45\% | -0.57\% | -0.07\% | -0.16\% | 0.41\% | -0.01\% | 0.06\% | 0.37\% | 0.53\% | 0.47\% | -0.06\% | 0.53\% | 0.60\% | 0.83\% | 0.59\% |
|  |  | -2.8594 | -0.8533 | -1.1892 | -0.1389 | -0.2375 | 0.6077 | -0.0135 | 0.1076 | 0.6063 | 0.8874 | 0.9123 | -0.1277 | 0.9277 | 1.0977 | 1.6315 | 1.1314 |
| BHAR (1) |  | -1.28\% | 0.03\% | -0.38\% | 0.09\% | 0.16\% | 0.32\% | -0.06\% | -0.10\% | 0.45\% | 0.63\% | 0.61\% | 0.02\% | 0.97\% | 0.52\% | 0.69\% | 0.57\% |
|  |  | -2.3920 | 0.0668 | -0.8432 | 0.2045 | 0.2501 | 0.4788 | -0.0901 | -0.1831 | 0.7117 | 1.0549 | 1.2789 | 0.0419 | 1.7909 | 0.9630 | 1.4248 | 1.0585 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.16\% | 0.39\% | 0.48\% | 0.48\% | 0.57\% | 0.90\% | 0.85\% | 0.63\% | 0.85\% | 1.01\% | 0.70\% | 0.47\% | 0.77\% | 0.66\% | 0.45\% | 0.24\% |
|  |  | -0.7075 | 2.0297 | 2.9208 | 3.3348 | 1.8533 | 3.4190 | 3.7244 | 3.0487 | 2.4423 | 3.4768 | 2.7439 | 2.0193 | 2.2331 | 2.0877 | 1.5956 | 0.9273 |
| CAR (1) |  | 0.04\% | 0.50\% | 0.47\% | 0.42\% | 0.75\% | 0.89\% | 0.72\% | 0.52\% | 0.76\% | 0.76\% | 0.47\% | 0.27\% | 0.53\% | 0.44\% | 0.26\% | 0.04\% |
|  |  | 0.1545 | 2.6726 | 2.9713 | 2.9449 | 2.4453 | 3.5327 | 3.1690 | 2.5626 | 2.2508 | 2.6883 | 1.8665 | 1.2130 | 1.5512 | 1.4287 | 0.9282 | 0.1701 |
| BHAR (0) |  | -0.42\% | 0.49\% | 0.23\% | 1.10\% | 0.53\% | 1.28\% | 0.49\% | 1.09\% | 0.72\% | 1.10\% | 0.90\% | 0.47\% | 0.64\% | 0.62\% | 0.36\% | 0.57\% |
|  |  | -1.4443 | 1.5717 | 0.7897 | 3.3804 | 1.4967 | 3.6187 | 1.6940 | 2.8198 | 1.7162 | 2.7799 | 2.5650 | 1.5007 | 1.6689 | 1.8658 | 0.9504 | 1.8330 |
| BHAR (1) |  | -0.06\% | 0.73\% | 0.04\% | 1.09\% | 0.81\% | 1.21\% | 0.44\% | 0.99\% | 0.83\% | 0.95\% | 0.66\% | 0.40\% | 0.63\% | 0.58\% | -0.04\% | 0.51\% |
|  |  | -0.2216 | 2.4480 | 0.1537 | 3.4285 | 2.3375 | 3.4823 | 1.5339 | 2.5572 | 2.0639 | 2.4890 | 1.8861 | 1.2462 | 1.6299 | 1.6732 | -0.1066 | 1.6014 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.45\% | 0.14\% | 0.13\% | 0.22\% | 0.30\% | 0.28\% | 0.34\% | 0.26\% | 0.28\% | 0.38\% | 0.25\% | 0.14\% | 0.48\% | 0.34\% | 0.16\% | -0.06\% |
|  |  | -2.1223 | 0.8271 | 0.9567 | 1.7842 | 1.3140 | 1.4834 | 2.0311 | 1.7094 | 1.2323 | 1.8428 | 1.3081 | 0.7952 | 2.0334 | 1.5154 | 0.7652 | -0.2837 |
| CAR (1) |  | -0.31\% | 0.08\% | 0.11\% | 0.15\% | 0.11\% | 0.13\% | 0.21\% | $\mathbf{0 . 1 1 \%}$ | 0.16\% | 0.18\% | 0.11\% | -0.05\% | 0.20\% | 0.13\% | -0.05\% | -0.24\% |
|  |  | -1.5550 | 0.5305 | 0.8208 | 1.2602 | 0.4944 | 0.7253 | 1.3002 | 0.7428 | 0.7173 | 0.8900 | 0.5596 | -0.2822 | 0.8771 | 0.5700 | -0.2543 | -1.2257 |
| BHAR (0) |  | -0.40\% | 0.33\% | 0.28\% | 0.36\% | 0.46\% | 0.63\% | 0.11\% | 0.18\% | 0.42\% | 0.39\% | 0.16\% | -0.08\% | 0.51\% | 0.50\% | 0.18\% | -0.01\% |
|  |  | -1.4507 | 1.2320 | 1.2159 | 1.4427 | 1.8719 | 2.8816 | 0.4549 | 0.9350 | 1.7402 | 1.5237 | 0.7459 | -0.3781 | 2.0096 | 2.1464 | 0.7405 | -0.0423 |
| BHAR (1) |  | -0.26\% | 0.23\% | 0.06\% | 0.14\% | 0.10\% | 0.36\% | -0.12\% | 0.04\% | 0.19\% | 0.10\% | 0.02\% | -0.27\% | 0.29\% | 0.10\% | -0.17\% | -0.40\% |
|  |  | -0.9514 | 0.9037 | 0.2693 | 0.5288 | 0.3690 | 1.6415 | -0.4572 | 0.2023 | 0.7206 | 0.3620 | 0.1061 | -1.2020 | 1.1108 | 0.4057 | -0.6789 | -1.7622 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.32\% | -0.61\% | -0.47\% | -0.46\% | -0.82\% | -0.50\% | -0.43\% | -0.54\% | -0.59\% | -0.44\% | -0.60\% | -0.74\% | -0.68\% | -0.68\% | -0.83\% | -0.99\% |
|  |  | -5.5199 | -2.9600 | -2.6185 | -3.1075 | -2.9118 | -2.0036 | -2.0299 | -2.9144 | -1.9905 | -1.6967 | -2.5717 | -3.5073 | -2.3224 | -2.5601 | -3.3991 | -4.3886 |
| CAR (1) |  | -1.27\% | -0.60\% | -0.47\% | -0.55\% | -0.81\% | -0.53\% | -0.52\% | -0.66\% | -0.61\% | -0.57\% | -0.74\% | -0.89\% | -0.88\% | -0.87\% | -1.02\% | -1.14\% |
|  |  | -5.5246 | -3.0268 | -2.7801 | -3.9102 | -2.9448 | -2.2566 | -2.5858 | -3.6871 | -2.1924 | -2.3159 | -3.2924 | -4.3798 | -3.1639 | -3.3925 | -4.2903 | -5.1683 |
| BHAR (0) |  | -1.24\% | -0.30\% | -0.37\% | -0.26\% | -0.83\% | -0.63\% | -0.53\% | -0.55\% | -0.51\% | -0.35\% | -0.54\% | -0.83\% | -0.62\% | -0.71\% | -0.81\% | -0.94\% |
|  |  | -4.1869 | -1.1065 | -1.4003 | -0.9255 | -2.7886 | -2.3215 | -1.7329 | -2.5304 | -1.6624 | -1.1701 | -2.2063 | -3.3261 | -2.1013 | -2.5475 | -2.9649 | -3.5727 |
| BHAR (1) |  | -1.10\% | -0.35\% | -0.41\% | -0.49\% | -0.83\% | -0.75\% | -0.81\% | -0.83\% | -0.60\% | -0.56\% | -0.77\% | -0.93\% | -0.95\% | -1.02\% | -1.08\% | -1.17\% |
|  |  | -3.5919 | -1.2863 | -1.5763 | -1.7587 | -2.5505 | -2.5800 | -2.5798 | -3.6895 | -1.8514 | -1.8676 | -2.9383 | -3.5773 | -3.0364 | -3.4999 | -3.8934 | -4.2108 |

Panel B. The time-series momentum using market-weighted return





| MW | J | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.53\% | -0.36\% | -0.13\% | -0.07\% | -1.17\% | -0.47\% | -0.22\% | -0.28\% | -1.47\% | -0.75\% | -0.52\% | -0.70\% | -0.74\% | -0.59\% | -0.54\% | -0.62\% |
|  |  | -2.7838 | -0.8416 | -0.3604 | -0.2262 | -1.7977 | -0.8630 | -0.4842 | -0.7293 | -2.1249 | -1.3086 | -1.0766 | $-1.6923$ | -1.0647 | -0.9960 | -1.0252 | -1.3557 |
| CAR (1) |  | -1.28\% | -0.29\% | 0.03\% | -0.16\% | -1.14\% | -0.31\% | -0.15\% | -0.44\% | -1.22\% | -0.75\% | -0.65\% | -0.86\% | -1.15\% | -0.83\% | -0.75\% | -0.83\% |
|  |  | -2.3340 | -0.6771 | 0.0720 | -0.5420 | -1.8541 | -0.5884 | -0.3516 | $-1.1678$ | $-1.7963$ | -1.3688 | -1.3786 | -2.1214 | -1.7872 | $-1.4615$ | -1.5200 | $-1.8290$ |
| BHAR (0) |  | -1.92\% | -0.90\% | -1.37\% | -1.19\% | -1.51\% | -0.69\% | -0.36\% | -0.06\% | -0.58\% | -0.80\% | -0.20\% | -0.52\% | -0.42\% | 0.02\% | -0.44\% | 0.42\% |
|  |  | -2.6045 | -1.1520 | -2.0617 | -1.7778 | -1.8312 | -0.9376 | -0.4617 | -0.0957 | -0.6756 | -0.9723 | -0.2666 | -0.7028 | -0.5035 | 0.0264 | -0.5858 | 0.5818 |
| BHAR (1) |  | -1.45\% | -0.17\% | -1.12\% | -1.03\% | -1.05\% | -0.47\% | $\mathbf{- 0 . 4 7 \%}$ | -0.30\% | -0.75\% | -0.52\% | -0.24\% | -0.63\% | -0.85\% | -0.58\% | -0.31\% | -0.18\% |
|  |  | -2.1870 | -0.2526 | -1.7587 | -1.6445 | -1.3427 | -0.6574 | -0.6348 | -0.4668 | -0.9312 | -0.6815 | -0.3333 | -0.8748 | -1.0763 | -0.7704 | -0.4342 | -0.2487 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.13\% | -0.25\% | 0.02\% | -0.01\% | -0.60\% | -0.34\% | -0.04\% | -0.24\% | -1.08\% | -0.39\% | -0.60\% | -0.71\% | -1.15\% | -0.83\% | -0.68\% | -0.60\% |
|  |  | -1.7406 | -0.4835 | 0.0508 | -0.0200 | -0.7989 | -0.5421 | -0.0698 | -0.4710 | $-1.4811$ | -0.5670 | -0.9601 | -1.2476 | -1.4607 | $-1.2623$ | -1.1344 | -1.0810 |
| CAR (1) |  | -0.32\% | 0.23\% | 0.13\% | 0.10\% | -0.51\% | -0.07\% | -0.04\% | -0.11\% | -0.81\% | -0.37\% | -0.52\% | -0.66\% | -1.04\% | -0.72\% | -0.58\% | -0.68\% |
|  |  | $-0.5217$ | 0.4509 | 0.2700 | 0.2432 | $-0.7299$ | -0.1059 | -0.0740 | -0.2230 | $-1.0901$ | -0.5447 | -0.8465 | -1.1459 | -1.4229 | -1.1299 | -0.9821 | -1.2261 |
| BHAR (0) |  | -0.93\% | 0.28\% | 0.29\% | 1.02\% | -0.37\% | 0.80\% | 0.57\% | 1.10\% | -1.33\% | -0.08\% | 0.48\% | 0.35\% | -1.42\% | -1.18\% | -1.31\% | -1.27\% |
|  |  | -1.0870 | 0.3051 | 0.3194 | 1.1228 | -0.4069 | 0.8796 | 0.6260 | 1.3068 | -1.5766 | -0.0856 | 0.5465 | 0.3715 | -1.5659 | -1.4935 | -1.5576 | -1.4315 |
| BHAR (1) |  | $-0.58 \%$ | 0.81\% | 0.20\% | 0.98\% | $0.53 \%$ | 0.85\% | 1.00\% | 0.99\% | $-1.02 \%$ | $0.18 \%$ | 0.85\% | $-0.07 \%$ | $-1.15 \%$ | $-1.44 \%$ | $-1.38 \%$ | $-1.59 \%$ |
|  |  | $-0.7044$ | 0.8721 | 0.2171 | 1.0990 | $0.6791$ | 0.9798 | 1.1055 | 1.2137 | $-1.3798$ | $0.2164$ | 1.1423 | $-0.0763$ | $-1.4020$ | $-1.8041$ | $-1.6554$ | $-1.8414$ |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.83\% | 0.22\% | 0.31\% | 0.38\% | -0.59\% | -0.01\% | 0.25\% | 0.35\% | -0.10\% | 0.20\% | 0.26\% | 0.18\% | 0.10\% | 0.31\% | 0.33\% | 0.22\% |
|  |  | -1.7424 | 0.6525 | 1.0589 | 1.4084 | -1.1653 | -0.0317 | 0.6401 | 0.9922 | -0.1879 | 0.3863 | 0.5417 | 0.4327 | 0.1591 | 0.5492 | 0.6404 | 0.4899 |
| CAR (1) |  | -0.84\% | 0.24\% | 0.29\% | 0.27\% | -0.41\% | 0.00\% | 0.22\% | 0.24\% | -0.35\% | 0.11\% | 0.11\% | 0.00\% | -0.20\% | 0.09\% | 0.16\% | 0.05\% |
|  |  | -1.8448 | 0.7300 | 0.9558 | 0.9926 | $-0.7704$ | 0.0079 | 0.5418 | 0.6767 | -0.6156 | 0.1966 | 0.2297 | -0.0017 | -0.3299 | 0.1603 | 0.3230 | 0.1144 |
| BHAR (0) |  | -1.06\% | 0.55\% | 0.11\% | $-\mathbf{0 . 6 5 \%}$ | 0.03\% | $-0.39 \%$ | $\mathbf{0 . 7 2 \%}$ | $0.01 \%$ | 0.15\% | -0.13\% | -0.37\% | -0.83\% | $-0.17 \%$ | 0.06\% | 0.66\% | -0.14\% |
|  |  | -1.8932 | 1.1111 | 0.2141 | -1.2083 | 0.0551 | -0.5941 | 1.1619 | 0.0190 | 0.2537 | -0.2133 | -0.5815 | -1.1854 | -0.2737 | 0.0844 | 1.0800 | -0.2176 |
| BHAR (1) |  | -1.50\% | -0.74\% | -0.01\% | -0.98\% | -0.77\% | -0.66\% | 1.09\% | 0.09\% | -0.75\% | 0.26\% | -0.29\% | -1.11\% | -0.45\% | -0.27\% | 0.10\% | -0.38\% |
|  |  | -2.7025 | -1.3597 | -0.0204 | -1.7724 | -1.1672 | -0.9943 | 1.5965 | 0.1538 | -1.1922 | 0.3926 | -0.4554 | -1.5673 | -0.7080 | -0.3997 | 0.1557 | -0.6123 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.31\% | -0.71\% | -0.27\% | 0.01\% | -1.43\% | -0.86\% | -0.25\% | -0.16\% | -1.64\% | -0.72\% | -0.39\% | -0.38\% | -0.50\% | -0.30\% | -0.24\% | -0.23\% |
|  |  | -2.8461 | -1.8327 | -0.8310 | 0.0391 | -2.6772 | -1.8885 | -0.6926 | -0.4979 | -3.0061 | -1.6499 | -0.9837 | -1.0061 | -1.0418 | -0.6829 | -0.5512 | -0.5865 |
| CAR (1) |  | -1.29\% | -0.55\% | -0.10\% | 0.02\% | -1.38\% | -0.59\% | -0.13\% | -0.20\% | -1.10\% | -0.51\% | -0.35\% | -0.28\% | -0.66\% | -0.45\% | -0.25\% | -0.28\% |
|  |  | -2.6212 | -1.4355 | -0.3233 | 0.0578 | -2.6298 | -1.3622 | -0.3646 | -0.6255 | -2.1286 | -1.1808 | -0.8793 | -0.7696 | $-1.4114$ | -0.9749 | -0.5827 | -0.7015 |
| BHAR (0) |  | -1.41\% | -1.93\% | -0.69\% | -0.36\% | -1.95\% | -1.65\% | -0.92\% | -0.87\% | -2.09\% | -1.04\% | -0.24\% | -0.96\% | -0.60\% | 0.39\% | -0.67\% | -0.15\% |
|  |  | -2.4564 | -2.8305 | -1.1241 | -0.5393 | -2.8793 | -2.2557 | -1.3828 | -1.3250 | -3.2591 | -1.6013 | -0.4384 | -1.4660 | -0.9771 | 0.6437 | -1.0692 | -0.2413 |
| BHAR (1) |  | -1.42\% | -1.33\% | -0.70\% | -0.17\% | -1.36\% | -1.14\% | -0.51\% | -0.89\% | -1.10\% | -0.83\% | -0.27\% | -0.60\% | -0.91\% | -0.16\% | -0.63\% | -0.22\% |
|  |  | -2.1584 | -1.9546 | -1.1248 | -0.2436 | -2.0891 | -1.6078 | -0.7770 | -1.3619 | -1.7975 | -1.2346 | -0.4998 | -0.9286 | -1.4673 | -0.2694 | -0.9996 | -0.3588 |



Panel C. The time-series momentum using inversed volatility-weighted return






| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| H |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.13\% | 0.03\% | 0.12\% | 0.25\% | -0.05\% | 0.45\% | 0.65\% | 0.55\% | 0.75\% | 1.04\% | 0.80\% | 0.55\% | 1.12\% | 1.02\% | 0.76\% | 0.50\% |
|  |  | -3.0453 | 0.1093 | 0.4547 | 1.0347 | -0.0980 | 1.1005 | 1.7808 | 1.6790 | 1.5087 | 2.3900 | 1.9898 | 1.5571 | 2.3472 | 2.2316 | 1.7860 | 1.3086 |
| CAR (1) |  | -0.81\% | 0.09\% | 0.15\% | 0.19\% | 0.20\% | 0.57\% | 0.65\% | 0.44\% | 0.86\% | 0.76\% | 0.56\% | 0.31\% | 0.94\% | 0.78\% | 0.58\% | 0.30\% |
|  |  | -2.3420 | 0.3022 | 0.5874 | 0.8096 | 0.4212 | 1.3786 | 1.7749 | 1.3635 | 1.8349 | 1.7959 | 1.4703 | 0.8924 | 2.0522 | 1.7234 | 1.4139 | 0.7979 |
| BHAR (0) |  | -1.35\% | -0.11\% | -0.01\% | 0.20\% | 0.17\% | 0.45\% | 0.40\% | 0.47\% | 0.86\% | 0.92\% | 0.89\% | 0.30\% | 0.89\% | 1.04\% | 1.07\% | 0.98\% |
|  |  | -2.4143 | -0.2270 | -0.0219 | 0.4229 | 0.2541 | 0.6741 | 0.6204 | 0.9091 | 1.4627 | 1.6322 | 1.8044 | 0.7029 | 1.5364 | 1.8322 | 2.1021 | 1.8172 |
| BHAR (1) |  | -1.09\% | 0.18\% | -0.09\% | $\mathbf{0 . 5 9 \%}$ | 0.23\% | 0.49\% | 0.40\% | 0.25\% | 0.86\% | 1.03\% | 1.02\% | 0.36\% | 1.33\% | 0.94\% | 0.91\% | 0.93\% |
|  |  | -2.0635 | 0.3947 | -0.1983 | 1.2852 | 0.3638 | 0.7766 | 0.6069 | 0.4759 | 1.4280 | 1.8588 | 2.2225 | 0.9068 | 2.4540 | 1.7120 | 1.8786 | 1.6874 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.39\% | 0.19\% | 0.36\% | 0.41\% | 0.43\% | 0.82\% | 0.81\% | 0.58\% | 0.68\% | 0.90\% | 0.59\% | 0.38\% | 0.54\% | 0.46\% | 0.31\% | 0.16\% |
|  |  | -2.0187 | 1.0911 | 2.4514 | 3.1547 | 1.6124 | 3.4449 | 3.8967 | 3.0406 | 2.0789 | 3.3201 | 2.4608 | 1.7515 | 1.6392 | 1.5376 | 1.1646 | 0.6419 |
| CAR (1) |  | -0.25\% | 0.31\% | 0.39\% | 0.33\% | 0.49\% | 0.76\% | 0.63\% | 0.45\% | 0.60\% | 0.65\% | 0.37\% | 0.20\% | 0.30\% | 0.27\% | 0.15\% | 0.00\% |
|  |  | -1.2761 | 1.8277 | 2.6759 | 2.5092 | 1.8746 | 3.2879 | 3.0712 | 2.4117 | 1.9316 | 2.4640 | 1.5780 | 0.9723 | 0.9419 | 0.9495 | 0.5870 | -0.0165 |
| BHAR (0) |  | -0.58\% | 0.41\% | 0.07\% | 0.99\% | 0.28\% | 1.11\% | 0.62\% | 1.01\% | 0.49\% | 0.97\% | 0.77\% | 0.37\% | 0.44\% | 0.49\% | 0.34\% | 0.41\% |
|  |  | -2.2645 | 1.4250 | 0.2362 | 3.1110 | 0.8559 | 3.1716 | 2.3124 | 2.5917 | 1.2083 | 2.5868 | 2.2305 | 1.2197 | 1.2025 | 1.5921 | 0.9195 | 1.4447 |
| BHAR (1) |  | -0.36\% | 0.50\% | -0.09\% | 0.82\% | 0.64\% | 1.06\% | 0.55\% | 0.95\% | 0.56\% | 0.71\% | 0.50\% | 0.33\% | 0.42\% | 0.40\% | -0.02\% | 0.39\% |
|  |  | -1.3662 | 1.7323 | -0.3580 | 2.5362 | 1.9572 | 3.0932 | 2.0688 | 2.4491 | 1.4319 | 1.8971 | 1.4796 | 1.0606 | 1.1960 | 1.2853 | -0.0708 | 1.3708 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.39\% | 0.18\% | 0.19\% | 0.32\% | 0.29\% | 0.34\% | 0.41\% | 0.32\% | 0.46\% | 0.54\% | 0.39\% | 0.26\% | 0.66\% | 0.51\% | 0.31\% | 0.08\% |
|  |  | -2.3306 | 1.2606 | 1.6891 | 3.1880 | 1.5181 | 2.0632 | 2.8041 | 2.4348 | 2.3439 | 3.0355 | 2.3075 | 1.6052 | 3.2216 | 2.5731 | 1.6394 | 0.4500 |
| CAR (1) |  | -0.39\% | 0.08\% | 0.15\% | 0.22\% | 0.03\% | 0.17\% | 0.26\% | 0.17\% | 0.32\% | 0.37\% | 0.25\% | 0.07\% | 0.38\% | 0.29\% | 0.10\% | -0.10\% |
|  |  | -2.3166 | 0.6208 | 1.4283 | 2.2682 | 0.1856 | 1.1071 | 1.9108 | 1.3659 | 1.6898 | 2.0261 | 1.4756 | 0.4384 | 1.8939 | 1.4913 | 0.5334 | -0.5423 |
| BHAR (0) |  | -0.20\% | 0.33\% | 0.47\% | 0.68\% | 0.45\% | 0.68\% | 0.21\% | 0.28\% | 0.64\% | $\mathbf{0 . 6 1 \%}$ | 0.35\% | 0.05\% | 0.75\% | 0.70\% | 0.37\% | 0.13\% |
|  |  | -0.8208 | 1.4648 | 2.0989 | 3.0569 | 2.0894 | 3.3106 | 0.9652 | 1.4682 | 2.9733 | 2.6784 | 1.7741 | 0.2270 | 3.3138 | 3.2813 | 1.6048 | 0.6076 |
| BHAR (1) |  | -0.13\% | 0.13\% | 0.35\% | 0.42\% | 0.11\% | 0.42\% | 0.04\% | 0.19\% | 0.44\% | 0.39\% | 0.31\% | -0.12\% | 0.54\% | 0.29\% | -0.01\% | -0.21\% |
|  |  | -0.4698 | 0.5588 | 1.4078 | 1.8346 | 0.4717 | 1.9705 | 0.1775 | 1.0078 | 1.8689 | 1.4679 | 1.2778 | -0.5835 | 2.3561 | 1.3447 | -0.0286 | -0.9838 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.38\% | -0.60\% | -0.42\% | -0.38\% | -0.88\% | -0.43\% | -0.30\% | -0.37\% | -0.62\% | -0.33\% | -0.41\% | -0.51\% | -0.62\% | -0.51\% | -0.59\% | -0.72\% |
|  |  | -6.1524 | -3.1402 | -2.5194 | -2.6277 | -3.2444 | -1.7931 | -1.4505 | -2.0252 | -2.2144 | -1.3370 | -1.8422 | -2.5537 | -2.2659 | -2.0117 | -2.5499 | -3.3470 |
| CAR (1) |  | -1.17\% | -0.52\% | -0.35\% | -0.40\% | -0.78\% | -0.41\% | -0.35\% | -0.45\% | -0.53\% | -0.38\% | -0.49\% | -0.62\% | -0.70\% | -0.62\% | -0.72\% | -0.82\% |
|  |  | -5.5315 | -2.8210 | -2.2277 | -2.9805 | -2.9256 | -1.7954 | -1.7662 | -2.5445 | -2.0330 | -1.6300 | -2.3109 | -3.2313 | -2.7018 | -2.5506 | -3.2127 | -3.9464 |
| BHAR (0) |  | -1.29\% | -0.25\% | -0.41\% | -0.22\% | -0.85\% | -0.57\% | -0.35\% | -0.42\% | -0.52\% | -0.20\% | -0.35\% | -0.55\% | -0.55\% | -0.52\% | -0.52\% | -0.68\% |
|  |  | -4.4884 | -0.9790 | -1.4993 | -0.8463 | -2.9781 | -2.1903 | -1.2062 | -1.9809 | -1.7989 | -0.7199 | -1.4865 | -2.3598 | -1.9858 | -1.9467 | -1.9742 | -2.7390 |
| BHAR (1) |  | -1.12\% | -0.28\% | -0.46\% | -0.33\% | -0.81\% | -0.63\% | -0.60\% | -0.64\% | -0.56\% | -0.37\% | -0.52\% | -0.67\% | -0.77\% | -0.76\% | -0.73\% | -0.86\% |
|  |  | -3.8637 | -1.0905 | -1.7349 | -1.2932 | -2.5957 | -2.2936 | -2.0252 | -2.9972 | -1.8324 | -1.2805 | -2.0599 | -2.6989 | -2.5931 | -2.7364 | -2.7414 | -3.3284 |

## Table 8.2. Sharp ratio of time-series momentum strategy

This table reports the average monthly Sharpe ratio after accounting for the transaction costs for 16 ( $\mathrm{J} \times \mathrm{H}$ ) time-series momentum strategies across the 24 stock markets along with an indication of significant level based on the Newey-West adjusted $t$-statistics. The results all relate to an implementation in which the cut-offs for selecting the stocks to be included in the cross-sectional momentum portfolios were set at $16 \%$.

The ratio measures the increments in excess returns (as measured by the portfolio return minus the risk-free rate) for each additional unit of risk (as measured by the standard deviation of the portfolio returns). Sharpe ratio $=\frac{\overline{M P}-R f}{S t d(M P)}$ where $\overline{\mathrm{MP}}$ is the average momentum return after accounting for the transaction costs, Rf is the average risk-free rate and $\operatorname{Std}(\mathrm{MP})$ is momentum portfolio standard deviation over the testing period.

Panel A. The time-series momentum using equal-weighted return







Panel B. The time-series momentum using market-weighted return




| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  |  | 6 |  | 12 | 6 |  |  | 12 | 3 | 6 |  | 12 | 3 | 6 |  | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  |  | -0.09 | 0.02 | 0.04 | 0.08 | 0.04 | 0.10 | 0.08 | 0.08 | 0.05 | 0.14 | 0.14 | 0.13 | 0.11 | 0.16 | 0.14 | 0.13 |
| CAR (1) |  | -0.03 | 0.05 | 0.08 | 0.08 | 0.06 | 0.10 | 0.09 | 0.06 | 0.10 | 0.16 | 0.13 | 0.12 | 0.09 | 0.15 | 0.13 | 0.11 |
| BHAR (0) |  | -0.06 | -0.09 | 0.03 | -0.02 | 0.04 | 0.03 | 0.01 | -0.01 | 0.03 | 0.02 | 0.08 | 0.03 | 0.11 | 0.14 | 0.08 | 0.14 |
| BHAR (1) |  | -0.04 | -0.07 | 0.11 | 0.04 | 0.00 | 0.01 | 0.01 | -0.04 | 0.04 | 0.06 | 0.06 | 0.05 | 0.08 | 0.12 | 0.07 | 0.12 |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.12 | -0.07 | -0.03 | 0.01 | -0.07 | -0.02 | 0.02 | 0.03 | -0.07 | 0.00 | 0.01 | 0.02 | -0.04 | 0.00 | 0.02 | 0.01 |
| CAR (1) |  | -0.13 | -0.06 | -0.01 | 0.00 | -0.04 | 0.00 | 0.04 | 0.03 | -0.05 | 0.00 | 0.02 | 0.01 | -0.05 | 0.00 | 0.02 | 0.00 |
| BHAR (0) |  | -0.08 | -0.01 | 0.02 | 0.13 | -0.06 | 0.01 | 0.01 | 0.08 | -0.03 | 0.04 | 0.00 | 0.05 | -0.01 | 0.03 | 0.00 | 0.02 |
| BHAR (1) |  | -0.07 | -0.05 | -0.03 | 0.14 | -0.04 | 0.04 | 0.01 | 0.07 | -0.06 | 0.01 | -0.01 | 0.01 | -0.03 | 0.01 | -0.03 | 0.00 |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.02 | 0.06 | 0.07 | 0.07 | -0.05 | 0.01 | 0.04 | 0.04 | 0.01 | 0.03 | 0.05 | 0.04 | 0.03 | 0.06 | 0.06 | 0.03 |
| CAR (1) |  | -0.01 | 0.04 | 0.05 | 0.06 | -0.06 | 0.02 | 0.01 | 0.01 | 0.01 | 0.02 | 0.04 | 0.02 | -0.02 | 0.04 | 0.01 | 0.00 |
| BHAR (0) |  | 0.01 | -0.01 | -0.03 | 0.08 | -0.06 | -0.02 | 0.02 | 0.16 | -0.01 | 0.07 | -0.02 | 0.08 | 0.02 | 0.07 | 0.00 | -0.03 |
| BHAR (1) |  | -0.02 | -0.04 | -0.05 | 0.12 | -0.06 | -0.02 | 0.01 | 0.13 | 0.03 | 0.07 | 0.01 | 0.07 | -0.03 | 0.02 | -0.01 | -0.09 |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.05 | 0.07 | 0.04 | 0.03 | 0.09 | 0.07 | 0.08 | 0.06 | 0.05 | 0.10 | 0.09 | 0.08 | 0.10 | 0.09 | 0.09 | 0.07 |
| CAR (1) |  | -0.01 | 0.01 | 0.01 | -0.03 | 0.05 | 0.03 | 0.04 | 0.02 | 0.04 | 0.08 | 0.07 | 0.06 | 0.06 | 0.06 | 0.06 | 0.04 |
| BHAR (0) |  | 0.03 | 0.00 | 0.02 | -0.10 | 0.04 | 0.02 | -0.03 | 0.01 | 0.01 | -0.07 | 0.07 | -0.05 | 0.14 | 0.18 | 0.11 | 0.05 |
| BHAR (1) |  | -0.02 | -0.09 | -0.05 | -0.11 | -0.02 | -0.08 | -0.05 | -0.07 | -0.01 | -0.05 | 0.06 | -0.05 | 0.10 | 0.09 | 0.07 | 0.02 |


| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  |  | 6 |  | 12 | 6 |  |  | 12 | 36 |  |  | 12 | 3 |  | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  |  | -0.17 | -0.03 | 0.02 | 0.04 | -0.10 | -0.02 | 0.01 | 0.00 | -0.12 | -0.05 | -0.03 | -0.06 | -0.06 | -0.03 | -0.03 | -0.05 |
| CAR (1) |  | -0.13 | -0.01 | 0.05 | 0.04 | -0.09 | 0.00 | 0.02 | -0.02 | -0.09 | -0.04 | -0.04 | -0.08 | -0.09 | -0.06 | -0.06 | -0.07 |
| BHAR (0) |  | -0.17 | -0.08 | -0.10 | -0.06 | -0.10 | -0.05 | 0.00 | 0.05 | -0.03 | -0.02 | -0.01 | 0.01 | -0.01 | 0.04 | 0.00 | 0.05 |
| BHAR (1) |  | -0.12 | -0.03 | -0.07 | -0.06 | -0.05 | -0.01 | -0.01 | 0.03 | -0.03 | -0.01 | -0.01 | -0.01 | -0.03 | 0.01 | 0.02 | 0.02 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.13 | -0.05 | 0.00 | 0.00 | -0.08 | -0.05 | 0.00 | -0.03 | -0.10 | -0.03 | -0.05 | -0.06 | -0.06 | -0.06 | -0.04 | -0.03 |
| CAR (1) |  | -0.06 | 0.02 | 0.02 | 0.03 | -0.07 | -0.01 | 0.00 | 0.00 | -0.07 | -0.03 | -0.04 | -0.05 | -0.07 | -0.05 | -0.03 | -0.04 |
| BHAR (0) |  | -0.08 | -0.02 | 0.04 | 0.05 | -0.04 | 0.04 | 0.04 | 0.07 | -0.12 | -0.04 | 0.01 | -0.01 | -0.05 | -0.06 | -0.08 | -0.06 |
| BHAR (1) |  | -0.05 | 0.02 | 0.03 | 0.05 | 0.05 | 0.08 | 0.07 | 0.08 | -0.11 | -0.02 | 0.05 | -0.02 | -0.04 | -0.08 | -0.08 | -0.09 |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.10 | 0.07 | 0.09 | 0.11 | -0.06 | 0.02 | 0.06 | 0.08 | -0.01 | 0.04 | 0.06 | 0.06 | 0.01 | 0.05 | 0.06 | 0.06 |
| CAR (1) |  | -0.11 | 0.07 | 0.08 | 0.09 | -0.02 | 0.02 | 0.06 | 0.06 | -0.03 | 0.04 | 0.05 | 0.04 | -0.01 | 0.03 | 0.05 | 0.05 |
| BHAR (0) |  | -0.11 | 0.03 | 0.08 | -0.07 | -0.01 | -0.03 | 0.05 | 0.01 | 0.00 | -0.05 | -0.01 | -0.07 | -0.02 | 0.02 | 0.08 | 0.02 |
| BHAR (1) |  | -0.16 | -0.11 | 0.06 | -0.10 | -0.07 | -0.04 | 0.08 | 0.02 | -0.09 | -0.01 | -0.01 | -0.09 | -0.04 | 0.00 | 0.02 | -0.01 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.21 | -0.15 | -0.09 | -0.03 | -0.20 | -0.15 | -0.08 | -0.06 | -0.21 | -0.13 | -0.07 | -0.07 | -0.08 | -0.05 | -0.04 | -0.04 |
| CAR (1) |  | -0.20 | -0.12 | -0.06 | -0.03 | -0.19 | -0.12 | -0.05 | -0.06 | -0.16 | -0.09 | -0.06 | -0.05 | -0.09 | -0.07 | -0.04 | -0.04 |
| BHAR (0) |  | -0.18 | -0.20 | -0.08 | -0.05 | -0.20 | -0.17 | -0.10 | -0.09 | -0.23 | -0.12 | -0.04 | -0.09 | -0.07 | 0.03 | -0.06 | -0.02 |
| BHAR (1) |  | -0.16 | -0.15 | -0.08 | -0.03 | -0.15 | -0.14 | -0.07 | -0.10 | -0.14 | -0.09 | -0.04 | -0.06 | -0.09 | -0.03 | -0.06 | -0.02 |





| IVOL |  | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 6 |  | 12 | 36 |  |  | 12 | 3 | 6 | 9 | 12 | 3 | 6 |  | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  |  | 0.01 | 0.06 | 0.11 | 0.14 | 0.06 | 0.15 | 0.17 | 0.14 | 0.12 | 0.19 | 0.20 | 0.17 | 0.14 | 0.20 | 0.18 | 0.15 |
| CAR (1) |  | -0.01 | 0.05 | 0.11 | 0.14 | 0.07 | 0.15 | 0.16 | 0.11 | 0.12 | 0.20 | 0.17 | 0.14 | 0.12 | 0.18 | 0.15 | 0.12 |
| BHAR (0) |  | -0.02 | -0.06 | 0.00 | -0.02 | 0.06 | 0.04 | 0.11 | -0.01 | 0.08 | 0.09 | 0.12 | 0.05 | 0.11 | 0.09 | 0.09 | 0.04 |
| BHAR (1) |  | -0.02 | -0.07 | 0.06 | 0.01 | -0.01 | 0.04 | 0.09 | -0.06 | 0.07 | 0.10 | 0.10 | 0.07 | 0.08 | 0.09 | 0.07 | 0.04 |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.24 | -0.16 | -0.13 | -0.07 | -0.18 | -0.12 | -0.05 | -0.05 | -0.14 | -0.06 | -0.04 | -0.05 | -0.08 | -0.05 | -0.05 | -0.06 |
| CAR (1) |  | -0.26 | -0.18 | -0.12 | -0.08 | -0.19 | -0.10 | -0.04 | -0.07 | -0.11 | -0.05 | -0.04 | -0.07 | -0.09 | -0.07 | -0.06 | -0.08 |
| BHAR (0) |  | -0.23 | -0.09 | -0.01 | -0.01 | -0.14 | -0.07 | -0.02 | 0.05 | -0.12 | -0.02 | -0.02 | -0.03 | -0.07 | -0.03 | -0.03 | -0.07 |
| BHAR (1) |  | -0.25 | -0.10 | -0.03 | 0.02 | -0.15 | -0.08 | -0.01 | -0.01 | -0.12 | -0.02 | -0.04 | -0.07 | -0.09 | -0.06 | -0.08 | -0.09 |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.07 | 0.15 | 0.18 | 0.21 | 0.08 | 0.13 | 0.16 | 0.15 | 0.17 | 0.20 | 0.20 | 0.19 | 0.15 | 0.20 | 0.19 | 0.16 |
| CAR (1) |  | 0.04 | 0.14 | 0.16 | 0.19 | 0.05 | 0.12 | 0.13 | 0.12 | 0.14 | 0.16 | 0.16 | 0.15 | 0.10 | 0.17 | 0.14 | 0.14 |
| BHAR (0) |  | 0.03 | 0.07 | 0.01 | 0.15 | 0.07 | 0.13 | 0.14 | 0.27 | 0.14 | 0.23 | 0.18 | 0.21 | 0.10 | 0.22 | 0.12 | 0.12 |
| BHAR (1) |  | 0.01 | 0.03 | -0.04 | 0.13 | 0.04 | 0.12 | 0.14 | 0.25 | 0.17 | 0.19 | 0.16 | 0.18 | 0.07 | 0.14 | 0.09 | 0.07 |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.01 | 0.07 | 0.03 | 0.05 | 0.15 | 0.13 | 0.16 | 0.14 | 0.10 | 0.16 | 0.13 | 0.12 | 0.17 | 0.15 | 0.13 | 0.12 |
| CAR (1) |  | 0.00 | 0.03 | 0.02 | 0.00 | 0.12 | 0.11 | 0.13 | 0.10 | 0.11 | 0.14 | 0.12 | 0.10 | 0.13 | 0.10 | 0.10 | 0.08 |
| BHAR (0) |  | -0.03 | 0.00 | 0.03 | -0.08 | 0.12 | 0.11 | 0.03 | 0.07 | 0.09 | 0.05 | 0.14 | 0.07 | 0.19 | 0.19 | 0.12 | 0.08 |
| BHAR (1) |  | -0.01 | -0.07 | -0.02 | -0.12 | 0.10 | 0.03 | 0.02 | 0.01 | 0.12 | 0.05 | 0.15 | 0.09 | 0.14 | 0.11 | 0.09 | 0.09 |




## Table 8.7. Risk-adjusted return (intercept in the three-factor model) of cross-sectional momentum strategy

This table reports the average monthly risk-adjusted returns (Fama-French alpha) after accounting for the transaction costs for 16 ( $\mathrm{J} \times \mathrm{H}$ ) cross-sectional momentum strategies across the 24 stock markets along with an indication of significant level based on the Newey-West adjusted t -statistics. The results all relate to an implementation in which the cut-offs for selecting the stocks to be included in the cross-sectional momentum portfolios were set at $16 \%$.

We run the three-factor regression model, $M R_{i}-R f_{i}=\alpha_{i}+\beta 1_{i}\left(R m_{i}-R f_{i}\right)+\beta 2_{i} S M B_{i}+\beta 3_{i} H M L_{i}$ where $M R_{i}$ is momentum return after accounting for the transaction costs at month t (from Chapter seven), $R f_{i}$ is the risk-free rate at month $\mathrm{t}, R m_{i}$ is market-weighted index at month $\mathrm{t}, S M B_{i}$ is 'small minus big' at month t , which is calculated by the market average return for the smallest $30 \%$ of stocks minus the market average return of the largest $30 \%$ of stocks in that month. $H M L_{i}$ is 'high minus low' at month t , which is calculated as the market average return for $50 \%$ of stocks with the highest book-to-market ratio minus market average return for $50 \%$ of stocks with the lowest book-to-market ratio.

Panel A. The cross-sectional momentum using equal-weighted return






| EW | J | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.95\% | -0.04\% | -0.03\% | 0.09\% | -0.05\% | 0.15\% | 0.23\% | 0.13\% | 0.14\% | 0.36\% | 0.16\% | -0.02\% | 0.35\% | 0.21\% | -0.06\% | -0.26\% |
|  |  | -2.6892 | -0.1145 | -0.1218 | 0.3978 | -0.1173 | 0.4288 | 0.7615 | 0.4705 | 0.3496 | 1.0209 | 0.5005 | -0.0572 | 0.8785 | 0.5654 | -0.1847 | -0.7793 |
| CAR (1) |  | -0.58\% | 0.02\% | 0.06\% | 0.08\% | 0.06\% | 0.17\% | 0.17\% | 0.00\% | 0.31\% | 0.29\% | 0.03\% | -0.17\% | 0.17\% | -0.02\% | -0.27\% | -0.42\% |
|  |  | -1.6605 | 0.0669 | 0.2517 | 0.3621 | 0.1510 | 0.5171 | 0.6067 | 0.0105 | 0.7917 | 0.8355 | 0.0791 | -0.5659 | 0.4440 | -0.0520 | -0.7658 | -1.2518 |
| BHAR (0) |  | -0.75\% | -0.22\% | -0.04\% | -0.28\% | 0.04\% | 0.38\% | 0.18\% | -0.01\% | 0.25\% | 0.13\% | 0.13\% | -0.20\% | 0.26\% | 0.26\% | -0.10\% | -0.25\% |
|  |  | -1.7106 | -0.5706 | -0.0972 | -0.7204 | 0.0923 | 0.9371 | 0.3940 | -0.0342 | 0.5625 | 0.2945 | 0.3220 | -0.4876 | 0.6228 | 0.6880 | -0.2724 | -0.7287 |
| BHAR (1) |  | -0.53\% | 0.03\% | -0.02\% | -0.05\% | 0.13\% | 0.16\% | 0.21\% | -0.07\% | 0.23\% | 0.28\% | 0.11\% | -0.25\% | 0.24\% | 0.00\% | -0.27\% | -0.50\% |
|  |  | -1.2418 | 0.0770 | -0.0531 | -0.1503 | 0.2862 | 0.3835 | 0.4647 | -0.1850 | 0.5312 | 0.6787 | 0.2623 | -0.6105 | 0.5675 | -0.0062 | -0.7219 | -1.3743 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.07\% | 0.32\% | 0.35\% | 0.41\% | 0.49\% | 0.49\% | 0.56\% | 0.48\% | 0.58\% | 0.62\% | 0.50\% | 0.35\% | 0.73\% | 0.59\% | 0.39\% | 0.21\% |
|  |  | 0.2852 | 1.6790 | 2.0230 | 2.7650 | 1.8919 | 2.0537 | 2.6282 | 2.4843 | 2.0975 | 2.4132 | 2.1503 | 1.6115 | 2.6458 | 2.2810 | 1.6095 | 0.9021 |
| CAR (1) |  | 0.01\% | 0.27\% | 0.32\% | 0.33\% | 0.38\% | 0.43\% | 0.48\% | 0.33\% | 0.54\% | 0.54\% | 0.39\% | 0.20\% | 0.60\% | 0.43\% | 0.24\% | 0.05\% |
|  |  | 0.0401 | 1.3937 | 1.9507 | 2.2805 | 1.4782 | 1.8025 | 2.3050 | 1.7609 | 1.9840 | 2.1580 | 1.6869 | 0.9653 | 2.2250 | 1.6803 | 1.0080 | 0.2433 |
| BHAR (0) |  | -0.02\% | 0.40\% | 0.22\% | 0.38\% | 0.50\% | 0.64\% | 0.46\% | 0.77\% | 0.60\% | 0.52\% | 0.58\% | 0.41\% | 0.72\% | 0.81\% | 0.55\% | 0.39\% |
|  |  | -0.0738 | 1.4850 | 0.8693 | 1.3568 | 1.8672 | 2.3713 | 1.8227 | 3.2854 | 2.1051 | 1.7649 | 2.3351 | 1.5288 | 2.5494 | 2.9499 | 1.9388 | 1.4047 |
| BHAR (1) |  | 0.04\% | 0.24\% | 0.20\% | 0.34\% | 0.42\% | 0.50\% | 0.32\% | 0.57\% | 0.45\% | 0.39\% | 0.47\% | 0.19\% | 0.55\% | 0.60\% | 0.32\% | 0.28\% |
|  |  | 0.1429 | 0.8934 | 0.8213 | 1.2112 | 1.5328 | 1.8544 | 1.2512 | 2.4050 | 1.5783 | 1.3268 | 1.8115 | 0.6984 | 1.9589 | 2.2454 | 1.1880 | 1.0270 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.37\% | 0.11\% | 0.10\% | 0.14\% | 0.30\% | 0.26\% | 0.30\% | 0.18\% | 0.34\% | 0.37\% | 0.16\% | -0.03\% | 0.49\% | 0.28\% | 0.00\% | -0.24\% |
|  |  | -1.5081 | 0.5464 | 0.5928 | 0.9932 | 1.1619 | 1.1676 | 1.5468 | 1.0478 | 1.2982 | 1.5329 | 0.7317 | -0.1458 | 1.7708 | 1.1061 | -0.0171 | -1.1149 |
| CAR (1) |  | -0.35\% | 0.04\% | 0.04\% | 0.04\% | 0.14\% | 0.14\% | 0.16\% | 0.01\% | 0.19\% | 0.17\% | -0.04\% | -0.23\% | 0.25\% | 0.03\% | -0.22\% | -0.42\% |
|  |  | -1.4910 | 0.2023 | 0.2854 | 0.2696 | 0.5784 | 0.6631 | 0.8340 | 0.0808 | 0.7484 | 0.7488 | -0.1857 | -1.1938 | 0.9629 | 0.1336 | -0.9979 | -2.0558 |
| BHAR (0) |  | -0.42\% | -0.09\% | 0.08\% | -0.08\% | 0.31\% | 0.23\% | 0.21\% | 0.27\% | 0.38\% | 0.31\% | 0.15\% | -0.12\% | 0.42\% | 0.28\% | 0.03\% | $-0.24 \%$ |
|  |  | -1.4401 | -0.3170 | 0.3039 | -0.2792 | 1.1248 | 0.9238 | 0.7506 | 1.3949 | 1.3298 | 1.0763 | 0.6469 | -0.5203 | 1.4782 | 1.1451 | 0.1007 | $-1.0205$ |
| BHAR (1) |  | -0.43\% | -0.24\% | -0.15\% | -0.32\% | 0.04\% | 0.01\% | -0.06\% | 0.11\% | 0.15\% | 0.01\% | -0.01\% | -0.25\% | 0.11\% | -0.08\% | -0.35\% | -0.62\% |
|  |  | -1.4258 | -0.8841 | -0.5748 | -1.1500 | 0.1497 | 0.0561 | -0.2210 | 0.5979 | 0.5218 | 0.0398 | -0.0557 | -1.0156 | 0.3928 | -0.3165 | -1.3122 | -2.6009 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.22\% | -0.61\% | -0.42\% | -0.47\% | -0.75\% | -0.49\% | -0.45\% | -0.61\% | -0.51\% | -0.49\% | -0.67\% | -0.85\% | -0.66\% | -0.78\% | -0.95\% | -1.12\% |
|  |  | -4.2703 | -2.5966 | -2.0874 | -2.7934 | -2.2628 | -1.6990 | -1.8461 | -2.8958 | -1.4999 | -1.6677 | -2.5350 | -3.5933 | -1.9945 | -2.5982 | -3.5060 | -4.5460 |
| CAR (1) |  | -1.23\% | -0.58\% | -0.43\% | -0.57\% | -0.70\% | -0.49\% | -0.55\% | -0.74\% | -0.55\% | -0.63\% | -0.83\% | -1.00\% | $\mathbf{- 0 . 8 7 \%}$ | -0.96\% | -1.13\% | -1.26\% |
|  |  | -4.6008 | -2.5832 | -2.2697 | -3.5944 | -2.2273 | -1.8070 | -2.3996 | -3.6739 | -1.7246 | -2.2453 | -3.2773 | -4.4247 | -2.8100 | -3.3659 | -4.3504 | -5.2990 |
| BHAR (0) |  | -1.25\% | -0.55\% | -0.59\% | -0.47\% | -0.69\% | -0.51\% | -0.79\% | -0.49\% | -0.46\% | -0.53\% | -0.62\% | -0.88\% | -0.56\% | -0.61\% | -0.87\% | -1.00\% |
|  |  | -3.7455 | -1.8168 | -2.0438 | -1.5771 | -2.0217 | -1.7011 | -2.2655 | -2.2239 | -1.2975 | -1.5520 | $-2.3262$ | -3.2635 | -1.6722 | -2.0414 | -2.9264 | -3.3837 |
| BHAR (1) |  | -1.15\% | -0.67\% | -0.68\% | -0.69\% | -0.72\% | -0.61\% | -1.02\% | -0.81\% | -0.61\% | -0.81\% | -0.89\% | -1.06\% | -0.94\% | -0.94\% | -1.17\% | -1.23\% |
|  |  | -3.2898 | -2.2611 | -2.3663 | -2.4100 | -2.0038 | -1.9485 | -2.9154 | -3.5807 | -1.6689 | -2.4204 | -3.1345 | -3.7464 | -2.7149 | -3.0542 | -4.0227 | -4.0878 |

Panel B. The cross-sectional momentum using market-weighted return



| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  |  |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 6 |  | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.19\% | -0.46\% | -0.45\% | -0.47\% | -0.33\% | -0.31\% | -0.25\% | -0.46\% | -0.49\% | -0.31\% | -0.37\% | -0.50\% | -0.64\% | -0.45\% | -0.62\% | -0.72\% |
|  |  | -1.8769 | -0.8464 | -0.9378 | -1.1029 | -0.4352 | -0.4432 | -0.4283 | -0.8808 | -0.6216 | -0.4134 | -0.5728 | -0.8918 | -0.8267 | -0.6259 | -0.9542 | -1.1871 |
| CAR (1) |  | -1.11\% | -0.45\% | -0.53\% | -0.55\% | -0.45\% | -0.35\% | -0.40\% | -0.59\% | -0.60\% | -0.37\% | -0.53\% | -0.65\% | -0.71\% | -0.68\% | -0.79\% | -0.87\% |
|  |  | -1.8031 | -0.8306 | -1.1024 | -1.2842 | -0.5981 | -0.5283 | -0.7080 | -1.1695 | -0.7609 | -0.5176 | -0.8664 | -1.1936 | -0.9488 | -0.9963 | -1.2590 | -1.4806 |
| BHAR (0) |  | -0.61\% | 0.12\% | -0.31\% | 0.31\% | -0.17\% | 0.05\% | -0.43\% | -0.17\% | 0.04\% | -0.45\% | -0.09\% | -1.24\% | -0.50\% | -0.72\% | -1.21\% | -1.83\% |
|  |  | -0.7565 | 0.1538 | -0.3919 | 0.3972 | -0.1831 | 0.0521 | -0.5179 | -0.2047 | 0.0440 | -0.5519 | -0.1123 | -1.5740 | -0.6238 | -0.8652 | -1.5879 | -2.2975 |
| BHAR (1) |  | -0.96\% | 0.07\% | -0.77\% | 0.36\% | -0.07\% | -0.14\% | -0.09\% | -0.38\% | -0.08\% | -0.60\% | -0.68\% | -1.63\% | -0.36\% | -0.80\% | -1.34\% | -1.81\% |
|  |  | -1.2485 | 0.0939 | -0.9945 | 0.4571 | -0.0826 | -0.1622 | -0.1016 | -0.4721 | -0.0923 | -0.7320 | -0.8572 | -2.1000 | -0.4523 | -0.9839 | -1.8001 | -2.2656 |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.13\% | -0.22\% | -0.15\% | -0.24\% | -0.50\% | -0.12\% | -0.15\% | -0.25\% | -0.67\% | -0.37\% | -0.38\% | -0.63\% | -0.85\% | -0.62\% | -0.83\% | -0.99\% |
|  |  | -2.1224 | -0.5941 | -0.4959 | -0.9177 | -0.9502 | -0.2917 | -0.3872 | -0.7251 | -1.2708 | -0.7727 | -0.8778 | -1.5543 | -1.6385 | -1.2731 | -1.8468 | -2.3821 |
| CAR (1) |  | -1.15\% | -0.30\% | -0.29\% | -0.34\% | -0.42\% | -0.20\% | -0.30\% | -0.43\% | -0.78\% | -0.52\% | -0.58\% | -0.81\% | -0.88\% | -0.79\% | -0.98\% | -1.11\% |
|  |  | -2.3855 | -0.8570 | -0.9812 | -1.2966 | -0.8594 | -0.4757 | -0.7706 | -1.2159 | -1.5282 | -1.0908 | -1.3266 | -2.0149 | -1.7263 | -1.6274 | -2.1810 | -2.7194 |
| BHAR (0) |  | -1.61\% | -0.79\% | -0.50\% | -0.84\% | -0.32\% | -0.21\% | 0.08\% | -0.81\% | -0.65\% | -0.33\% | -0.47\% | -0.85\% | -0.81\% | -0.48\% | -0.99\% | -0.85\% |
|  |  | -2.4902 | -1.3199 | -0.8850 | -1.7636 | -0.5801 | -0.3909 | 0.1687 | -1.7169 | -1.0845 | -0.5871 | -0.8684 | -1.5654 | -1.3992 | -0.8311 | -1.6166 | -1.4823 |
| BHAR (1) |  | $-\mathbf{1 . 6 0 \%}$ | $-0.83 \%$ | -0.71\% | -0.95\% | -0.66\% | -0.53\% | -0.27\% | -1.12\% | -0.90\% | -0.73\% | -0.90\% | -0.84\% | -0.92\% | -0.64\% | -1.21\% | -0.97\% |
|  |  | $-2.4870$ | $-1.3090$ | $-1.2817$ | -1.8533 | $-1.1878$ | $-1.0480$ | $-0.5305$ | -2.4131 | $-1.5284$ | $-1.2152$ | $-1.6779$ | -1.5473 | $-1.6108$ | -1.1728 | -1.9874 | $-1.7172$ |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.08\% | 0.53\% | 0.03\% | 0.12\% | 0.69\% | 0.61\% | 0.30\% | 0.18\% | -0.07\% | 0.20\% | 0.08\% | 0.03\% | 0.26\% | -0.04\% | -0.18\% | -0.29\% |
|  |  | 0.1146 | 0.9420 | 0.0636 | 0.2768 | 0.8915 | 0.8841 | 0.5174 | 0.3304 | -0.0891 | 0.2847 | 0.1216 | 0.0440 | 0.3224 | -0.0526 | -0.2500 | -0.4261 |
| CAR (1) |  | 0.28\% | 0.25\% | -0.06\% | -0.08\% | 0.61\% | 0.28\% | 0.09\% | -0.03\% | -0.30\% | -0.13\% | -0.15\% | -0.22\% | -0.43\% | -0.41\% | -0.48\% | -0.63\% |
|  |  | 0.4162 | 0.4506 | -0.1333 | -0.1941 | 0.7791 | 0.4337 | 0.1497 | -0.0503 | -0.3879 | -0.1824 | -0.2209 | -0.3345 | -0.5296 | -0.5272 | -0.6458 | -0.9144 |
| BHAR (0) |  | -0.07\% | -1.25\% | -1.28\% | -0.75\% | 0.22\% | $0.84 \%$ | $-1.08 \%$ | 1.95\% | $-0.28 \%$ | $-0.27 \%$ | $0.26 \%$ | 0.69\% | 0.05\% | -0.08\% | 0.44\% | $-0.24 \%$ |
|  |  | -0.0860 | -1.4985 | -1.4989 | -0.7997 | 0.2451 | 1.0016 | -1.1647 | 2.1397 | $-0.3171$ | $-0.2925$ | 0.3105 | 0.7724 | 0.0518 | -0.0828 | 0.4954 | -0.2664 |
| BHAR (1) |  | -0.75\% | -1.38\% | -1.88\% | -0.83\% | 0.10\% | 0.24\% | -0.78\% | 1.47\% | -0.63\% | -0.78\% | -0.29\% | -0.23\% | -1.11\% | -0.42\% | -0.44\% | -0.59\% |
|  |  | -0.9131 | -1.5667 | -2.1188 | -0.9040 | 0.1097 | 0.2856 | -0.8720 | 1.6967 | -0.7127 | -0.8424 | -0.3303 | -0.2423 | -1.2734 | -0.4838 | -0.4888 | -0.6444 |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.24\% | -0.60\% | -0.40\% | -0.44\% | -0.73\% | -0.40\% | -0.49\% | -0.69\% | -0.37\% | -0.46\% | -0.69\% | -0.89\% | -0.67\% | -0.77\% | -0.98\% | -1.15\% |
|  |  | -2.6626 | -1.6274 | -1.2303 | -1.5124 | -1.4125 | -0.8693 | -1.1992 | -1.8732 | -0.7230 | -0.9617 | -1.4907 | -2.1265 | -1.1877 | -1.4431 | -1.9449 | -2.4686 |
| CAR (1) |  | -1.48\% | -0.66\% | -0.44\% | -0.62\% | -0.56\% | -0.43\% | -0.63\% | -0.83\% | -0.33\% | -0.71\% | -0.86\% | -1.09\% | -1.03\% | -1.05\% | -1.22\% | -1.34\% |
|  |  | -3.2886 | -1.7608 | $-1.4041$ | -2.1332 | -1.0894 | -0.9527 | -1.5790 | -2.2589 | -0.6420 | -1.4484 | -1.9130 | -2.6109 | -1.8184 | -1.9611 | -2.4764 | -2.9311 |
| BHAR (0) |  | -1.85\% | -1.01\% | -0.36\% | -1.05\% | -0.80\% | -0.68\% | -0.51\% | $\mathbf{- 0 . 4 1 \%}$ | -0.16\% | 0.20\% | -0.43\% | 0.73\% | -0.71\% | -0.80\% | -0.52\% | -1.03\% |
|  |  | -3.2270 | -1.9382 | -0.6556 | -2.1750 | -1.2995 | -1.1779 | -0.9429 | -0.8666 | -0.2796 | 0.3551 | -0.7439 | 1.3583 | -1.1181 | -1.3042 | -0.8160 | -1.6503 |
| BHAR (1) |  | -1.91\% | -1.01\% | -0.39\% | -1.00\% | -0.48\% | -0.40\% | -0.70\% | -0.60\% | -0.18\% | -0.58\% | -0.61\% | 0.33\% | -1.02\% | -0.94\% | -0.93\% | -0.88\% |
|  |  | -3.1561 | -1.8665 | -0.6986 | -2.1032 | -0.7943 | -0.7071 | -1.3195 | -1.2307 | -0.3077 | -1.0040 | $-1.0313$ | 0.5849 | -1.6019 | -1.5307 | -1.4443 | -1.4242 |





Panel C. The cross-sectional momentum using inversed volatility-weighted return




| IVOL | J = | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.58\% | -0.26\% | -0.04\% | -0.03\% | -0.32\% | -0.01\% | 0.09\% | 0.01\% | 0.03\% | 0.08\% | 0.00\% | -0.11\% | 0.03\% | 0.00\% | -0.09\% | -0.22\% |
|  |  | -2.0559 | -1.0930 | -0.2046 | -0.1580 | -1.0352 | -0.0480 | 0.3935 | 0.0255 | 0.1001 | 0.2999 | 0.0122 | -0.4624 | 0.0947 | -0.0039 | -0.3374 | -0.8772 |
| CAR (1) |  | -0.61\% | -0.21\% | -0.05\% | -0.07\% | -0.20\% | 0.03\% | 0.05\% | -0.07\% | 0.05\% | 0.02\% | -0.10\% | -0.23\% | -0.03\% | -0.09\% | -0.20\% | -0.31\% |
|  |  | -2.3545 | -0.9535 | -0.2748 | -0.4020 | -0.7122 | 0.1355 | 0.2512 | -0.3211 | 0.1779 | 0.0609 | -0.4039 | -0.9772 | -0.1022 | -0.3349 | -0.7649 | -1.2739 |
| BHAR (0) |  | -0.65\% | -0.32\% | -0.13\% | -0.13\% | -0.44\% | 0.03\% | -0.08\% | -0.26\% | -0.04\% | -0.03\% | 0.12\% | -0.30\% | -0.16\% | -0.16\% | -0.16\% | -0.37\% |
|  |  | -2.0188 | -1.0419 | -0.4844 | -0.4632 | -1.3318 | 0.0875 | -0.2453 | -1.0020 | -0.1172 | -0.0905 | 0.4183 | -0.9864 | -0.5166 | -0.5514 | -0.5262 | -1.2851 |
| BHAR (1) |  | -0.68\% | -0.26\% | 0.13\% | -0.02\% | -0.31\% | -0.02\% | -0.10\% | -0.34\% | 0.05\% | -0.15\% | -0.06\% | -0.57\% | -0.16\% | -0.17\% | -0.23\% | -0.33\% |
|  |  | -2.2021 | -0.7546 | 0.4358 | -0.0602 | -0.9717 | -0.0608 | -0.3420 | -1.3420 | 0.1643 | -0.4771 | -0.2177 | -1.7574 | -0.5064 | -0.5972 | -0.7805 | -1.1918 |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.34\% | -0.91\% | -0.66\% | -0.48\% | -1.33\% | -1.00\% | -0.65\% | -0.62\% | -1.17\% | -0.81\% | -0.74\% | -0.74\% | -0.92\% | -0.87\% | -0.85\% | -0.85\% |
|  |  | -5.4904 | -4.5845 | -4.0086 | -3.2890 | -4.6944 | -4.0976 | -3.0511 | -3.2404 | -4.0842 | -3.0913 | -3.1403 | -3.5420 | -3.2135 | -3.2954 | -3.5757 | -4.0141 |
| CAR (1) |  | -1.22\% | -0.83\% | -0.53\% | -0.45\% | -1.19\% | -0.83\% | -0.56\% | -0.63\% | -0.90\% | -0.69\% | -0.71\% | -0.75\% | -0.85\% | -0.89\% | -0.87\% | -0.86\% |
|  |  | -5.5475 | -4.4658 | -3.4316 | -3.2801 | -4.4526 | -3.5145 | -2.7285 | -3.4690 | -3.3068 | -2.7366 | -3.1525 | -3.7870 | -3.1164 | -3.5291 | -3.8409 | -4.2508 |
| BHAR (0) |  | -1.39\% | -0.69\% | -0.60\% | -0.39\% | -1.24\% | -1.04\% | -0.74\% | -0.33\% | -1.05\% | -0.68\% | -0.53\% | -0.59\% | -0.88\% | -0.85\% | -0.80\% | -0.83\% |
|  |  | -5.0983 | -2.6018 | -2.2888 | -1.5279 | -4.2208 | -3.7063 | -2.6781 | -1.3335 | -3.6812 | -2.3526 | -2.3223 | -2.3200 | -3.0955 | -3.1120 | -3.1138 | -3.2704 |
| BHAR (1) |  | -1.41\% | -0.74\% | -0.70\% | -0.37\% | -1.33\% | -1.29\% | -0.71\% | -0.48\% | -1.12\% | -0.66\% | -0.61\% | -0.70\% | -0.98\% | -1.07\% | -1.04\% | -0.94\% |
|  |  | $-5.1916$ | -2.8790 | -2.7125 | -1.5367 | $-4.5646$ | -4.5365 | -2.6760 | -2.0444 | -4.0010 | -2.3425 | -2.7358 | $-2.7621$ | $-3.4805$ | -3.9442 | -4.1556 | $-3.6195$ |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.52\% | -0.05\% | 0.14\% | 0.22\% | 0.05\% | 0.29\% | 0.47\% | 0.39\% | 0.32\% | 0.55\% | 0.47\% | 0.39\% | 0.55\% | 0.50\% | 0.44\% | 0.33\% |
|  |  | -1.9919 | -0.2142 | 0.7471 | 1.3070 | 0.1554 | 1.0754 | 1.9776 | 1.8173 | 1.0509 | 1.9885 | 1.8119 | 1.6042 | 1.7733 | 1.6791 | 1.5621 | 1.2536 |
| CAR (1) |  | -0.55\% | 0.00\% | 0.19\% | 0.16\% | 0.02\% | 0.34\% | 0.40\% | 0.29\% | $\mathbf{0 . 4 1 \%}$ | 0.51\% | 0.41\% | 0.30\% | 0.48\% | 0.40\% | 0.33\% | 0.27\% |
|  |  | -2.1675 | -0.0156 | 1.0193 | 0.9491 | 0.0755 | 1.3248 | 1.7410 | 1.3518 | 1.3776 | 1.8723 | 1.5923 | 1.2555 | 1.5736 | 1.3847 | 1.1994 | 1.0216 |
| BHAR (0) |  | -0.49\% | $-0.04 \%$ | $0.13 \%$ | $-\mathbf{0 . 0 5 \%}$ | 0.14\% | 0.43\% | $\mathbf{0 . 3 9 \%}$ | $\mathbf{0 . 8 1 \%}$ | 0.26\% | 0.33\% | 0.55\% | 0.47\% | 0.38\% | 0.47\% | 0.48\% | $0.34 \%$ |
|  |  | -1.4517 | -0.1252 | 0.4292 | -0.1525 | 0.4202 | 1.3241 | 1.1509 | 2.9195 | 0.8124 | 0.9785 | 1.7889 | 1.4928 | 1.0946 | 1.4671 | 1.4716 | $1.0549$ |
| BHAR (1) |  | -0.46\% | -0.08\% | -0.05\% | -0.03\% | -0.14\% | 0.20\% | 0.20\% | 0.49\% | 0.37\% | 0.30\% | 0.63\% | 0.33\% | 0.24\% | 0.23\% | 0.36\% | 0.20\% |
|  |  | -1.3647 | -0.2464 | -0.1611 | -0.1097 | -0.4230 | 0.6064 | 0.5851 | 1.7836 | 1.1408 | 0.8869 | 2.0083 | 0.9866 | 0.7131 | 0.7086 | 1.1939 | 0.6324 |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.26\% | 0.58\% | 0.42\% | 0.40\% | 0.54\% | 0.56\% | 0.52\% | 0.39\% | 0.62\% | 0.62\% | 0.46\% | 0.34\% | 0.71\% | 0.55\% | 0.36\% | 0.18\% |
|  |  | 0.6611 | 1.9876 | 1.7792 | 2.0019 | 1.8374 | 2.0935 | 2.1671 | 1.7686 | 2.0376 | 2.2019 | 1.7681 | 1.4580 | 2.2936 | 1.8790 | 1.3317 | 0.7568 |
| CAR (1) |  | 0.13\% | 0.40\% | 0.35\% | 0.26\% | 0.48\% | 0.49\% | 0.44\% | 0.23\% | 0.58\% | 0.53\% | 0.35\% | 0.18\% | 0.52\% | 0.40\% | 0.23\% | 0.03\% |
|  |  | 0.3516 | 1.4293 | 1.5299 | 1.3414 | 1.6420 | 1.8794 | 1.8520 | 1.0889 | 1.9362 | 1.8996 | 1.3785 | 0.8089 | 1.6855 | 1.4075 | 0.8763 | 0.1076 |
| BHAR (0) |  | 0.16\% | 0.25\% | 0.40\% | -0.48\% | 0.74\% | 0.71\% | 0.47\% | 0.27\% | 0.88\% | 0.60\% | 0.62\% | $\mathbf{0 . 6 2 \%}$ | 0.66\% | 0.59\% | 0.17\% | 0.28\% |
|  |  | 0.3311 | 0.7357 | 0.8431 | $-1.5283$ | 2.1662 | 2.1039 | 1.3573 | 0.9508 | 2.6788 | 1.7653 | 1.8209 | 1.9926 | 2.0076 | 1.8623 | 0.5538 | 0.8605 |
| BHAR (1) |  | 0.32\% | 0.14\% | 0.17\% | -0.44\% | 0.83\% | 0.51\% | 0.33\% | 0.04\% | 0.91\% | 0.65\% | 0.59\% | 0.58\% | 0.69\% | 0.37\% | 0.08\% | 0.31\% |
|  |  | 0.7291 | 0.4345 | 0.3939 | -1.3563 | 2.2760 | 1.4261 | 1.0005 | 0.1390 | 2.5172 | 1.8401 | 1.7170 | 1.8681 | 1.9766 | 1.1145 | 0.2533 | 0.9576 |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  |  |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | $3 \quad 6$ |  | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.98\% | -0.36\% | -0.12\% | -0.12\% | -0.48\% | -0.19\% | 0.03\% | -0.15\% | 0.00\% | 0.08\% | -0.13\% | -0.38\% | 0.01\% | -0.24\% | -0.42\% | -0.64\% |
|  |  | -2.7749 | -1.3814 | -0.4939 | -0.5568 | -1.3255 | -0.5663 | 0.1054 | -0.5726 | 0.0071 | 0.2349 | -0.4098 | -1.2627 | 0.0235 | -0.6546 | -1.2162 | -2.0282 |
| CAR (1) |  | -1.20\% | -0.45\% | -0.20\% | -0.28\% | -0.48\% | -0.11\% | -0.05\% | -0.31\% | -0.02\% | -0.05\% | -0.32\% | -0.58\% | -0.38\% | -0.54\% | -0.64\% | -0.83\% |
|  |  | -3.7111 | -1.7394 | -0.8382 | -1.3901 | -1.3422 | -0.3586 | -0.1680 | -1.2401 | -0.0647 | -0.1384 | -0.9778 | -1.9854 | -0.9754 | -1.4764 | -1.8809 | -2.6747 |
| BHAR (0) |  | -0.90\% | -0.22\% | 0.07\% | $\mathbf{- 0 . 0 9 \%}$ | -0.48\% | -0.01\% | 0.01\% | 0.23\% | 0.27\% | 0.10\% | -0.22\% | 0.00\% | -0.06\% | -0.22\% | -0.45\% | -0.68\% |
|  |  | -1.9632 | -0.5256 | 0.1729 | -0.2415 | -1.1431 | -0.0151 | 0.0273 | 0.6155 | 0.5971 | 0.2163 | -0.5175 | 0.0041 | -0.1279 | -0.5555 | -1.1522 | -1.6986 |
| BHAR (1) |  | -1.32\% | -0.21\% | -0.20\% | -0.33\% | -0.52\% | -0.25\% | -0.11\% | -0.17\% | 0.13\% | 0.21\% | -0.25\% | 0.01\% | -0.28\% | -0.65\% | -0.46\% | -0.99\% |
|  |  | -3.1060 | -0.5675 | -0.5735 | -0.9096 | -1.2933 | -0.5900 | -0.2599 | -0.4358 | 0.2998 | 0.5014 | -0.5916 | 0.0302 | -0.6458 | -1.6000 | -1.2368 | -2.4462 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.23\% | -0.29\% | -0.04\% | -0.14\% | -0.27\% | 0.15\% | 0.23\% | 0.08\% | 0.08\% | 0.15\% | 0.05\% | -0.09\% | 0.01\% | -0.08\% | -0.13\% | -0.22\% |
|  |  | -3.3714 | -0.9298 | -0.1560 | -0.5013 | -0.7129 | 0.4117 | 0.6758 | 0.2771 | 0.2156 | 0.3762 | 0.1431 | -0.2645 | 0.0342 | -0.1932 | -0.3482 | -0.6214 |
| CAR (1) |  | -1.26\% | -0.34\% | -0.03\% | -0.18\% | -0.17\% | 0.17\% | 0.13\% | -0.04\% | 0.01\% | 0.03\% | -0.09\% | -0.20\% | -0.11\% | -0.15\% | -0.22\% | -0.32\% |
|  |  | -3.2516 | -1.0232 | -0.1047 | -0.6256 | -0.4592 | 0.4584 | 0.3642 | -0.1334 | 0.0174 | 0.0866 | -0.2418 | -0.6336 | -0.2508 | -0.3804 | -0.5879 | -0.9537 |
| BHAR (0) |  | -1.75\% | -0.30\% | -0.27\% | -0.16\% | -0.33\% | -0.14\% | 0.30\% | 0.00\% | -0.27\% | 0.40\% | 0.03\% | 0.04\% | 0.08\% | 0.02\% | -0.25\% | -0.59\% |
|  |  | -2.9832 | -0.5003 | -0.4379 | -0.2772 | -0.6622 | -0.2922 | 0.4478 | -0.0067 | -0.6229 | 0.7775 | 0.0622 | 0.0837 | 0.1672 | 0.0465 | -0.5197 | -1.2843 |
| BHAR (1) |  | -1.36\% | 0.39\% | 0.30\% | 0.29\% | -0.61\% | 0.24\% | 0.49\% | -0.19\% | -0.14\% | 0.13\% | -0.23\% | -0.33\% | -0.26\% | -0.09\% | -0.13\% | -0.48\% |
|  |  | -2.3750 | 0.6286 | 0.4249 | 0.4587 | $-1.2285$ | $0.3949$ | 0.7133 | -0.3688 | $-0.3324$ | 0.2670 | -0.4826 | -0.6951 | $-0.5883$ | -0.2064 | -0.2669 | -1.0934 |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.83\% | -0.03\% | 0.11\% | 0.01\% | -0.29\% | 0.04\% | 0.07\% | -0.09\% | -0.05\% | 0.02\% | -0.10\% | -0.23\% | -0.22\% | -0.21\% | -0.31\% | -0.45\% |
|  |  | -2.3357 | -0.1314 | 0.4657 | 0.0291 | -0.8016 | 0.1169 | 0.2350 | -0.3411 | -0.1360 | 0.0564 | -0.3012 | -0.7910 | -0.5609 | -0.5797 | -0.9621 | -1.5648 |
| CAR (1) |  | -0.85\% | -0.09\% | 0.02\% | -0.08\% | -0.31\% | -0.07\% | -0.08\% | -0.19\% | -0.17\% | -0.13\% | -0.27\% | -0.37\% | -0.40\% | -0.38\% | -0.50\% | -0.55\% |
|  |  | -2.5796 | -0.3696 | 0.0807 | -0.3859 | -0.9066 | -0.2176 | -0.2653 | -0.7645 | -0.4419 | -0.3658 | -0.8673 | -1.3452 | -1.0672 | -1.1094 | -1.5957 | -2.0098 |
| BHAR (0) |  | -0.95\% | -0.63\% | 0.12\% | -0.32\% | 0.05\% | 0.22\% | $\mathbf{0 . 0 5 \%}$ | 0.21\% | 0.04\% | -0.02\% | 0.17\% | -0.17\% | -0.01\% | 0.18\% | -0.12\% | $-0.25 \%$ |
|  |  | -2.0497 | $-1.5669$ | 0.3732 | -1.1751 | 0.1080 | 0.5138 | 0.1065 | 0.5353 | 0.1027 | -0.0567 | 0.5141 | -0.4642 | $-0.0278$ | 0.4530 | -0.3493 | -0.7246 |
| BHAR (1) |  | -0.97\% | -0.82\% | 0.07\% | -0.34\% | -0.16\% | 0.15\% | -0.24\% | 0.14\% | -0.19\% | -0.24\% | 0.10\% | -0.39\% | -0.27\% | 0.02\% | -0.48\% | -0.30\% |
|  |  | -2.4546 | -2.4433 | 0.2390 | -1.3372 | -0.4023 | 0.4018 | -0.6020 | 0.4363 | -0.4449 | -0.6466 | 0.3184 | -1.1110 | -0.6815 | 0.0561 | -1.3786 | -0.8583 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.48\% | -0.23\% | 0.01\% | 0.05\% | -0.15\% | 0.09\% | 0.24\% | 0.13\% | 0.31\% | 0.42\% | 0.37\% | 0.26\% | 0.43\% | 0.34\% | 0.29\% | 0.17\% |
|  |  | -2.0222 | -1.1423 | 0.0710 | 0.3344 | -0.5073 | 0.3449 | 0.9952 | 0.6190 | 1.0081 | 1.4492 | 1.3479 | 1.0160 | 1.3164 | 1.1003 | 0.9917 | 0.6052 |
| CAR (1) |  | -0.57\% | -0.25\% | -0.01\% | $\mathbf{- 0 . 0 1 \%}$ | -0.17\% | 0.08\% | 0.12\% | 0.02\% | 0.32\% | 0.38\% | 0.30\% | 0.15\% | 0.29\% | 0.23\% | 0.17\% | 0.05\% |
|  |  | -2.4951 | -1.2670 | -0.0348 | -0.0741 | -0.6090 | 0.3169 | 0.5066 | 0.1086 | 1.0452 | 1.3008 | 1.1363 | 0.5956 | 0.8931 | 0.7505 | 0.5821 | 0.1961 |
| BHAR (0) |  | -0.51\% | -0.50\% | 0.02\% | 0.07\% | -0.31\% | 0.18\% | 0.41\% | 0.02\% | 0.40\% | 0.53\% | 0.49\% | 0.13\% | 0.40\% | 0.36\% | 0.41\% | 0.01\% |
|  |  | -1.7107 | -1.4990 | 0.0778 | 0.1877 | -1.0305 | 0.5544 | 1.1613 | 0.0556 | 1.1820 | 1.6047 | 1.5499 | 0.4402 | 1.2052 | 1.0366 | 1.3285 | 0.0161 |
| BHAR (1) |  | -0.76\% | -0.52\% | -0.02\% | -0.22\% | -0.31\% | 0.27\% | 0.10\% | -0.17\% | 0.21\% | 0.35\% | 0.19\% | -0.22\% | 0.20\% | 0.13\% | 0.35\% | -0.16\% |
|  |  | -2.2961 | -1.5147 | -0.0708 | -0.6448 | -0.9860 | 0.8478 | 0.3080 | -0.5521 | 0.6256 | 1.0605 | 0.5900 | -0.7459 | 0.5794 | 0.3858 | 1.1337 | -0.4616 |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| H |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.62\% | 0.04\% | 0.12\% | 0.27\% | 0.16\% | 0.29\% | 0.43\% | 0.32\% | 0.42\% | 0.57\% | 0.36\% | 0.16\% | 0.50\% | 0.28\% | 0.03\% | -0.14\% |
|  |  | -1.7741 | 0.1306 | 0.4431 | 1.1714 | 0.3868 | 0.7785 | 1.3815 | 1.1125 | 0.9976 | 1.5697 | 1.0897 | 0.4996 | 1.2389 | 0.7341 | 0.0900 | -0.3916 |
| CAR (1) |  | -0.73\% | -0.03\% | 0.14\% | 0.20\% | 0.09\% | 0.29\% | 0.34\% | 0.15\% | 0.47\% | 0.48\% | 0.22\% | -0.01\% | 0.25\% | 0.07\% | -0.17\% | -0.29\% |
|  |  | -2.1566 | -0.0909 | 0.5578 | 0.8974 | 0.2137 | 0.8335 | 1.1583 | 0.5502 | 1.1818 | 1.3803 | 0.6553 | -0.0270 | 0.6302 | 0.1947 | -0.4602 | -0.8427 |
| BHAR (0) |  | -0.41\% | -0.13\% | 0.50\% | -0.16\% | 0.32\% | 0.54\% | 0.58\% | 0.28\% | 0.54\% | 0.36\% | 0.32\% | 0.02\% | 0.39\% | 0.37\% | 0.02\% | -0.12\% |
|  |  | -0.9490 | -0.3053 | 1.1206 | -0.4094 | 0.7075 | 1.3505 | 1.2854 | 0.7576 | 1.2457 | 0.8232 | 0.7678 | 0.0385 | 0.9198 | 0.9713 | 0.0520 | -0.3557 |
| BHAR (1) |  | -0.44\% | -0.11\% | 0.01\% | 0.24\% | 0.25\% | 0.32\% | 0.69\% | 0.12\% | 0.54\% | 0.57\% | 0.26\% | -0.04\% | 0.30\% | 0.07\% | -0.17\% | -0.36\% |
|  |  | -1.1106 | -0.2667 | 0.0351 | 0.5932 | 0.5691 | 0.7621 | 1.5226 | 0.3270 | 1.2358 | 1.3651 | 0.6304 | -0.0928 | 0.7195 | 0.1829 | -0.4389 | -1.0529 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.06\% | 0.20\% | 0.26\% | 0.36\% | 0.27\% | 0.33\% | 0.46\% | 0.41\% | 0.42\% | 0.51\% | 0.45\% | 0.31\% | 0.65\% | 0.55\% | 0.36\% | 0.19\% |
|  |  | -0.2716 | 1.0491 | 1.5034 | 2.3846 | 1.0214 | 1.3267 | 2.0859 | 2.1031 | 1.4704 | 1.9142 | 1.8527 | 1.3801 | 2.2671 | 2.0386 | 1.3919 | 0.7796 |
| CAR (1) |  | -0.26\% | 0.06\% | 0.23\% | 0.25\% | 0.08\% | 0.23\% | 0.38\% | 0.26\% | 0.37\% | 0.46\% | 0.35\% | 0.18\% | 0.49\% | 0.38\% | 0.20\% | 0.04\% |
|  |  | -1.2368 | 0.2896 | 1.3391 | 1.6989 | 0.2822 | 0.9357 | 1.7702 | 1.3517 | 1.2996 | 1.7443 | 1.4575 | 0.7926 | 1.7250 | 1.4054 | 0.8038 | 0.1612 |
| BHAR (0) |  | -0.11\% | 0.32\% | 0.05\% | 0.26\% | 0.23\% | 0.41\% | 0.44\% | 0.71\% | 0.47\% | 0.51\% | 0.55\% | $\mathbf{0 . 4 2 \%}$ | 0.65\% | 0.70\% | 0.50\% | 0.24\% |
|  |  | -0.4113 | 1.1384 | 0.1856 | 0.9178 | 0.8396 | 1.4569 | 1.7623 | 2.8477 | 1.6008 | 1.6703 | 2.1493 | 1.5472 | 2.2230 | 2.4483 | 1.7128 | 0.8106 |
| BHAR (1) |  | -0.27\% | 0.04\% | 0.01\% | 0.23\% | 0.09\% | 0.15\% | 0.27\% | 0.49\% | 0.28\% | 0.36\% | 0.44\% | 0.14\% | 0.42\% | 0.48\% | 0.31\% | 0.16\% |
|  |  | -1.0108 | 0.1404 | 0.0347 | 0.7936 | 0.3155 | 0.5202 | 1.0717 | 1.9129 | 0.9100 | 1.1344 | 1.6163 | 0.4863 | 1.4383 | 1.7239 | 1.0643 | 0.5778 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.32\% | 0.13\% | 0.13\% | 0.21\% | 0.27\% | 0.31\% | 0.38\% | 0.24\% | 0.41\% | 0.48\% | 0.25\% | 0.02\% | 0.55\% | 0.36\% | 0.06\% | -0.18\% |
|  |  | -1.5667 | 0.7648 | 0.8722 | 1.6230 | 1.1177 | 1.4808 | 2.0826 | 1.4904 | 1.6477 | 2.1247 | 1.1863 | 0.0900 | 2.1672 | 1.5317 | 0.2747 | -0.8956 |
| CAR (1) |  | -0.41\% | 0.01\% | 0.07\% | 0.12\% | 0.07\% | 0.18\% | 0.23\% | 0.06\% | 0.26\% | 0.30\% | 0.04\% | -0.20\% | 0.34\% | 0.13\% | -0.17\% | -0.37\% |
|  |  | -2.0640 | 0.0555 | 0.5257 | 0.9658 | 0.2955 | 0.9217 | 1.3276 | 0.3619 | 1.0733 | 1.3298 | 0.2046 | -1.0326 | 1.4100 | 0.5412 | -0.7767 | -1.9016 |
| BHAR (0) |  | -0.31\% | -0.07\% | 0.31\% | 0.06\% | 0.21\% | 0.25\% | 0.20\% | 0.37\% | 0.36\% | 0.29\% | 0.27\% | -0.04\% | 0.47\% | 0.39\% | 0.22\% | -0.16\% |
|  |  | -1.2122 | -0.2963 | 1.2298 | 0.2356 | 0.7869 | 0.9806 | 0.7380 | 1.9672 | 1.3059 | 1.0471 | 1.2169 | -0.1781 | 1.7914 | 1.6732 | 0.8621 | -0.6653 |
| BHAR (1) |  | -0.28\% | -0.50\% | 0.23\% | -0.14\% | -0.02\% | 0.06\% | 0.01\% | 0.30\% | 0.19\% | 0.13\% | 0.20\% | -0.14\% | 0.22\% | 0.03\% | -0.19\% | -0.53\% |
|  |  | -0.8954 | -1.8623 | 0.8347 | -0.5671 | -0.0682 | 0.2247 | 0.0452 | 1.5959 | 0.6681 | 0.4114 | 0.7509 | -0.6027 | 0.8378 | 0.1471 | -0.7311 | -2.3172 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -1.34\% | -0.67\% | -0.42\% | -0.43\% | -0.92\% | -0.48\% | -0.36\% | -0.49\% | -0.60\% | -0.42\% | -0.52\% | -0.68\% | -0.71\% | -0.70\% | -0.78\% | -0.93\% |
|  |  | -4.5164 | -2.8203 | -2.0781 | -2.5454 | -2.7686 | -1.6665 | -1.4826 | -2.3299 | -1.7546 | -1.4208 | -1.9946 | -2.8936 | -2.1601 | -2.3365 | -2.9214 | -3.8039 |
| CAR (1) |  | -1.32\% | -0.59\% | -0.39\% | -0.50\% | -0.79\% | -0.42\% | -0.43\% | -0.57\% | -0.54\% | -0.50\% | -0.64\% | $\mathbf{- 0 . 8 0 \%}$ | -0.85\% | -0.81\% | -0.93\% | -1.03\% |
|  |  | -4.9262 | -2.6753 | -2.1033 | -3.1927 | -2.4656 | -1.5599 | -1.8807 | -2.8520 | -1.7159 | -1.7968 | -2.5545 | -3.5669 | -2.7510 | -2.8692 | -3.6084 | -4.3985 |
| BHAR (0) |  | -1.42\% | -0.64\% | -0.65\% | -0.52\% | -0.79\% | -0.46\% | -0.64\% | -0.33\% | -0.49\% | -0.39\% | -0.44\% | -0.57\% | -0.56\% | -0.47\% | -0.64\% | -0.78\% |
|  |  | -4.1007 | -2.0847 | -2.1149 | -1.7657 | -2.3013 | -1.5533 | -1.8491 | -1.5279 | -1.3950 | -1.1344 | -1.6668 | -2.0910 | -1.6577 | -1.5671 | -2.1537 | -2.6549 |
| BHAR (1) |  | -1.28\% | -0.72\% | -0.73\% | -0.66\% | -0.83\% | -0.56\% | -0.87\% | -0.62\% | -0.61\% | -0.62\% | -0.69\% | -0.76\% | -0.86\% | -0.75\% | -0.90\% | -0.97\% |
|  |  | -3.5673 | -2.3360 | -2.4407 | -2.3511 | -2.2705 | -1.8191 | -2.4900 | -2.8294 | -1.6762 | -1.7969 | -2.4104 | -2.6446 | -2.4918 | -2.4737 | -3.1273 | -3.3395 |

## Table 8.8. Sharp ratio of cross-sectional momentum strategy

This table reports the average monthly Sharpe ratio after accounting for the transaction costs for $16(\mathrm{~J} \times \mathrm{H})$ cross-sectional momentum strategies across the 24 stock markets along with an indication of significant level based on the Newey-West adjusted $t$-statistics. The results all relate to an implementation in which the cut-offs for selecting the stocks to be included in the cross-sectional momentum portfolios were set at $16 \%$.

The ratio measures the increments in excess returns (as measured by the portfolio return minus the risk-free rate) for each additional unit of risk (as measured by the standard deviation of the portfolio returns). Sharpe ratio $=\frac{\overline{M P}-R f}{S t d(M P)}$ where $\overline{\mathrm{MP}}$ is the average momentum return after accounting for the transaction costs, Rf is the average risk-free rate and $\operatorname{Std}(\mathrm{MP})$ is momentum portfolio standard deviation over the testing period.

Panel A. The cross-sectional momentum using equal-weighted return







Panel B. The cross-sectional momentum using market-weighted return




| MW | J H | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  |  | 6 |  | 12 | 3 | 6 |  | 12 | 3 | 6 |  | 12 | 3 | 6 |  | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  |  | -0.13 | -0.02 | 0.00 | 0.03 | -0.03 | 0.02 | 0.05 | 0.06 | 0.00 | 0.06 | 0.08 | 0.08 | 0.06 | 0.09 | 0.08 | 0.09 |
| CAR (1) |  | -0.07 | 0.02 | 0.03 | 0.05 | -0.01 | 0.03 | 0.05 | 0.06 | 0.05 | 0.07 | 0.08 | 0.08 | 0.06 | 0.08 | 0.08 | 0.08 |
| BHAR (0) |  | -0.07 | -0.05 | 0.06 | 0.03 | -0.01 | -0.01 | 0.00 | 0.05 | 0.02 | -0.01 | 0.06 | -0.04 | 0.04 | 0.09 | 0.12 | 0.11 |
| BHAR (1) |  | -0.08 | -0.02 | 0.10 | 0.05 | -0.04 | -0.03 | -0.01 | 0.06 | 0.02 | 0.02 | 0.02 | -0.05 | 0.04 | 0.09 | 0.10 | 0.10 |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.19 | -0.13 | -0.08 | -0.06 | -0.15 | -0.11 | -0.06 | -0.07 | -0.13 | -0.08 | -0.07 | -0.07 | -0.10 | -0.10 | -0.09 | -0.09 |
| CAR (1) |  | -0.18 | -0.12 | -0.06 | -0.06 | -0.13 | -0.08 | -0.04 | -0.07 | -0.09 | -0.06 | -0.06 | -0.08 | -0.10 | -0.10 | -0.09 | -0.09 |
| BHAR (0) |  | -0.16 | -0.07 | -0.08 | -0.01 | -0.11 | -0.11 | -0.07 | 0.01 | -0.12 | -0.06 | -0.03 | -0.01 | -0.09 | -0.06 | -0.12 | -0.07 |
| BHAR (1) |  | -0.16 | -0.14 | -0.15 | -0.01 | -0.13 | -0.12 | -0.07 | -0.01 | -0.12 | -0.06 | -0.06 | -0.06 | -0.12 | -0.12 | -0.16 | -0.12 |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.14 | -0.13 | -0.08 | -0.05 | -0.11 | -0.08 | -0.03 | -0.03 | -0.10 | -0.06 | -0.05 | -0.06 | -0.09 | -0.07 | -0.06 | -0.07 |
| CAR (1) |  | -0.17 | -0.14 | -0.08 | -0.08 | -0.13 | -0.07 | -0.03 | -0.05 | -0.09 | -0.06 | -0.05 | -0.07 | -0.10 | -0.08 | -0.08 | -0.07 |
| BHAR (0) |  | -0.10 | -0.10 | -0.08 | -0.07 | -0.13 | -0.11 | -0.06 | 0.04 | -0.12 | -0.09 | -0.02 | -0.03 | -0.10 | -0.05 | -0.06 | -0.05 |
| BHAR (1) |  | -0.13 | -0.15 | -0.12 | -0.06 | -0.14 | -0.12 | -0.07 | -0.02 | -0.12 | -0.12 | -0.03 | -0.07 | -0.09 | -0.09 | -0.07 | -0.06 |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.01 | 0.07 | 0.04 | 0.05 | 0.01 | 0.04 | 0.05 | 0.02 | 0.01 | 0.03 | 0.02 | 0.01 | 0.02 | 0.04 | 0.03 | 0.00 |
| CAR (1) |  | -0.07 | 0.00 | 0.01 | -0.01 | -0.03 | 0.02 | 0.03 | -0.02 | -0.01 | 0.02 | 0.00 | -0.02 | 0.00 | 0.02 | 0.01 | -0.03 |
| BHAR (0) |  | -0.04 | 0.07 | -0.05 | -0.03 | 0.00 | 0.01 | 0.04 | -0.07 | 0.05 | 0.05 | 0.06 | -0.01 | -0.01 | 0.08 | 0.02 | 0.05 |
| BHAR (1) |  | -0.11 | -0.03 | -0.11 | -0.06 | -0.06 | -0.07 | 0.01 | -0.13 | 0.03 | 0.03 | 0.03 | -0.04 | 0.02 | 0.04 | -0.01 | 0.05 |




Panel C. The cross-sectional momentum using inversed volatility-weighted return



| IVOL |  | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  |  | 6 |  | 12 | 6 |  |  | 12 |  | 6 |  | 12 | 3 | 6 |  | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  |  | -0.22 | -0.13 | -0.15 | -0.16 | -0.13 | -0.11 | -0.10 | -0.13 | -0.12 | -0.10 | -0.14 | -0.17 | -0.12 | -0.13 | -0.16 | -0.18 |
| CAR (1) |  | -0.22 | -0.14 | -0.15 | -0.17 | -0.12 | -0.10 | -0.11 | -0.15 | -0.10 | -0.10 | -0.15 | -0.18 | -0.13 | -0.15 | -0.17 | -0.20 |
| BHAR (0) |  | -0.22 | -0.06 | -0.10 | -0.01 | -0.11 | -0.07 | -0.10 | -0.06 | -0.10 | -0.09 | -0.14 | -0.12 | -0.12 | -0.15 | -0.14 | -0.23 |
| BHAR (1) |  | -0.15 | -0.05 | -0.10 | 0.01 | -0.12 | -0.09 | -0.11 | -0.09 | -0.08 | -0.09 | -0.13 | -0.16 | -0.11 | -0.16 | -0.18 | -0.21 |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.33 | -0.21 | -0.20 | -0.22 | -0.23 | -0.17 | -0.19 | -0.23 | -0.21 | -0.20 | -0.21 | -0.26 | -0.24 | -0.22 | -0.26 | -0.29 |
| CAR (1) |  | -0.41 | -0.22 | -0.23 | -0.27 | -0.23 | -0.19 | -0.22 | -0.27 | -0.24 | -0.22 | -0.25 | -0.29 | -0.28 | -0.26 | -0.29 | -0.33 |
| BHAR (0) |  | -0.28 | -0.19 | -0.19 | -0.15 | -0.21 | -0.14 | -0.15 | -0.18 | -0.20 | -0.17 | -0.18 | -0.20 | -0.25 | -0.20 | -0.23 | -0.23 |
| BHAR (1) |  | -0.32 | -0.22 | -0.21 | -0.19 | -0.23 | -0.18 | -0.16 | -0.24 | -0.24 | -0.20 | -0.21 | -0.22 | -0.29 | -0.24 | -0.25 | -0.25 |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.17 | -0.08 | -0.06 | -0.03 | -0.06 | -0.03 | 0.00 | 0.01 | -0.06 | -0.02 | -0.01 | -0.01 | -0.01 | 0.00 | -0.01 | -0.02 |
| CAR (1) |  | -0.15 | -0.09 | -0.06 | -0.06 | -0.07 | -0.04 | -0.01 | -0.02 | -0.06 | -0.03 | -0.02 | -0.03 | -0.03 | -0.02 | -0.03 | -0.05 |
| BHAR (0) |  | -0.11 | -0.15 | -0.16 | -0.07 | -0.08 | -0.01 | -0.08 | 0.10 | -0.02 | 0.01 | 0.02 | 0.09 | 0.00 | 0.03 | 0.05 | -0.05 |
| BHAR (1) |  | -0.15 | -0.16 | -0.16 | -0.04 | -0.08 | -0.02 | -0.07 | 0.07 | -0.10 | -0.01 | -0.02 | 0.00 | -0.05 | 0.01 | 0.00 | -0.08 |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.54 | -0.43 | -0.41 | -0.41 | -0.33 | -0.28 | -0.29 | -0.33 | -0.27 | -0.24 | -0.27 | -0.30 | -0.22 | -0.20 | -0.22 | -0.26 |
| CAR (1) |  | -0.60 | -0.42 | -0.40 | -0.43 | -0.31 | -0.27 | -0.31 | -0.36 | -0.26 | -0.26 | -0.30 | -0.35 | -0.24 | -0.22 | -0.25 | -0.30 |
| BHAR (0) |  | -0.37 | -0.27 | -0.29 | -0.23 | -0.29 | -0.25 | -0.26 | -0.17 | -0.25 | -0.19 | -0.22 | -0.12 | -0.21 | -0.19 | -0.20 | -0.27 |
| BHAR (1) |  | -0.38 | -0.32 | -0.30 | -0.24 | -0.24 | -0.18 | -0.24 | -0.15 | -0.25 | -0.23 | -0.25 | -0.18 | -0.21 | -0.20 | -0.22 | -0.28 |




| IVOL | $\mathrm{J}=$ | 3 |  |  |  |  | 6 |  |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  |  | 6 |  | 9 | 12 |  | 6 |  | 9 |  | 12 | 3 |  | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  |  | -0.13 | -0.01 | 0.01 |  | 0.05 | 0.01 | 0.03 |  | 0.06 |  | 0.05 | 0.05 | 0.08 | 0.05 | 0.02 | 0.06 | 0.04 | 0.00 | -0.01 |
| CAR (1) |  | -0.13 | -0.02 | 0.01 |  | 0.03 | 0.00 | 0.03 |  | 0.04 |  | 0.02 | 0.05 | 0.06 | 0.03 | 0.00 | 0.02 | 0.01 | -0.02 | -0.03 |
| BHAR (0) |  | -0.07 | -0.03 | 0.04 |  | -0.05 | 0.03 | 0.07 |  | 0.05 |  | 0.03 | 0.05 | 0.04 | 0.03 | -0.01 | 0.04 | 0.06 | 0.00 | 0.02 |
| BHAR (1) |  | -0.08 | -0.06 | -0.01 |  | 0.00 | 0.03 | 0.05 |  | 0.06 |  | 0.01 | 0.05 | 0.05 | 0.03 | -0.02 | 0.03 | 0.03 | -0.03 | 0.00 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.05 | 0.06 | 0.08 |  | 0.14 | 0.06 | 0.09 |  | 0.13 |  | 0.14 | 0.09 | 0.13 | 0.13 | 0.10 | 0.15 | 0.15 | 0.11 | 0.08 |
| CAR (1) |  | -0.09 | 0.02 | 0.08 |  | 0.10 | 0.03 | 0.07 |  | 0.12 |  | 0.10 | 0.09 | 0.12 | 0.11 | 0.07 | 0.13 | 0.12 | 0.08 | 0.04 |
| BHAR (0) |  | -0.05 | 0.03 | 0.01 |  | 0.06 | 0.05 | 0.10 |  | 0.08 |  | 0.21 | 0.09 | 0.09 | 0.14 | 0.10 | 0.15 | 0.18 | 0.13 | 0.07 |
| BHAR (1) |  | -0.10 | -0.04 | 0.00 |  | 0.04 | 0.01 | 0.05 |  | 0.05 |  | 0.16 | 0.05 | 0.06 | 0.11 | 0.03 | 0.11 | 0.14 | 0.08 | 0.06 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.11 | 0.09 | 0.11 |  | 0.17 | 0.11 | 0.15 |  | 0.20 |  | 0.19 | 0.15 | 0.20 | 0.16 | 0.11 | 0.20 | 0.18 | 0.12 | 0.06 |
| CAR (1) |  | -0.12 | 0.06 | 0.09 |  | 0.14 | 0.07 | 0.12 |  | 0.16 |  | 0.13 | 0.13 | 0.16 | 0.11 | 0.05 | 0.16 | 0.13 | 0.06 | 0.01 |
| BHAR (0) |  | -0.12 | 0.00 | 0.10 |  | 0.02 | 0.07 | 0.09 |  | 0.06 |  | 0.23 | 0.11 | 0.11 | 0.17 | 0.10 | 0.16 | 0.19 | 0.13 | 0.02 |
| BHAR (1) |  | -0.07 | -0.07 | 0.08 |  | 0.00 | 0.04 | 0.07 |  | 0.05 |  | 0.18 | 0.10 | 0.08 | 0.11 | 0.04 | 0.12 | 0.11 | 0.04 | -0.05 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.36 | -0.24 | -0.18 |  | -0.20 | -0.23 | -0.14 |  | -0.12 |  | -0.15 | -0.15 | -0.11 | -0.12 | -0.16 | -0.16 | -0.14 | -0.16 | -0.20 |
| CAR (1) |  | -0.37 | -0.21 | -0.17 |  | -0.22 | -0.19 | -0.12 |  | -0.12 |  | -0.16 | -0.13 | -0.11 | -0.14 | -0.19 | -0.18 | -0.16 | -0.19 | -0.22 |
| BHAR (0) |  | -0.34 | -0.20 | -0.16 |  | -0.13 | -0.22 | -0.13 |  | -0.16 |  | -0.04 | -0.14 | -0.12 | -0.09 | -0.12 | -0.14 | -0.09 | -0.11 | -0.16 |
| BHAR (1) |  | -0.29 | -0.20 | -0.17 |  | -0.14 | -0.18 | -0.12 |  | -0.16 |  | -0.12 | -0.13 | -0.14 | -0.14 | -0.16 | -0.17 | -0.14 | -0.17 | -0.19 |

## Appendix 4. Upper and Lower cut-offs for the time-series momentum strategy with investing $\mathbf{3 2 \%}$ of the sample

This table reports the lower (upper) cut-off points for the time-series momentum under numerous implementation approaches with investing approximately one-third of the market from 1992 to 2012. Within each market, the lower (upper) level is determined by $\mathrm{x} \%$ standard deviation plus (minus) mean of formation-return matrix which contains average returns over past J ( $\mathrm{J}=$ three, six, nine and 12 months) for each stock at end of month if using monthly rebalancing, and at end of each holding period if using buy-and-hold across whole time period. $\mathrm{x} \%$ is adjusted under different implementation approaches in order to have as same/close total number of stocks as the number in the cross-sectional momentum strategies to get fairly comparison. This is an effective "in-sample" means of calculating the cut-offs as they are based on the mean and standard deviations of the returns of the stocks in our universe over the entire sample period. The study also determined and applied cut-offs determined "out-of-sample" by setting new cut-offs each calendar year based on the history of stock returns realised in past period. When applying these "out-of-sample" cut-offs, I obtained results almost identical to those reported in this paper.

| $\mathrm{J}=$ |  | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |


|  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| CAR (0) | -7\% (9\%) -7\% (9\%) -7\% (9\%)-7\% (9\%) | \|-5\% (7\%) -5\% (7\%)-5\% (7\%)-5\% (7\%)| | -4\% (6\%) -4\% (6\%) -4\% (6\%) -4\% (6\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%) -3\% (5\%) |
| CAR (1) | -7\% (9\%) -7\% (9\%) -7\% (9\%)-7\% (9\%) | -5\% (7\%) -5\% (7\%)-5\% (7\%)-5\% (7\%) | -4\% (6\%) -4\% (6\%) -4\% (6\%)-4\% (6\%) | $-3 \%(5 \%)-3 \%(5 \%)-3 \%(5 \%)-3 \%(5 \%)$ |
| BHAR (0) | -7\% (9\%) -7\% (9\%) -7\% (9\%) -7\% (9\%) | -5\% (7\%) -5\% (7\%)-5\% (7\%)-5\% (7\%) | -4\% (6\%) -4\% (6\%) -4\% (6\%)-4\% (6\%) | $-3 \%(5 \%)-3 \%(5 \%)-3 \%(5 \%)-4 \%(5 \%)$ |
| BHAR (1) | -7\% (9\%) -7\% (9\%) -7\% (9\%)-7\% (9\%) | -5\% (7\%) -5\% (7\%)-5\% (7\%)-5\% (7\%) | -4\% (6\%) -4\% (6\%) -4\% (6\%)-4\% (6\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%) -4\% (5\%) |
| AUSTRIA |  |  |  |  |
| CAR (0) | -4\% (5\%) -4\% (5\%)-4\% (5\%)-4\% (5\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) |
| CAR (1) | -4\% (5\%) -4\% (5\%) -4\% (5\%)-4\% (5\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%)-2\% (3\%) | $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)$ |
| BHAR (0) | -4\% (5\%) -4\% (5\%) -4\% (5\%)-4\% (5\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (3\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%)-2\% (3\%) | $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)$ |
| BHAR (1) | -4\% (5\%) -4\% (5\%) -4\% (5\%) -4\% (5\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%) -3\% (3\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) |
| BELGIUM |  |  |  |  |
| CAR (0) | -3\% (4\%) -3\% (4\%) -3\% (4\%) -3\% (4\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%)-2\% (3\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) |
| CAR (1) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -2\% (3\%) $-2 \%$ (3\%) $-2 \%$ (3\%) $-2 \%(3 \%)$ | -2\% (3\%) $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)$ | $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)$ |
| BHAR (0) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-4\% (5\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) | $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \% ~(3 \%)$ |
| BHAR (1) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-4\% (5\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) |
| CANADA |  |  |  |  |
| CAR (0) | -6\% (9\%) -6\% (9\%)-6\% (9\%)-6\% (9\%) | -4\% (7\%) -4\% (7\%)-4\% (7\%)-4\% (7\%) | -3\% (6\%) -3\% (6\%)-3\% (6\%)-3\% (6\%) | -3\% (6\%) -3\% (6\%) -3\% (6\%)-3\% (6\%) |
| CAR (1) | -6\% (9\%) -6\% (9\%)-6\% (9\%)-6\% (9\%) | -4\% (7\%) -4\% (7\%) -4\% (7\%)-4\% (7\%) | -3\% (6\%) -3\% (6\%) -3\% (6\%)-3\% (6\%) | -3\% (6\%) -3\% (6\%) -3\% (6\%) -3\% (6\%) |
| BHAR (0) | -6\% (9\%) -6\% (9\%)-6\% (9\%)-6\% (9\%) | -4\% (7\%) -4\% (7\%)-4\% (7\%)-4\% (7\%) | -3\% (6\%) -3\% (6\%) -3\% (6\%)-3\% (6\%) | $-3 \%(5 \%)-3 \%(5 \%)-3 \%(5 \%)-3 \%(6 \%)$ |
| BHAR (1) | -6\% (9\%) -6\% (9\%) -6\% (9\%)-6\% (9\%) | -4\% (7\%) -4\% (7\%) -4\% (7\%)-4\% (7\%) | -3\% (6\%) -3\% (6\%) -3\% (6\%) -3\% (6\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%) -3\% (6\%) |
| DENMARK |  |  |  |  |
| CAR (0) | -4\% (5\%) -4\% (5\%) -4\% (5\%) -4\% (5\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) |
| CAR (1) | -4\% (5\%) -4\% (5\%) -4\% (5\%)-4\% (5\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)$ |
| BHAR (0) | -4\% (5\%) -4\% (5\%) -4\% (5\%)-4\% (5\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-2\% (3\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) |
| BHAR (1) | $-4 \%(5 \%)-4 \%(5 \%)-4 \%(5 \%)-4 \%(5 \%)$ | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-2\% (3\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%)-2\% (3\%) |
| FINLAND |  |  |  |  |
| CAR (0) | -5\% (7\%) -5\% (7\%)-5\% (7\%)-5\% (7\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%)-3\% (5\%) | -3\% (4\%) -3\% (4\%)-3\% (4\%)-3\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%)-2\% (4\%) |
| CAR (1) | -5\% (7\%) -5\% (7\%) -5\% (7\%)-5\% (7\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%)-3\% (5\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%) -2\% (4\%) |
| BHAR (0) | -5\% (7\%) -5\% (7\%)-4\% (6\%)-5\% (7\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%)-3\% (5\%) | -3\% (4\%) -3\% (4\%) -2\% (4\%)-2\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%)-2\% (4\%) |
| BHAR (1) | -5\% (7\%) -5\% (7\%) -4\% (6\%) -5\% (7\%) | ) $-3 \%$ |  | (4\%) $-2 \%$ (4\%) -2\% |


| $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |


|  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| CAR (0) | -5\% (6\%) -5\% (6\%)-5\% (6\%)-5\% (6\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%) -3\% (5\%) | -3\% (4\%) -3\% (4\%)-3\% (4\%)-3\% (4\%) | $-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)$ |
| CAR (1) | -5\% (6\%) -5\% (6\%) -5\% (6\%)-5\% (6\%) | -3\% (5\%) $-3 \%(5 \%)-3 \%(5 \%)-3 \%(5 \%)$ | -3\% (4\%) $-3 \%(4 \%)-3 \%(4 \%)-3 \%(4 \%)$ | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) |
| BHAR (0) | -5\% (6\%) -5\% (6\%) -5\% (6\%)-5\% (7\%) | -3\% (5\%) $-3 \%(5 \%)-3 \%(5 \%)-3 \%(5 \%)$ | -3\% (4\%) $-3 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)$ | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) |
| BHAR (1) | -5\% (6\%) -5\% (6\%) -5\% (6\%) -5\% (7\%) | -3\% (5\%) $-3 \%(5 \%)-3 \%(5 \%)-3 \%(5 \%)$ | -3\% (4\%) -3\% (4\%)-2\% (4\%)-2\% (4\%) | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) |
| GERMANY |  |  |  |  |
| CAR (0) | -6\% (6\%) -6\% (6\%)-6\% (6\%)-6\% (6\%) | -4\% (5\%) -4\% (5\%) -4\% (5\%) -4\% (5\%) | -4\% (4\%) -4\% (4\%) -4\% (4\%)-4\% (4\%) | -3\% (4\%) -3\% (4\%)-3\% (4\%)-3\% (4\%) |
| CAR (1) | -6\% (6\%) -6\% (6\%) -6\% (6\%)-6\% (6\%) | -4\% (5\%) -4\% (5\%)-4\% (5\%)-4\% (5\%) | -4\% (4\%) -4\% (4\%) -4\% (4\%)-4\% (4\%) | -3\% (4\%) $-3 \%(4 \%)-3 \%(4 \%)-3 \%(4 \%)$ |
| BHAR (0) | -6\% (6\%) -6\% (6\%) -6\% (6\%)-6\% (6\%) | -4\% (5\%) -4\% (5\%)-4\% (5\%)-4\% (4\%) | -4\% (4\%) -4\% (4\%) -3\% (4\%)-3\% (4\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) |
| BHAR (1) | -6\% (6\%) -6\% (6\%) -6\% (6\%)-6\% (6\%) | -4\% (5\%) -4\% (5\%) -4\% (5\%) -4\% (4\%) | -4\% (4\%) -4\% (4\%) -3\% (4\%)-3\% (4\%) | -3\% (4\%) -3\% (4\%)-3\% (4\%)-3\% (4\%) |
| GREECE |  |  |  |  |
| CAR (0) | -7\% (9\%) -7\% (9\%) -7\% (9\%) -7\% (9\%) | -5\% (7\%) -5\% (7\%)-5\% (7\%)-5\% (7\%) | -5\% (6\%) -5\% (6\%)-5\% (6\%)-5\% (6\%) | -4\% (5\%) -4\% (5\%) -4\% (5\%) -4\% (5\%) |
| CAR (1) | $-7 \%(9 \%)-7 \%(9 \%)-7 \%(9 \%)-7 \%$ (9\%) | -5\% (7\%) -5\% (7\%)-5\% (7\%)-5\% (7\%) | -5\% (6\%) -5\% (6\%)-5\% (6\%)-5\% (6\%) | -4\% (5\%) -4\% (5\%)-4\% (5\%)-4\% (5\%) |
| BHAR (0) | $-7 \%$ (8\%) -7\% (8\%) -8\% (9\%) -8\% (9\%) | -5\% (7\%) -5\% (6\%)-5\% (7\%)-5\% (6\%) | -5\% (6\%) -5\% (6\%)-4\% (5\%)-4\% (5\%) | -4\% (5\%) -4\% (5\%) -4\% (5\%) -4\% (5\%) |
| BHAR (1) | $-7 \%(8 \%)-7 \%(8 \%)-8 \%(9 \%)-8 \%(9 \%)$ | -5\% (7\%) -5\% (6\%)-5\% (7\%)-5\% (6\%) | -5\% (6\%) -5\% (6\%)-4\% (5\%)-4\% (5\%) | -4\% (5\%) -4\% (5\%) -4\% (5\%) -4\% (5\%) |
| HONGKONG |  |  |  |  |
| CAR (0) | -7\% (10\%)-7\% (10\%)-7\% (10\%)-7\% (10\%) | -5\% (8\%) -5\% (8\%)-5\% (8\%)-5\% (8\%) | -4\% (7\%) -4\% (7\%) -4\% (7\%) -4\% (7\%) | -4\% (6\%) -4\% (6\%) -4\% (6\%)-4\% (6\%) |
| CAR (1) | -7\% (10\%)-7\% (10\%)-7\% (10\%)-7\% (10\%) | -5\% (8\%) -5\% (8\%)-5\% (8\%)-5\% (8\%) | -4\% (7\%) -4\% (7\%)-4\% (7\%)-4\% (7\%) | -4\% (6\%) -4\% (6\%) -4\% (6\%)-4\% (6\%) |
| BHAR (0) | -7\% (10\%)-6\% (9\%)-7\% (10\%)-6\% (8\%) | -5\% (7\%) -5\% (7\%)-5\% (7\%)-5\% (7\%) | -4\% (7\%) -4\% (7\%)-4\% (6\%)-4\% (7\%) | -3\% (6\%) $-3 \%(6 \%)-3 \%(6 \%)-4 \%(6 \%)$ |
| BHAR (1) | -7\% (10\%)-7\% (9\%)-7\% (10\%)-6\% (8\%) | -5\% (7\%) -5\% (7\%) -5\% (7\%)-5\% (7\%) | -4\% (7\%) -4\% (7\%) -4\% (6\%) -4\% (7\%) | -3\% (6\%) -3\% (6\%) -3\% (6\%) -4\% (6\%) |
| IRELAND |  |  |  |  |
| CAR (0) | -5\% (7\%) -5\% (7\%)-5\% (7\%)-5\% (7\%) | -4\% (5\%) -4\% (5\%)-4\% (5\%)-4\% (5\%) | -3\% (4\%) -3\% (4\%)-3\% (4\%)-3\% (4\%) | $-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)$ |
| CAR (1) | -5\% (7\%) -5\% (7\%)-5\% (7\%)-5\% (7\%) | -4\% (5\%) -4\% (5\%) -4\% (5\%)-4\% (5\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) |
| BHAR (0) | -5\% (7\%) -5\% (7\%)-5\% (7\%)-5\% (7\%) | -4\% (5\%) -4\% (5\%) -4\% (5\%)-4\% (5\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) |
| BHAR (1) | -5\% (7\%) -5\% (7\%) -5\% (7\%) -5\% (7\%) | -4\% (5\%) -4\% (5\%) -4\% (5\%)-4\% (5\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) |
| ISRAEL |  |  |  |  |
| CAR (0) | -6\% (8\%) -6\% (8\%) -6\% (8\%)-6\% (8\%) | -4\% (6\%) -4\% (6\%) -4\% (6\%)-4\% (6\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%)-3\% (5\%) | -3\% (5\%) -3\% (5\%)-3\% (5\%) -3\% (5\%) |
| CAR (1) | -6\% (8\%) -6\% (8\%) -6\% (8\%) -6\% (8\%) | -4\% (6\%) -4\% (6\%) -4\% (6\%)-4\% (6\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%)-3\% (5\%) | -3\% (5\%) $-3 \%(5 \%)-3 \%(5 \%)-3 \%(5 \%)$ |
| BHAR (0) | -6\% (8\%) -6\% (8\%) -6\% (8\%)-6\% (8\%) | -4\% (6\%) -4\% (6\%) -4\% (6\%)-4\% (6\%) | -3\% (5\%) $-3 \%(5 \%)-3 \%(5 \%)-3 \%(5 \%)$ | -3\% (5\%) $-3 \%(5 \%)-3 \%(5 \%)-3 \%(5 \%)$ |
| BHAR (1) | -6\% (8\%) -6\% (8\%) -6\% (8\%) -6\% (8\%) | -4\% (6\%) -4\% (6\%) -4\% (6\%) -4\% (6\%) | -3\% (5\%) $-3 \%(5 \%)-3 \%(5 \%)-3 \%(5 \%)$ | -3\% (5\%) $-3 \%(5 \%)-3 \%(5 \%)-3 \%(5 \%)$ |


| $\mathrm{J}=$ |  | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |


| CAR (0) | -5\% (5\%) -5\% (5\%) -5\% (5\%) -5\% (5\%) | -4\% (4\%) -4\% (4\%) -4\% (4\%) -4\% (4\%) | -3\% (3\%) -3\% (3\%) -3\% (3\%) -3\% (3\%) | -3\% (3\%) $-3 \%(3 \%)-3 \%(3 \%)-3 \%(3 \%)$ |
| :---: | :---: | :---: | :---: | :---: |
| CAR (1) | -5\% (5\%) -5\% (5\%)-5\% (5\%)-5\% (5\%) | -4\% (4\%) -4\% (4\%) -4\% (4\%)-4\% (4\%) | -3\% (3\%) $-3 \%(3 \%)-3 \%(3 \%)-3 \%(3 \%)$ | -3\% (3\%) $-3 \%(3 \%)-3 \%(3 \%)-3 \%(3 \%)$ |
| BHAR (0) | -5\% (5\%) -5\% (5\%) -5\% (5\%) -5\% (6\%) | -4\% (4\%) -4\% (4\%)-4\% (4\%)-4\% (4\%) | $-3 \%(3 \%)-3 \%(3 \%)-3 \%(3 \%)-3 \%(3 \%)$ | -3\% (3\%) $-3 \%(3 \%)-3 \%(3 \%)-3 \%(3 \%)$ |
| BHAR (1) | -5\% (5\%) -5\% (5\%)-5\% (5\%)-5\% (6\%) | -4\% (4\%) -4\% (4\%)-4\% (4\%) -4\% (4\%) | -3\% (3\%) -3\% (3\%) -3\% (3\%)-3\% (3\%) | -3\% (3\%) $-3 \%(3 \%)-3 \%(3 \%)-3 \%(3 \%)$ |
| JAPAN |  |  |  |  |
| CAR (0) | -5\% (5\%) -5\% (5\%)-5\% (5\%)-5\% (5\%) | -4\% (4\%) -4\% (4\%)-4\% (4\%) -4\% (4\%) | -3\% (3\%) -3\% (3\%)-3\% (3\%)-3\% (3\%) | -3\% (3\%) -3\% (3\%)-3\% (3\%)-3\% (3\%) |
| CAR (1) | -5\% (5\%) -5\% (5\%)-5\% (5\%)-5\% (5\%) | -4\% (4\%) -4\% (4\%)-4\% (4\%)-4\% (4\%) | -3\% (3\%) -3\% (3\%) -3\% (3\%)-3\% (3\%) | -3\% (3\%) $-3 \%(3 \%)-3 \%(3 \%)-3 \%(3 \%)$ |
| BHAR (0) | -5\% (5\%) -5\% (5\%)-5\% (6\%)-5\% (6\%) | -4\% (4\%) -4\% (4\%)-4\% (4\%)-4\% (4\%) | -3\% (3\%) -3\% (3\%) -3\% (3\%)-3\% (3\%) | -2\% (3\%) $-2 \%(3 \%)-3 \%(3 \%)-2 \%(3 \%)$ |
| BHAR (1) | -5\% (5\%) -5\% (5\%)-5\% (6\%)-5\% (6\%) | -4\% (4\%) - $4 \%(4 \%)-4 \%(4 \%)-4 \%(4 \%)$ | -3\% (3\%) -3\% (3\%) -3\% (3\%) -3\% (3\%) | -2\% (3\%) $-2 \%(3 \%)-3 \%(3 \%)-2 \%(3 \%)$ |
| NETHERLANDS |  |  |  |  |
| CAR (0) | -5\% (6\%) -5\% (6\%)-5\% (6\%)-5\% (6\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%) -3\% (4\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%)-2\% (3\%) |
| CAR (1) | -5\% (6\%) -5\% (6\%)-5\% (6\%)-5\% (6\%) | -3\% (4\%) -3\% (4\%)-3\% (4\%)-3\% (4\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -2\% (3\%) -2\% (3\%)-2\% (3\%)-2\% (3\%) |
| BHAR (0) | -4\% (5\%) -5\% (6\%)-4\% (5\%)-5\% (6\%) | -3\% (4\%) -3\% (4\%)-3\% (4\%)-3\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%)-2\% (4\%) | -2\% (3\%) $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)$ |
| BHAR (1) | -4\% (5\%) -5\% (6\%) -4\% (5\%) -5\% (6\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%) -3\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%) -2\% (4\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%)-2\% (3\%) |
| NEWZEALAND |  |  |  |  |
| CAR (0) | -4\% (6\%) -4\% (6\%) -4\% (6\%)-4\% (6\%) | -3\% (4\%) -3\% (4\%)-3\% (4\%)-3\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%)-2\% (4\%) | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) |
| CAR (1) | -4\% (6\%) -4\% (6\%) -4\% (6\%) -4\% (6\%) | -3\% (4\%) $-3 \%(4 \%)-3 \%(4 \%)-3 \%(4 \%)$ | -2\% (4\%) -2\% (4\%) -2\% (4\%) -2\% (4\%) | -2\% (4\%) $-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)$ |
| BHAR (0) | -4\% (6\%) -4\% (6\%) -4\% (6\%) -4\% (6\%) | -3\% (4\%) -3\% (4\%)-3\% (5\%)-3\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%)-2\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%)-2\% (4\%) |
| BHAR (1) | -4\% (6\%) - $4 \%(6 \%$ ) $-4 \%(6 \%)-4 \%(6 \%)$ | -3\% (4\%) -3\% (4\%) -3\% (5\%) -3\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%) -2\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%) -2\% (4\%) |
| NORWAY |  |  |  |  |
| CAR (0) | -6\% (8\%) -6\% (8\%)-6\% (8\%)-6\% (8\%) | -4\% (6\%) -4\% (6\%) -4\% (6\%)-4\% (6\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%)-3\% (5\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%) -3\% (5\%) |
| CAR (1) | -6\% (8\%) -6\% (8\%)-6\% (8\%)-6\% (8\%) | -4\% (6\%) -4\% (6\%)-4\% (6\%)-4\% (6\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%)-3\% (5\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%)-3\% (5\%) |
| BHAR (0) | -5\% (7\%) -5\% (7\%)-5\% (7\%)-5\% (7\%) | -4\% (6\%) -4\% (6\%) -4\% (6\%) -4\% (5\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%)-3\% (5\%) | -3\% (5\%) $-3 \%(4 \%)-3 \%(5 \%)-3 \%(5 \%)$ |
| BHAR (1) | -5\% (7\%) -5\% (7\%) -5\% (7\%) -5\% (7\%) | -4\% (6\%) -4\% (6\%) -4\% (6\%) -4\% (5\%) | -3\% (5\%) -3\% (5\%) -3\% (5\%) -3\% (5\%) | -3\% (5\%) -3\% (4\%) -3\% (5\%)-3\% (5\%) |
| PORTUGAL |  |  |  |  |
| CAR (0) | -5\% (6\%) -5\% (6\%)-5\% (6\%)-5\% (6\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%)-2\% (4\%) |
| CAR (1) | -5\% (6\%) -5\% (6\%)-5\% (6\%)-5\% (6\%) | -3\% (4\%) $-3 \%(4 \%)-3 \%(4 \%)-3 \%(4 \%)$ | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -2\% (4\%) $-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)$ |
| BHAR (0) | -5\% (6\%) -5\% (6\%)-5\% (6\%)-5\% (6\%) | -3\% (4\%) -3\% (4\%) -3\% (4\%)-3\% (4\%) | -3\% (4\%) -3\% (4\%) -2\% (4\%)-3\% (4\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%)-2\% (3\%) |
| BHAR (1) | -5\% (6\%) -5\% (6\%) -5\% (6\%)-5\% (6\%) | -3\% (4\%) $-3 \%(4 \%)-3 \%(4 \%)-3 \%(4 \%)$ | -3\% (4\%) $-3 \%(4 \%)-2 \%(4 \%)-3 \%$ | -2\% (3\%) - $2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)$ |




## Appendix 5. Upper and Lower cut-offs for the time-series momentum strategy with investing $60 \%$ of the sample

This table reports the lower (upper) cut-off points for the time-series momentum under numerous implementation approaches with investing approximately $60 \%$ of the market from 1992 to 2012. Within each market, the lower (upper) level is determined by $\mathrm{x} \%$ standard deviation plus (minus) mean of formation-return matrix which contains average returns over past J ( $\mathrm{J}=$ three, six, nine and 12 months) for each stock at end of month if using monthly rebalancing, and at end of each holding period if using buy-and-hold across whole time period. $\mathrm{x} \%$ is adjusted under different implementation approaches in order to have as same/close total number of stocks as the number in the cross-sectional momentum strategies to get fairly comparison. This is an effective "in-sample" means of calculating the cut-offs as they are based on the mean and standard deviations of the returns of the stocks in our universe over the entire sample period. The study also determined and applied cut-offs determined "out-of-sample" by setting new cut-offs each calendar year based on the history of stock returns realised in past period. When applying these "out-of-sample" cut-offs, I obtained results almost identical to those reported in this paper.

| $\mathrm{J}=$ | 3 |  |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |


| CAR (0) | -3\% (5\%) -3\% (5\%) -3\% (5\%) -3\% (5\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%) -2\% (4\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%) -1\% (3\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%) -1\% (3\%) |
| :---: | :---: | :---: | :---: | :---: |
| CAR (1) | -3\% (5\%) -3\% (5\%) -3\% (5\%) -3\% (5\%) | $-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)$ | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) | -1\% (3\%) -1\% (3\%)-1\% (3\%)-1\% (3\%) |
| BHAR (0) | -3\% (5\%) -3\% (4\%) -3\% (5\%) -2\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%)-2\% (4\%) | $-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)$ | -1\% (3\%) -1\% (3\%)-1\% (3\%)-1\% (3\%) |
| BHAR (1) | -3\% (5\%) -3\% (4\%) -3\% (5\%) -2\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%) -2\% (4\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%) -1\% (3\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) |
| AUSTRIA |  |  |  |  |
| CAR (0) | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) | -1\% (1\%) -1\% (1\%)-1\% (1\%)-1\% (1\%) | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) |
| CAR (1) | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | $-1 \%(1 \%)-1 \%(1 \%)-1 \%(1 \%)-1 \%(1 \%)$ | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) |
| BHAR (0) | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \% ~(2 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) | -1\% (1\%) -1\% (2\%)-1\% (1\%)-1\% (2\%) |
| BHAR (1) | -1\% (2\%) -1\% (2\%) -1\% (2\%) -1\% (2\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%) -1\% (2\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) | -1\% (1\%) -1\% (2\%)-1\% (1\%)-1\% (2\%) |
| BELGIUM |  |  |  |  |
| CAR (0) | -1\% (2\%) -1\% (2\%) -1\% (2\%) -1\% (2\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) | -1\% (1\%) -1\% (1\%)-1\% (1\%)-1\% (1\%) |
| CAR (1) | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) | -1\% (1\%) -1\% (1\%)-1\% (1\%)-1\% (1\%) |
| BHAR (0) | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) |
| BHAR (1) | -1\% (2\%) -1\% (2\%) -1\% (2\%) -1\% (2\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%) -1\% (2\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) |
| CANADA |  |  |  |  |
| CAR (0) | -2\% (5\%) -2\% (5\%) -2\% (5\%) -2\% (5\%) | -1\% (4\%) -1\% (4\%) -1\% (4\%)-1\% (4\%) | -1\% (4\%) -1\% (4\%) -1\% (4\%)-1\% (4\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) |
| CAR (1) | $-2 \%(5 \%)-2 \%(5 \%)-2 \%(5 \%)-2 \%(5 \%)$ | $-1 \%(4 \%)-1 \%(4 \%)-1 \%(4 \%)-1 \%(4 \%)$ | $-1 \%(4 \%)-1 \%(4 \%)-1 \%(4 \%)-1 \%(4 \%)$ | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) |
| BHAR (0) | $-2 \%(5 \%)-2 \%(5 \%)-2 \%(5 \%)-2 \% ~(5 \%)$ | -1\% (4\%) -1\% (4\%) -1\% (4\%)-1\% (4\%) | -1\% (4\%) -1\% (4\%) -1\% (3\%)-1\% (3\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) |
| BHAR (1) | -2\% (5\%) -2\% (5\%) -2\% (5\%) -2\% (5\%) | -1\% (4\%) -1\% (4\%) -1\% (4\%)-1\% (4\%) | -1\% (4\%) -1\% (4\%) -1\% (3\%)-1\% (3\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) |
| DENMARK |  |  |  |  |
| CAR (0) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) |
| CAR (1) | $-2 \%$ (3\%) $-2 \%$ (3\%) -2\% (3\%) -2\% (3\%) | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) |
| BHAR (0) | $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \% ~(3 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) |
| BHAR (1) | -2\% (3\%) -2\% (3\%) -2\% (3\%) -2\% (3\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%) -1\% (2\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%) -1\% (2\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) |
| FINLAND |  |  |  |  |
| CAR (0) | -2\% (4\%) -2\% (4\%) -2\% (4\%) -2\% (4\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%) -1\% (3\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%) -1\% (3\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) |
| CAR (1) | $-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)$ | $-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)$ | $-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)$ | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) |
| BHAR (0) | $-2 \%(3 \%)-2 \%(4 \%)-2 \%(3 \%)-2 \%(4 \%)$ | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) | -1\% (3\%) -1\% (3\%)-1\% (3\%)-1\% (3\%) |
| BHAR (1) | -2\% (3\%) -2\% (4\%) -2\% (3\%) -2\% (4\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) | -1\% (3\%) $-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)$ | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) |


| $\mathrm{J}=$ |  | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |


| CAR (0) | -2\% (3\%) -2\% (3\%) -2\% (3\%)-2\% (3\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%) -1\% (3\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%) -1\% (2\%) |
| :---: | :---: | :---: | :---: | :---: |
| CAR (1) | -2\% (3\%) - $2 \%$ (3\%) -2\% (3\%) -2\% (3\%) | $-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)$ | -1\% (2\%) - $1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | -1\% (2\%) $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%$ |
| BHAR (0) | -2\% (3\%) $-2 \%$ (3\%) -2\% (3\%) -2\% (3\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) | -1\% (2\%) -1\% (2\%) - $1 \%$ ( $2 \%$ ) $-1 \%(2 \%)$ | -1\% (2\%) -1\% (2\%) -1\% (2\%) -1\% (2\% |
| BHAR (1) | -2\% (3\%) - $2 \%$ (3\%) -2\% (3\%) -2\% (3\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%) -1\% (3\%) | -1\% (2\%) -1\% (2\%) - $1 \%(2 \%)-1 \%(2 \%)$ | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) |
| GERMANY |  |  |  |  |


|  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| CAR (0) | -2\% (3\%) -2\% (3\%)-2\% (3\%)-2\% (3\%) | -2\% (2\%) -2\% (2\%)-2\% (2\%)-2\% (2\%) | -2\% (2\%) -2\% (2\%)-2\% (2\%)-2\% (2\%) | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) |
| CAR (1) | -2\% (3\%) -2\% (3\%) -2\% (3\%)-2\% (3\%) | $-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)$ | -2\% (2\%) - $2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)$ | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) |
| BHAR (0) | -2\% (3\%) -2\% (3\%) -2\% (3\%)-2\% (3\%) | -2\% (2\%) $-2 \%$ ( $2 \%$ ) $-2 \%(2 \%)-2 \%(2 \%)$ | -2\% (2\%) $-2 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) |
| BHAR (1) | -2\% (3\%) -2\% (3\%) -2\% (3\%)-2\% (3\%) | -2\% (2\%) $-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)$ | -2\% (2\%) $-2 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) |
| GREECE |  |  |  |  |
| CAR (0) | -3\% (5\%) -3\% (5\%)-3\% (5\%) -3\% (5\%) | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) | -2\% (3\%) -2\% (3\%)-2\% (3\%)-2\% (3\%) | -2\% (3\%) -2\% (3\%)-2\% (3\%)-2\% (3\%) |
| CAR (1) | -3\% (5\%) -3\% (5\%) -3\% (5\%)-3\% (5\%) | -2\% (4\%) $-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)$ | -2\% (3\%) $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)$ | -2\% (3\%) $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)$ |
| BHAR (0) | -3\% (5\%) -3\% (5\%) -3\% (5\%) -3\% (5\%) | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) | -2\% (3\%) -2\% (3\%)-2\% (3\%)-2\% (3\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%)-2\% (3\%) |
| BHAR (1) | -3\% (5\%) -3\% (5\%) -3\% (5\%)-3\% (5\%) | -2\% (4\%) - $2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)$ | -2\% (3\%) -2\% (3\%)-2\% (3\%)-2\% (3\%) | -2\% (3\%) $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)$ |
| HONGKONG |  |  |  |  |
| CAR (0) | -3\% (5\%) -3\% (5\%) -3\% (5\%)-3\% (5\%) | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) | -1\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) | -1\% (4\%) -1\% (4\%)-1\% (4\%)-1\% (4\%) |
| CAR (1) | -3\% (5\%) -3\% (5\%) -3\% (5\%) -3\% (5\%) | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) | -1\% (4\%) -1\% (4\%)-1\% (4\%)-1\% (4\%) |
| BHAR (0) | -3\% (5\%) -2\% (5\%) -3\% (5\%)-2\% (5\%) | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) | -1\% (4\%) -1\% (4\%)-1\% (4\%)-1\% (4\%) | -1\% (4\%) -1\% (3\%)-1\% (3\%)-1\% (4\%) |
| BHAR (1) | -3\% (5\%) -3\% (5\%) -3\% (5\%)-2\% (5\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%)-2\% (4\%) | -1\% (4\%) -1\% (4\%) -1\% (4\%)-1\% (4\%) | -1\% (4\%) -1\% (3\%) -1\% (3\%)-1\% (4\%) |
| IRELAND |  |  |  |  |
| CAR (0) | -2\% (4\%) -2\% (4\%) -2\% (4\%)-2\% (4\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%)-2\% (3\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) |
| CAR (1) | -2\% (4\%) -2\% (4\%) -2\% (4\%)-2\% (4\%) | -2\% (3\%) -2\% (3\%)-2\% (3\%)-2\% (3\%) | -1\% (3\%) -1\% (3\%)-1\% (3\%)-1\% (3\%) | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) |
| BHAR (0) | -2\% (4\%) -2\% (4\%) -2\% (4\%)-2\% (4\%) | -1\% (3\%) -1\% (3\%)-1\% (3\%)-1\% (3\%) | -2\% (3\%) -2\% (3\%) -2\% (3\%)-1\% (2\%) | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) |
| BHAR (1) | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) | -1\% (3\%) -1\% (3\%)-1\% (3\%)-1\% (3\%) | -2\% (3\%) -2\% (3\%)-2\% (3\%)-1\% (2\%) | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) |
| ISRAEL |  |  |  |  |
| CAR (0) | -3\% (4\%) -3\% (4\%) -3\% (4\%) -3\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%)-2\% (4\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) |
| CAR (1) | -3\% (4\%) -3\% (4\%) -3\% (4\%) -3\% (4\%) | -2\% (4\%) -2\% (4\%)-2\% (4\%)-2\% (4\%) | -1\% (3\%) -1\% (3\%)-1\% (3\%)-1\% (3\%) | -1\% (3\%) -1\% (3\%)-1\% (3\%)-1\% (3\%) |
| BHAR (0) | -2\% (4\%) -2\% (4\%) -2\% (4\%)-3\% (4\%) | -2\% (4\%) $-2 \%$ (4\%) -2\% (4\%) -2\% (4\%) | -1\% (3\%) -1\% (3\%)-1\% (3\%)-1\% (3\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) |
| BHAR (1) | -2\% (4\%) -2\% (4\%) -2\% (4\%) -3\% (4\%) | -2\% (4\%) -2\% (4\%) -2\% (4\%) -2\% (4\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) | -1\% (3\%) -1\% (3\%) -1\% (3\%)-1\% (3\%) |



## CAR (0)

AR (1)
HAR (0)
BHAR (1)
$-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$

JAPAN

| CAR (0) | -3\% (3\%) -3\% (3\%) -3\% (3\%) -3\% (3\%) | -2\% (2\%) -2\% (2\%) -2\% (2\%)-2\% (2\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) | -1\% (1\%) -1\% (1\%)-1\% (1\%)-1\% (1\%) |
| :---: | :---: | :---: | :---: | :---: |
| CAR (1) | -3\% (3\%) $-3 \%(3 \%)-3 \%(3 \%)-3 \%(3 \%)$ | -2\% (2\%) $-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)$ | -1\% (2\%) -1\% (2\%)-1\% (2\%)-1\% (2\%) | -1\% (1\%) -1\% (1\%)-1\% (1\%)-1\% (1\%) |
| BHAR (0) | $-2 \%$ (3\%) $-2 \%$ (3\%) -3\% (3\%) -3\% (3\%) | -2\% (2\%) $-2 \%(2 \%)-2 \%(2 \%)-2 \%(2 \%)$ | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) | -1\% (1\%) -1\% (1\%)-1\% (2\%)-1\% (1\%) |
| BHAR (1) | -3\% (3\%) -2\% (3\%) -3\% (3\%) -3\% (3\%) | -2\% (2\%) -2\% (2\%) -2\% (2\%) -2\% (2\%) | -1\% (2\%) -1\% (2\%) -1\% (2\%)-1\% (2\%) | -1\% (1\%) -1\% (1\%)-1\% (2\%)-1\% (1\%) |

## NETHERLANDS

CAR (0)
CAR (1)
BHAR (0)
BHAR (0)
BHAR (1) $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$

## NEWZEALAND

AR
BHAR (0)
BHAR (1) NORWAY

## $\frac{\text { NOR }}{\text { CAR }(0)}$

$-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%) 0 \%(2 \%)-1 \%(2 \%)$ $-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-2 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%) 0 \%(2 \%)-1 \%(2 \%)$

CAR (0)
BHAR (0)
BHAR (1)

| $-2 \%(4 \%)$ | $-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)$ | $-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)$ | $-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)$ | $-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)$ | $-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)$ | $-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)$ | $-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)$ |  | $-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)$

$-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)$ $-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)-2 \%(4 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)-1 \%(3 \%)$

## PORTUGAL

| PORTUGAL |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| CAR (0) | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ |
| CAR (1) | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ |
| BHAR (0) | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-2 \%(3 \%)$ | $-1 \%(3 \%)-1 \%(3 \%)-1 \%(2 \%)-1 \%(3 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ |
| BHAR (1) | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-2 \%(3 \%)$ | $-1 \%(3 \%)-1 \%(3 \%)-1 \%(2 \%)-1 \%(3 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ | $-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)-1 \%(2 \%)$ |


| $\mathrm{J}=$ |  | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |



## Appendix 6. Time-series momentum strategies investing $60 \%$ of sample








Panel B. The time-series momentum strategy using market-weighted return



| MW | J | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.18\% | 0.04\% | -0.07\% | 0.05\% | 0.61\% | 0.55\% | 0.43\% | 0.14\% | -0.15\% | 0.00\% | -0.18\% | -0.38\% | 0.51\% | 0.32\% | 0.04\% | -0.29\% |
|  |  | 0.3714 | 0.0985 | -0.1896 | 0.1553 | 0.9283 | 0.9620 | 0.8956 | 0.2983 | -0.2222 | -0.0028 | -0.2874 | -0.6108 | 0.7758 | 0.5064 | 0.0662 | -0.4502 |
| CAR (1) |  | 0.22\% | -0.07\% | -0.09\% | 0.02\% | 0.84\% | 0.59\% | 0.42\% | 0.14\% | -0.05\% | -0.06\% | -0.29\% | -0.42\% | 0.85\% | 0.36\% | -0.08\% | -0.27\% |
|  |  | 0.4342 | -0.1594 | -0.2506 | 0.0544 | 1.2831 | 1.1298 | 0.8869 | 0.3047 | -0.0688 | -0.0909 | -0.4507 | -0.6559 | 1.2871 | 0.5716 | -0.1296 | -0.4109 |
| BHAR (0) |  | 0.81\% | 0.56\% | 0.36\% | 0.46\% | 1.37\% | 1.00\% | -0.23\% | -0.02\% | 0.41\% | 0.62\% | -0.43\% | -0.22\% | 1.03\% | 0.26\% | 0.55\% | -0.11\% |
|  |  | 1.2505 | 0.7540 | 0.4711 | 0.7067 | 1.9087 | 1.4223 | -0.3353 | -0.0263 | 0.5167 | 0.9555 | -0.4454 | -0.2847 | 1.4275 | 0.3139 | 0.8754 | -0.1261 |
| BHAR (1) |  | 0.69\% | 0.35\% | 0.34\% | 0.62\% | 1.61\% | 0.91\% | -0.05\% | 0.10\% | 0.10\% | 0.86\% | -0.52\% | -0.15\% | 1.73\% | 0.42\% | 0.87\% | 0.48\% |
|  |  | 1.0106 | 0.4549 | 0.4495 | 0.8308 | 2.1009 | 1.2948 | -0.0612 | 0.1312 | 0.1134 | 1.1455 | -0.5324 | -0.2029 | 2.1655 | 0.5215 | 1.3271 | 0.5568 |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.79\% | 0.82\% | 0.77\% | 0.72\% | 1.50\% | 1.11\% | 0.96\% | 0.88\% | 1.14\% | 1.03\% | 0.88\% | 0.77\% | 1.20\% | 0.98\% | 0.87\% | 0.84\% |
|  |  | 2.2447 | 3.0772 | 3.3398 | 3.3262 | 3.6806 | 2.9754 | 2.8919 | 2.8312 | 2.7467 | 2.6050 | 2.3948 | 2.2254 | 3.0365 | 2.6023 | 2.3897 | 2.3472 |
| CAR (1) |  | 0.84\% | 0.86\% | 0.83\% | 0.70\% | 1.51\% | 1.07\% | 0.91\% | 0.80\% | 1.16\% | 0.96\% | 0.82\% | 0.72\% | 1.09\% | 0.98\% | 0.84\% | 0.81\% |
|  |  | 2.5359 | 3.3126 | 3.7203 | 3.3127 | 3.4160 | 2.7891 | 2.7637 | 2.6599 | 2.5757 | 2.4467 | 2.2434 | 2.0851 | 2.8942 | 2.6664 | 2.3207 | 2.2942 |
| BHAR (0) |  | 0.21\% | 0.39\% | -0.18\% | 0.54\% | 1.44\% | 0.94\% | 1.13\% | 0.31\% | 1.13\% | 0.89\% | 1.28\% | 0.71\% | 1.01\% | 0.96\% | 0.78\% | 1.58\% |
|  |  | 0.4818 | 0.8912 | -0.3956 | 1.4303 | 3.3168 | 1.9510 | 2.2680 | 0.7512 | 2.2616 | 1.6780 | 3.1840 | 1.4920 | 2.2974 | 2.3157 | 1.7194 | 3.4100 |
| BHAR (1) |  | 0.22\% | 0.46\% | -0.16\% | 0.50\% | 1.49\% | 0.70\% | 1.01\% | 0.23\% | 0.89\% | 0.60\% | $1.16 \%$ | $\mathbf{0 . 8 2 \%}$ | $0.98 \%$ | $1.17 \%$ | $0.80 \%$ | $1.44 \%$ |
|  |  | 0.5293 | 1.1293 | -0.3445 | 1.3082 | 3.1130 | 1.3837 | 2.0601 | 0.5568 | 1.7539 | 1.1471 | $2.7102$ | 1.7729 | $2.4112$ | $2.9752$ | $1.9094$ | $3.3710$ |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.66\% | 1.03\% | 0.70\% | 0.74\% | 1.23\% | 1.12\% | 0.69\% | 0.62\% | 0.96\% | 0.93\% | 0.66\% | 0.42\% | 1.25\% | 0.96\% | 0.86\% | 0.64\% |
|  |  | 1.1686 | 2.1159 | 1.5840 | 2.0540 | 1.7349 | 1.7936 | 1.3099 | 1.2968 | 1.2224 | 1.4069 | 1.0840 | 0.7471 | 1.6931 | 1.4346 | 1.3405 | 1.1054 |
| CAR (1) |  | 1.44\% | 1.23\% | 0.86\% | 0.83\% | 1.37\% | 0.90\% | 0.58\% | 0.49\% | 1.10\% | 0.76\% | 0.54\% | 0.33\% | 0.90\% | 0.83\% | 0.71\% | 0.44\% |
|  |  | 2.7233 | 2.5343 | 2.0279 | 2.4580 | 2.0375 | 1.4947 | 1.1421 | 1.0523 | 1.5680 | 1.2369 | 0.9402 | 0.6266 | 1.2333 | 1.2314 | 1.1286 | 0.7962 |
| BHAR (0) |  | 1.04\% | 0.32\% | -0.86\% | 0.47\% | 0.58\% | 1.12\% | -0.46\% | 1.94\% | 0.87\% | 0.15\% | 1.35\% | 0.55\% | 1.83\% | 1.35\% | 1.38\% | 1.64\% |
|  |  | 1.4179 | 0.3787 | -1.0185 | 0.5297 | 0.7265 | 1.5759 | -0.6970 | 2.5283 | 0.9011 | 0.1695 | 1.5086 | 0.7271 | 2.1891 | 1.6086 | 1.7950 | 2.0264 |
| BHAR (1) |  | 1.27\% | 0.05\% | -1.08\% | 0.65\% | 0.81\% | 1.02\% | 0.02\% | 1.71\% | 0.17\% | 0.13\% | 0.92\% | -0.06\% | 1.08\% | 1.21\% | 0.93\% | 1.57\% |
|  |  | 1.6461 | 0.0518 | -1.1193 | 0.6460 | 1.0491 | 1.4576 | 0.0271 | 2.3216 | 0.1866 | 0.1313 | 1.0313 | -0.0814 | 1.3175 | 1.4326 | 1.2692 | 1.9481 |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.63\% | 0.65\% | 0.65\% | 0.53\% | 0.92\% | 0.84\% | 0.61\% | 0.41\% | 1.08\% | 0.72\% | 0.54\% | 0.33\% | 0.69\% | 0.52\% | 0.34\% | 0.09\% |
|  |  | 1.7614 | 2.1164 | 2.4078 | 2.1392 | 1.9812 | 2.0744 | 1.7356 | 1.2011 | 2.1828 | 1.6404 | 1.3063 | 0.8524 | 1.2568 | 1.0542 | 0.7400 | 0.2127 |
| CAR (1) |  | 0.88\% | 0.81\% | 0.75\% | 0.48\% | 0.97\% | 0.77\% | 0.57\% | 0.25\% | 1.00\% | 0.63\% | 0.46\% | 0.25\% | 0.44\% | 0.35\% | 0.19\% | 0.00\% |
|  |  | 2.4659 | 2.6156 | 2.8192 | 1.8439 | 2.1594 | 2.0614 | 1.6044 | 0.7423 | 2.1968 | 1.4052 | 1.1062 | 0.6243 | 0.7856 | 0.6970 | 0.4113 | -0.0076 |
| BHAR (0) |  | 0.34\% | 0.20\% | 0.84\% | 0.02\% | 1.25\% | 1.16\% | 0.52\% | 1.22\% | 1.01\% | 0.96\% | 1.05\% | 0.88\% | 0.57\% | 0.25\% | 0.53\% | 0.15\% |
|  |  | 0.8112 | 0.4556 | 1.9222 | 0.0572 | 2.4651 | 2.2143 | 1.2286 | 2.3948 | 2.0584 | 1.9591 | 2.4201 | 1.8407 | 1.0088 | 0.4334 | 1.0538 | 0.2501 |
| BHAR (1) |  | 0.52\% | 0.32\% | 0.96\% | -0.02\% | 1.27\% | 1.22\% | 0.53\% | 1.17\% | 1.06\% | 0.73\% | 0.67\% | 0.85\% | 0.54\% | 0.50\% | 0.28\% | 0.30\% |
|  |  | 1.1593 | 0.7240 | 2.4931 | -0.0570 | 2.7333 | 2.5549 | 1.2189 | 2.3467 | 2.2369 | 1.5962 | 1.5186 | 1.7797 | 0.8948 | 0.8547 | 0.5469 | 0.4880 |


| MW | J | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.70\% | 0.83\% | 0.79\% | 0.81\% | 0.91\% | 1.00\% | 0.93\% | 0.95\% | 1.08\% | 1.45\% | 1.39\% | 1.33\% | 1.48\% | 1.36\% | 1.27\% | 1.19\% |
|  |  | 2.0386 | 2.7917 | 3.4544 | 4.1343 | 2.2360 | 3.1193 | 3.4659 | 3.7737 | 2.7670 | 4.1852 | 4.3172 | 4.3640 | 3.5701 | 3.4588 | 3.4040 | 3.3408 |
| CAR (1) |  | 0.89\% | 0.94\% | 0.87\% | 0.83\% | 1.08\% | 1.02\% | 0.94\% | 0.86\% | 1.58\% | 1.53\% | 1.38\% | 1.32\% | 1.39\% | 1.28\% | 1.17\% | 1.17\% |
|  |  | 2.5892 | 3.3899 | 3.8573 | 4.3092 | 3.0157 | 3.4979 | 3.5712 | 3.4183 | 4.0676 | 4.5257 | 4.3613 | 4.3332 | 3.3976 | 3.1995 | 3.1318 | 3.2420 |
| BHAR (0) |  | 0.94\% | 0.48\% | 1.24\% | 0.51\% | 0.98\% | 0.99\% | 0.70\% | 1.37\% | 1.26\% | 1.18\% | 1.01\% | 1.36\% | 1.49\% | 1.07\% | 1.21\% | 0.96\% |
|  |  | 2.0591 | 1.0480 | 2.7321 | 1.1515 | 2.1613 | 2.2081 | 1.8287 | 3.0123 | 2.8830 | 2.6637 | 2.3707 | 3.2682 | 3.0843 | 2.2785 | 2.3950 | 2.2502 |
| BHAR (1) |  | 1.08\% | 0.67\% | 1.60\% | 0.59\% | 0.93\% | 0.86\% | 0.78\% | 1.50\% | 1.71\% | 1.33\% | 0.80\% | 1.34\% | 1.19\% | 0.94\% | 1.39\% | 0.93\% |
|  |  | 2.5252 | 1.4898 | 3.4799 | 1.3559 | 2.3648 | 2.0965 | 2.2172 | 3.3549 | 3.4842 | 2.8713 | 1.9334 | 3.2014 | 2.5427 | 2.0125 | 2.7734 | 2.0859 |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.07\% | 0.04\% | 0.10\% | 0.14\% | 0.11\% | 0.10\% | 0.20\% | 0.14\% | 0.19\% | 0.26\% | 0.22\% | 0.16\% | 0.25\% | 0.18\% | 0.16\% | 0.16\% |
|  |  | 0.2645 | 0.1532 | 0.4778 | 0.8052 | 0.3199 | 0.3219 | 0.7478 | 0.6044 | 0.5505 | 0.8353 | 0.8035 | 0.6634 | 0.7417 | 0.5667 | 0.5704 | 0.6070 |
| CAR (1) |  | 0.12\% | 0.11\% | 0.16\% | 0.12\% | 0.21\% | 0.20\% | 0.25\% | 0.13\% | 0.30\% | 0.34\% | 0.22\% | 0.16\% | 0.25\% | 0.17\% | 0.16\% | 0.15\% |
|  |  | 0.4859 | 0.4504 | 0.7906 | 0.7217 | 0.6680 | 0.7056 | 1.0064 | 0.5864 | 0.9029 | 1.1327 | 0.8362 | 0.6564 | 0.7728 | 0.5814 | 0.6067 | 0.6039 |
| BHAR (0) |  | 0.06\% | 0.24\% | 0.16\% | 0.44\% | 0.27\% | 0.22\% | 0.06\% | 0.43\% | 0.29\% | 0.37\% | 0.35\% | $\mathbf{0 . 2 0 \%}$ | 0.33\% | 0.32\% | 0.16\% | 0.12\% |
|  |  | 0.1975 | 0.8032 | 0.4956 | 1.6444 | 0.7443 | 0.6101 | 0.1747 | 1.4981 | 0.7876 | 1.1566 | 1.0577 | 0.6857 | 0.9269 | 0.9600 | 0.5251 | 0.3995 |
| BHAR (1) |  | 0.02\% | 0.13\% | 0.01\% | 0.49\% | $0.30 \%$ | $0.18 \%$ | $0.09 \%$ | $\mathbf{0 . 3 3 \%}$ | $0.24 \%$ | $0.41 \%$ | $0.21 \%$ | $0.06 \%$ | $0.21 \%$ | $0.07 \%$ | $0.06 \%$ | -0.09\% |
|  |  | 0.0661 | 0.4454 | 0.0481 | 1.9205 | $0.9765$ | $0.5843$ | $0.2748$ | $1.1545$ | $0.7330$ | $1.3586$ | $0.6919$ | $0.2249$ | $0.6184$ | $0.2019$ | $0.2070$ | $-0.2968$ |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.38\% | 0.45\% | 0.42\% | 0.46\% | 0.72\% | 0.60\% | 0.51\% | 0.41\% | 0.79\% | 0.58\% | 0.49\% | 0.35\% | 0.47\% | 0.45\% | 0.39\% | 0.36\% |
|  |  | 1.2593 | 1.8674 | 2.0317 | 2.5906 | 2.0711 | 1.8974 | 1.7706 | 1.5427 | 2.0981 | 1.6896 | 1.4631 | 1.1044 | 1.2175 | 1.1651 | 1.0769 | 1.0691 |
| CAR (1) |  | 0.63\% | 0.49\% | 0.44\% | 0.40\% | 0.70\% | 0.58\% | 0.50\% | 0.30\% | 0.55\% | 0.38\% | 0.35\% | 0.26\% | 0.15\% | 0.42\% | 0.28\% | 0.31\% |
|  |  | 2.0767 | 2.0802 | 2.1948 | 2.2961 | 1.9001 | 1.7698 | 1.7130 | 1.0934 | 1.3378 | 1.0453 | 1.0049 | 0.8127 | 0.3579 | 1.0401 | 0.7636 | 0.9303 |
| BHAR (0) |  | 0.53\% | 0.26\% | $\mathbf{0 . 6 1 \%}$ | 0.31\% | 0.59\% | 0.66\% | -0.35\% | 0.79\% | 0.75\% | 0.69\% | 0.40\% | 0.50\% | 0.48\% | 0.61\% | 0.39\% | 0.27\% |
|  |  | 1.4110 | 0.6549 | 1.5175 | 0.6638 | 1.3753 | 1.4305 | -0.6722 | 1.8085 | 1.7412 | 1.6211 | 0.9414 | 1.2397 | 1.0707 | 1.4370 | 0.8675 | 0.6289 |
| BHAR (1) |  | 0.92\% | 0.41\% | 0.44\% | 0.66\% | 0.38\% | 0.54\% | -0.31\% | 0.69\% | 0.25\% | 0.23\% | 0.42\% | 0.45\% | 0.30\% | 0.36\% | 0.38\% | -0.01\% |
|  |  | 2.2612 | 1.0264 | 1.0956 | 1.4444 | 0.9650 | 1.1737 | -0.5976 | 1.5003 | 0.5401 | 0.5118 | 0.9672 | 1.1149 | 0.6039 | 0.7870 | 0.8771 | -0.0282 |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.34\% | 0.89\% | 0.62\% | 0.65\% | 1.65\% | 1.12\% | 0.92\% | 0.77\% | 1.20\% | 0.96\% | 0.77\% | 0.64\% | 1.42\% | 0.96\% | 0.87\% | 0.70\% |
|  |  | 2.5854 | 2.8608 | 2.5558 | 3.0698 | 2.4689 | 2.4639 | 2.7487 | 2.7385 | 2.0533 | 2.4760 | 2.3334 | 2.1901 | 2.5657 | 2.4074 | 2.5950 | 2.3416 |
| CAR (1) |  | 0.89\% | 0.56\% | 0.50\% | 0.52\% | 0.99\% | 0.78\% | 0.73\% | 0.55\% | 0.86\% | 0.77\% | 0.62\% | 0.50\% | 0.87\% | 0.73\% | 0.65\% | 0.54\% |
|  |  | 2.2155 | 2.1521 | 2.3803 | 2.7109 | 1.7883 | 2.0625 | 2.4739 | 2.2413 | 1.8514 | 2.2672 | 2.0456 | 1.8791 | 1.8917 | 1.9968 | 2.0740 | 1.8544 |
| BHAR (0) |  | 1.59\% | 0.83\% | 0.92\% | 0.01\% | 1.63\% | 1.10\% | 1.28\% | 0.71\% | 1.17\% | 0.79\% | 0.48\% | 0.41\% | 1.49\% | 1.39\% | 0.90\% | 0.53\% |
|  |  | 2.6013 | 1.7363 | 1.3751 | 0.0103 | 3.5060 | 2.2903 | 3.2960 | 1.5636 | 1.8289 | 1.5142 | 1.0754 | 1.2214 | 2.6418 | 2.6412 | 2.5011 | 1.5435 |
| BHAR (1) |  | 1.14\% | 0.23\% | 0.50\% | 0.00\% | 1.14\% | 0.66\% | 0.91\% | 0.19\% | 0.67\% | 0.62\% | 0.36\% | 0.14\% | 0.90\% | 0.75\% | 0.55\% | 0.36\% |
|  |  | 2.2577 | 0.5142 | 0.9635 | -0.0048 | 2.6446 | 1.5021 | 2.3009 | 0.5172 | 1.3208 | 1.1208 | 0.7954 | 0.3909 | 1.9293 | 1.6936 | 1.5945 | 0.9568 |


| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.19\% | 0.22\% | 0.29\% | 0.39\% | 0.32\% | 0.51\% | 0.72\% | 0.63\% | 0.40\% | 0.64\% | 0.66\% | 0.59\% | 0.61\% | 0.75\% | 0.65\% | 0.50\% |
|  |  | -0.5469 | 0.9792 | 1.5855 | 2.3392 | 0.9022 | 1.7459 | 2.6119 | 2.4035 | 1.0375 | 1.9700 | 2.2739 | 2.2095 | 1.7207 | 2.2361 | 2.0508 | 1.5534 |
| CAR (1) |  | 0.01\% | 0.27\% | 0.44\% | 0.37\% | 0.54\% | 0.75\% | 0.81\% | 0.64\% | 0.76\% | 0.75\% | 0.72\% | 0.56\% | 0.80\% | 0.65\% | 0.62\% | 0.42\% |
|  |  | 0.0246 | 1.2878 | 2.4337 | 2.1735 | 1.5405 | 2.4110 | 2.8648 | 2.4509 | 2.0325 | 2.4066 | 2.4946 | 2.0776 | 2.1267 | 1.8797 | 1.8165 | 1.2888 |
| BHAR (0) |  | -0.53\% | -0.26\% | 0.26\% | 0.83\% | 0.30\% | 0.16\% | 1.13\% | 0.68\% | 0.55\% | 0.93\% | 0.78\% | 1.26\% | 0.82\% | 0.94\% | 0.83\% | 0.44\% |
|  |  | -1.1503 | -0.5510 | 0.6169 | 1.8341 | 0.6977 | 0.3439 | 2.7506 | 1.9842 | 1.1886 | 2.1057 | 2.2376 | 3.1833 | 1.9958 | 2.0718 | 1.8651 | 0.9588 |
| BHAR (1) |  | -0.15\% | 0.21\% | 0.40\% | 0.86\% | 0.75\% | 0.29\% | 1.41\% | 0.62\% | 0.96\% | 1.18\% | 0.78\% | 1.22\% | 1.25\% | 0.66\% | 0.95\% | 0.57\% |
|  |  | -0.3206 | 0.4562 | 1.0910 | 1.8442 | 1.7316 | 0.6276 | 3.6819 | 1.6692 | 1.9222 | 2.9218 | 2.2595 | 3.0196 | 2.9083 | 1.4103 | 2.2744 | 1.2896 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.00\% | 0.73\% | 0.84\% | 0.81\% | 0.12\% | 0.35\% | 0.67\% | 0.51\% | 0.04\% | 0.48\% | 0.57\% | 0.43\% | 0.25\% | 0.43\% | 0.49\% | 0.47\% |
|  |  | 2.1904 | 2.0984 | 2.9513 | 3.1096 | 0.2074 | 0.8000 | 1.7966 | 1.5293 | 0.0779 | 1.0958 | 1.5052 | 1.1904 | 0.4338 | 0.9004 | 1.1685 | 1.1700 |
| CAR (1) |  | 1.06\% | 0.85\% | 0.98\% | $\mathbf{0 . 8 1 \%}$ | 0.47\% | 0.72\% | 0.73\% | 0.57\% | 0.49\% | 0.70\% | 0.61\% | 0.48\% | 0.45\% | 0.57\% | 0.61\% | 0.54\% |
|  |  | 2.5263 | 2.6691 | 3.4205 | 3.1250 | 0.9120 | 1.6765 | 2.0030 | 1.6972 | 0.9908 | 1.6765 | 1.6666 | 1.3696 | 0.8136 | 1.2309 | 1.4640 | 1.3447 |
| BHAR (0) |  | 0.81\% | -0.01\% | 0.80\% | 1.00\% | 0.16\% | 1.17\% | 1.11\% | 1.37\% | 0.23\% | 0.55\% | 1.18\% | 0.65\% | 0.72\% | 0.98\% | 0.63\% | 0.84\% |
|  |  | 1.4172 | -0.0263 | 1.8398 | 1.8739 | 0.2924 | 2.0394 | 2.2869 | 2.6041 | 0.3802 | 0.9602 | 2.0021 | 1.4048 | 1.3180 | 1.7635 | 1.0731 | 1.5576 |
| BHAR (1) |  | 1.18\% | 0.15\% | 0.65\% | 1.05\% | 0.74\% | 2.01\% | 1.34\% | 1.53\% | 0.62\% | 0.46\% | $0.66 \%$ | 0.45\% | $0.72 \%$ | $0.85 \%$ | 0.53\% | 0.97\% |
|  |  | 2.2063 | 0.3139 | 1.5322 | 2.0144 | 1.3461 | 3.3998 | 2.7688 | 2.5731 | 1.1412 | 0.8357 | $1.1062$ | 1.1037 | $1.1587$ | $1.4924$ | 0.8768 | $1.7724$ |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.60\% | 0.66\% | 0.53\% | 0.49\% | 0.99\% | 0.66\% | 0.53\% | 0.51\% | 0.65\% | 0.60\% | 0.52\% | 0.52\% | 0.80\% | 0.73\% | 0.66\% | 0.52\% |
|  |  | 1.8407 | 3.1056 | 2.7124 | 2.5769 | 2.9767 | 2.1262 | 1.7290 | 1.8269 | 1.7510 | 1.6558 | 1.4438 | 1.6620 | 1.8965 | 1.8111 | 1.7942 | 1.6301 |
| CAR (1) |  | 0.52\% | 0.65\% | 0.51\% | 0.41\% | 0.95\% | 0.58\% | 0.51\% | 0.45\% | 0.74\% | 0.62\% | 0.51\% | 0.48\% | 0.95\% | 0.76\% | 0.61\% | 0.52\% |
|  |  | 1.5551 | 2.9647 | 2.4526 | 2.0337 | 2.7876 | 1.6696 | 1.6028 | 1.6305 | 1.9286 | 1.6505 | 1.3980 | 1.6040 | 2.0964 | 1.8243 | 1.6408 | 1.6863 |
| BHAR (0) |  | 0.55\% | 0.55\% | 0.91\% | 0.10\% | 1.24\% | 0.62\% | 0.58\% | 0.13\% | 0.88\% | 1.00\% | 0.59\% | 0.94\% | 0.92\% | 1.11\% | 0.80\% | 1.19\% |
|  |  | 1.3110 | 1.4039 | 2.9037 | 0.2541 | 3.4469 | 1.5738 | 1.0694 | 0.2723 | 2.0551 | 2.2170 | 1.3390 | 2.3195 | 1.8454 | 2.9015 | 2.1959 | 2.9336 |
| BHAR (1) |  | 0.51\% | 0.04\% | 1.03\% | $\mathbf{0 . 0 1 \%}$ | 0.62\% | 0.45\% | 0.28\% | 0.34\% | 0.70\% | 0.87\% | 0.75\% | $\mathbf{0 . 7 9 \%}$ | 0.97\% | 1.01\% | 0.41\% | 0.90\% |
|  |  | 1.2880 | 0.0963 | 3.1166 | 0.0196 | 1.5808 | 1.0194 | 0.4988 | 0.7558 | 1.5917 | 1.8638 | 1.5698 | 1.8859 | 1.8783 | 2.3434 | 1.0111 | 2.1396 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.13\% | -0.12\% | 0.12\% | 0.24\% | -0.09\% | 0.12\% | 0.41\% | 0.40\% | 0.20\% | 0.33\% | 0.47\% | 0.35\% | 0.61\% | 0.43\% | 0.36\% | 0.34\% |
|  |  | -0.4485 | -0.4681 | 0.5270 | 1.3223 | -0.2282 | 0.3156 | 1.3140 | 1.4569 | 0.3996 | 0.7449 | 1.2409 | 0.9738 | 1.2043 | 0.9789 | 0.8519 | 0.8679 |
| CAR (1) |  | -0.16\% | 0.03\% | 0.20\% | 0.26\% | -0.10\% | 0.33\% | 0.53\% | 0.36\% | 0.33\% | 0.46\% | 0.44\% | 0.32\% | 0.50\% | 0.31\% | 0.33\% | 0.40\% |
|  |  | -0.4775 | 0.0957 | 0.8458 | 1.4260 | $-0.2482$ | 0.9118 | 1.7347 | 1.3227 | 0.6611 | 1.1167 | 1.1734 | 0.9249 | 1.0742 | 0.7067 | 0.7769 | 1.0210 |
| BHAR (0) |  | -0.18\% | -0.44\% | 0.05\% | -0.39\% | 0.07\% | -0.18\% | 0.37\% | 0.21\% | -0.18\% | 0.09\% | 0.83\% | $\mathbf{0 . 6 1 \%}$ | 0.28\% | 0.78\% | 0.78\% | 0.86\% |
|  |  | -0.4135 | -0.9077 | 0.1123 | -0.8038 | 0.1466 | $-0.3401$ | 0.6689 | 0.4230 | $-0.3393$ | 0.1453 | 1.5908 | 1.2907 | 0.5141 | 1.5336 | 1.7563 | 1.8929 |
| BHAR (1) |  | 0.05\% | -0.04\% | 0.10\% | -0.28\% | 0.22\% | 0.46\% | 0.26\% | 0.24\% | 0.39\% | 0.76\% | 0.98\% | 0.72\% | 0.68\% | 0.80\% | 0.88\% | 0.83\% |
|  |  | 0.1140 | -0.0902 | 0.2433 | -0.5441 | 0.4804 | 1.0305 | 0.4802 | 0.4938 | 0.7184 | 1.2214 | 1.9883 | 1.4625 | 1.3882 | 1.5343 | 2.0462 | 1.9547 |


| MW | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.53\% | 0.70\% | 0.53\% | 0.49\% | 0.83\% | 0.64\% | 0.68\% | 0.62\% | 0.91\% | 0.76\% | 0.66\% | 0.55\% | 0.53\% | 0.64\% | 0.51\% | 0.39\% |
|  |  | 1.1643 | 1.9460 | 1.6371 | 1.6576 | 1.7862 | 1.5173 | 1.6947 | 1.5310 | 1.6941 | 1.4544 | 1.2939 | 1.0987 | 0.9466 | 1.1411 | 0.9163 | 0.7274 |
| CAR (1) |  | 0.69\% | 0.63\% | 0.54\% | 0.46\% | 0.81\% | 0.67\% | 0.69\% | 0.57\% | 0.95\% | 0.77\% | 0.59\% | 0.53\% | 0.62\% | 0.55\% | $\mathbf{0 . 4 1 \%}$ | 0.35\% |
|  |  | 1.5387 | 1.8783 | 1.7853 | 1.5955 | 1.7526 | 1.5672 | 1.6790 | 1.3229 | 1.7958 | 1.4671 | 1.1656 | 1.0394 | 1.1003 | 0.9734 | 0.7371 | 0.6519 |
| BHAR (0) |  | 0.40\% | $\mathbf{0 . 6 1 \%}$ | 0.17\% | -0.05\% | 1.01\% | 0.88\% | 1.09\% | 0.44\% | 0.92\% | 0.48\% | 0.30\% | -0.02\% | 0.67\% | 0.74\% | 0.69\% | 0.54\% |
|  |  | 0.7025 | 1.0772 | 0.3251 | -0.0737 | 1.9996 | 1.7333 | 1.8062 | 0.7550 | 1.5813 | 0.7415 | 0.5148 | -0.0261 | 1.1842 | 1.3101 | 1.1171 | 0.8708 |
| BHAR (1) |  | 0.67\% | 0.32\% | 0.19\% | -0.11\% | 1.15\% | 0.50\% | 0.88\% | 0.24\% | 0.96\% | 0.63\% | 0.35\% | -0.02\% | 1.03\% | 0.77\% | 0.73\% | 0.95\% |
|  |  | 1.1528 | 0.5753 | 0.3621 | -0.1695 | 2.2135 | 0.8785 | 1.4554 | 0.3826 | 1.6591 | 0.9237 | 0.5645 | -0.0290 | 1.7357 | 1.2605 | 1.1519 | 1.4292 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.11\% | 0.35\% | 0.35\% | 0.39\% | 0.72\% | 0.68\% | 0.62\% | 0.49\% | 0.52\% | 0.69\% | 0.51\% | 0.37\% | 0.80\% | 0.75\% | 0.52\% | 0.33\% |
|  |  | 0.4942 | 2.1617 | 2.3408 | 2.9798 | 3.0924 | 2.9705 | 2.9819 | 2.6351 | 1.8999 | 2.7720 | 2.2353 | 1.6891 | 3.2456 | 3.0685 | 2.2399 | 1.5378 |
| CAR (1) |  | 0.40\% | 0.48\% | 0.48\% | 0.39\% | 0.80\% | 0.70\% | 0.61\% | 0.43\% | 0.72\% | 0.67\% | 0.51\% | 0.27\% | 0.82\% | 0.68\% | 0.43\% | 0.24\% |
|  |  | 1.9190 | 2.7884 | 3.0181 | 2.9818 | 3.0924 | 3.0070 | 3.0085 | 2.3157 | 2.5678 | 2.7314 | 2.2689 | 1.3095 | 3.2564 | 2.7035 | 1.8648 | 1.1013 |
| BHAR (0) |  | 0.14\% | 0.37\% | 0.04\% | 0.43\% | 0.62\% | 0.57\% | 0.51\% | 0.68\% | 0.46\% | 0.64\% | 0.32\% | 0.39\% | 0.81\% | 1.03\% | 0.27\% | 0.56\% |
|  |  | 0.5086 | 1.2524 | 0.1333 | 1.4215 | 2.3300 | 1.8647 | 1.7801 | 2.3599 | 1.5774 | 1.9407 | 1.1228 | 1.2935 | 2.7528 | 3.3034 | 0.8250 | 1.8923 |
| BHAR (1) |  | 0.34\% | 0.45\% | 0.12\% | 0.49\% | 0.70\% | 0.54\% | 0.54\% | 0.62\% | 0.66\% | $0.79 \%$ | $0.29 \%$ | 0.30\% | $0.76 \%$ | $0.86 \%$ | 0.24\% | 0.33\% |
|  |  | 1.3095 | 1.5064 | 0.4255 | 1.6204 | 2.7067 | 1.8632 | 1.7418 | 2.1333 | 2.0934 | $2.1605$ | $1.0159$ | 1.0161 | $2.6949$ | $2.9433$ | 0.7673 | $1.1838$ |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.08\% | 0.22\% | 0.30\% | 0.53\% | 0.40\% | 0.49\% | 0.65\% | 0.65\% | 0.34\% | 0.61\% | 0.64\% | 0.51\% | 0.64\% | 0.68\% | 0.49\% | 0.40\% |
|  |  | -0.2862 | 1.0083 | 1.5188 | 3.1102 | 1.2599 | 1.6665 | 2.4710 | 2.5948 | 0.9832 | 1.9565 | 2.1319 | 1.7720 | 1.8535 | 2.0712 | 1.5400 | 1.2918 |
| CAR (1) |  | 0.10\% | 0.32\% | 0.47\% | 0.56\% | 0.53\% | 0.63\% | 0.75\% | 0.62\% | 0.53\% | 0.76\% | 0.65\% | 0.48\% | 0.75\% | 0.63\% | 0.46\% | 0.32\% |
|  |  | 0.3893 | 1.5311 | 2.3894 | 3.4159 | 1.6732 | 2.1374 | 2.8364 | 2.4996 | 1.5719 | 2.4158 | 2.1630 | 1.6658 | 2.2212 | 1.9164 | 1.4391 | 1.0379 |
| BHAR (0) |  | $-0.28 \%$ | 0.26\% | 0.16\% | $\mathbf{0 . 0 2 \%}$ | 0.44\% | $0.58 \%$ | 0.72\% | 0.70\% | $0.34 \%$ | 0.55\% | 0.54\% | 0.59\% | 0.52\% | 0.54\% | 0.45\% | 0.55\% |
|  |  | $-0.8788$ | 0.8840 | 0.4989 | 0.0687 | 1.2551 | 1.6600 | 1.9220 | 2.0766 | 0.9204 | 1.5573 | 1.5728 | 1.6392 | 1.3950 | 1.4517 | 1.2277 | 1.5476 |
| BHAR (1) |  | 0.17\% | 0.17\% | 0.29\% | $\mathbf{0 . 3 1 \%}$ | 0.65\% | 0.58\% | 0.77\% | 0.48\% | 0.47\% | 0.72\% | 0.54\% | 0.55\% | 0.79\% | 0.43\% | 0.34\% | 0.39\% |
|  |  | 0.5902 | 0.6064 | 0.9217 | 0.8849 | 2.0217 | 1.8003 | 2.2034 | 1.3718 | 1.3583 | 2.0678 | 1.5782 | 1.4625 | 2.1131 | 1.2114 | 0.9007 | 1.1301 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.13\% | 0.17\% | 0.29\% | 0.31\% | 0.22\% | 0.40\% | 0.44\% | 0.40\% | 0.55\% | 0.57\% | 0.52\% | 0.43\% | 0.56\% | 0.49\% | 0.40\% | 0.33\% |
|  |  | -0.6629 | 1.0210 | 1.9478 | 2.1024 | 0.9011 | 1.7451 | 2.0455 | 1.8950 | 2.0293 | 2.1651 | 1.9944 | 1.6951 | 1.8875 | 1.6678 | 1.3968 | 1.2052 |
| CAR (1) |  | 0.10\% | 0.31\% | 0.38\% | 0.32\% | 0.44\% | 0.50\% | 0.50\% | 0.39\% | 0.68\% | 0.62\% | 0.52\% | 0.39\% | 0.58\% | 0.48\% | 0.38\% | 0.30\% |
|  |  | 0.4685 | 1.8860 | 2.5134 | 2.2310 | 1.7348 | 2.1533 | 2.2483 | 1.8286 | 2.4255 | 2.2935 | 1.9763 | 1.5551 | 1.9784 | 1.6364 | 1.3287 | 1.0774 |
| BHAR (0) |  | -0.29\% | 0.34\% | -0.12\% | 0.25\% | 0.15\% | 0.17\% | 0.27\% | 0.42\% | 0.55\% | 0.73\% | 0.58\% | 0.49\% | 0.59\% | 0.42\% | 0.36\% | 0.39\% |
|  |  | -1.1829 | 1.4167 | -0.4238 | 0.9394 | 0.5265 | 0.6309 | 0.8524 | 1.9007 | 1.9469 | 2.5172 | 2.1009 | 1.7538 | 1.9130 | 1.3327 | 1.2245 | 1.2400 |
| BHAR (1) |  | 0.02\% | 0.15\% | -0.06\% | 0.20\% | 0.30\% | 0.26\% | 0.25\% | 0.26\% | 0.77\% | 0.70\% | 0.48\% | 0.32\% | 0.52\% | 0.32\% | 0.25\% | 0.25\% |
|  |  | 0.1002 | 0.5771 | -0.2023 | 0.7078 | 1.0908 | 1.0710 | 0.7633 | 1.1926 | 2.6923 | 2.1204 | 1.6205 | 1.0576 | 1.5850 | 1.0123 | 0.8273 | 0.7794 |

Panel C. The time-series momentum strategy using inversed volatility-weighted return


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.94\% | 1.02\% | 0.90\% | 0.88\% | 1.31\% | 1.18\% | 1.18\% | 1.07\% | 1.40\% | 1.34\% | 1.24\% | 1.06\% | 1.51\% | 1.38\% | 1.18\% | 1.02\% |
|  |  | 6.8946 | 7.8668 | 7.2000 | 7.3723 | 6.7980 | 6.6318 | 6.9088 | 6.1620 | 5.8888 | 6.1060 | 5.5554 | 4.9227 | 6.8021 | 5.9600 | 5.3223 | 4.7086 |
| CAR (1) |  | 0.98\% | 0.99\% | 0.88\% | $\mathbf{0 . 8 2 \%}$ | 1.25\% | 1.10\% | 1.11\% | 0.95\% | 1.40\% | 1.31\% | 1.15\% | 0.95\% | 1.49\% | 1.25\% | 1.08\% | 0.89\% |
|  |  | 6.6853 | 7.2700 | 6.7971 | 6.5551 | 5.9289 | 5.9652 | 5.8855 | 5.3752 | 6.0373 | 5.8981 | 5.0640 | 4.4687 | 6.3921 | 5.3018 | 4.7614 | 4.1239 |
| BHAR (0) |  | 1.08\% | 1.20\% | 0.76\% | 0.74\% | 1.24\% | 0.92\% | 1.11\% | 1.24\% | 1.37\% | 1.27\% | 1.02\% | 1.15\% | 1.19\% | 1.22\% | 1.00\% | 0.87\% |
|  |  | 6.7972 | 6.5978 | 3.8491 | 2.9154 | 6.0223 | 3.5625 | 4.8644 | 6.0303 | 5.8781 | 5.0051 | 3.9349 | 5.1304 | 4.1335 | 4.1761 | 3.5694 | 3.3268 |
| BHAR (1) |  | 1.07\% | 1.24\% | 0.81\% | 0.84\% | 1.15\% | 1.18\% | 0.95\% | 1.11\% | 1.46\% | 1.57\% | 1.02\% | 1.03\% | 1.54\% | 1.31\% | 1.00\% | 0.78\% |
|  |  | 5.7941 | 5.9390 | 3.4987 | 3.3170 | 4.5501 | 5.2146 | 4.0743 | 5.3003 | 6.0376 | 5.6005 | 4.1629 | 4.4874 | 5.9475 | 4.9187 | 3.6309 | 3.1150 |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.64\% | 0.51\% | 0.53\% | 0.49\% | 0.96\% | 0.78\% | 0.84\% | 0.74\% | 0.97\% | 0.84\% | 0.69\% | 0.57\% | 1.23\% | 0.96\% | 0.82\% | 0.72\% |
|  |  | 2.4040 | 2.2455 | 2.5749 | 2.4656 | 3.1471 | 2.5295 | 2.8475 | 2.6523 | 2.8157 | 2.4738 | 2.0454 | 1.7878 | 2.7538 | 2.2199 | 1.9340 | 1.8130 |
| CAR (1) |  | 0.77\% | 0.63\% | 0.55\% | 0.49\% | 1.00\% | 0.87\% | 0.82\% | 0.68\% | 1.10\% | 0.80\% | 0.68\% | 0.53\% | 1.05\% | 0.81\% | 0.71\% | 0.60\% |
|  |  | 3.0463 | 2.8946 | 2.7502 | 2.4738 | 3.3983 | 2.8542 | 2.7710 | 2.4794 | 3.1815 | 2.1941 | 1.9451 | 1.6314 | 2.2172 | 1.8276 | 1.6552 | 1.5203 |
| BHAR (0) |  | 0.80\% | 0.42\% | 0.31\% | 0.75\% | 1.33\% | 1.08\% | 0.45\% | 0.88\% | 0.87\% | 0.41\% | 0.66\% | 0.28\% | 1.49\% | 1.26\% | 0.88\% | 1.11\% |
|  |  | 2.6560 | 1.1869 | 1.0662 | 1.8067 | 3.7376 | 3.0838 | 0.9474 | 2.1387 | 2.0072 | 0.7472 | 1.4287 | 0.6451 | 3.0555 | 2.7536 | 1.7257 | 2.7266 |
| BHAR (1) |  | 1.01\% | 0.49\% | 0.40\% | 0.76\% | 0.99\% | 1.01\% | 0.20\% | 0.71\% | $\mathbf{0 . 8 8 \%}$ | 0.37\% | 0.45\% | 0.26\% | 1.22\% | 1.20\% | 0.76\% | 1.14\% |
|  |  | 3.5253 | 1.4033 | 1.3977 | 1.9454 | 2.8959 | 2.4629 | 0.4478 | 1.7809 | 1.7706 | 0.6909 | 0.9644 | 0.5630 | 2.5261 | 2.4057 | 1.5344 | 2.9078 |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.29\% | 0.43\% | 0.35\% | 0.43\% | 0.62\% | 0.55\% | 0.57\% | 0.57\% | 0.73\% | 0.78\% | 0.77\% | 0.61\% | 0.97\% | 0.99\% | 0.77\% | 0.62\% |
|  |  | 1.5184 | 2.8561 | 2.6047 | 3.9144 | 3.7969 | 3.4717 | 4.0754 | 4.2348 | 3.8817 | 4.6127 | 4.6414 | 3.9538 | 5.1093 | 5.3319 | 4.4410 | 3.7593 |
| CAR (1) |  | 0.60\% | 0.46\% | 0.35\% | 0.37\% | 0.77\% | 0.60\% | 0.66\% | 0.55\% | 1.00\% | 0.91\% | 0.79\% | 0.57\% | 1.14\% | 0.96\% | 0.71\% | 0.57\% |
|  |  | 3.2659 | 2.7614 | 2.4137 | 2.9072 | 4.6168 | 3.6649 | 4.4620 | 3.6899 | 5.5213 | 5.3277 | 4.4622 | 3.6126 | 6.2314 | 4.7689 | 3.8672 | 3.2561 |
| BHAR (0) |  | 0.41\% | -0.11\% | 0.38\% | -0.45\% | 0.56\% | 0.24\% | 0.36\% | 0.17\% | 0.68\% | 0.62\% | 0.98\% | 0.95\% | 0.85\% | 1.09\% | 0.74\% | 0.81\% |
|  |  | 1.4501 | -0.3814 | 1.2801 | -1.2880 | 2.8078 | 0.9143 | 1.4671 | 0.4199 | 3.7190 | 2.9228 | 3.8355 | 3.2594 | 4.3392 | 3.6100 | 2.2451 | 2.7944 |
| BHAR (1) |  | 0.55\% | 0.21\% | 0.46\% | -0.05\% | 0.73\% | 0.53\% | 0.58\% | 0.78\% | 0.91\% | 0.95\% | 0.86\% | 0.76\% | 1.35\% | 1.02\% | 0.66\% | 0.71\% |
|  |  | 2.1879 | 0.5644 | 1.3308 | -0.1316 | 3.9512 | 2.7407 | 2.2387 | 3.1188 | 4.7141 | 3.7960 | 3.3247 | 2.5816 | 5.5845 | 3.1826 | 1.8531 | 2.1458 |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.80\% | 0.66\% | 0.62\% | 0.58\% | 1.07\% | 1.00\% | 1.04\% | 0.92\% | 1.21\% | 1.20\% | 1.10\% | 0.96\% | 1.44\% | 1.24\% | 1.08\% | 0.94\% |
|  |  | 4.9427 | 4.1936 | 4.6687 | 4.7104 | 4.9125 | 5.1331 | 5.8492 | 5.2589 | 5.5017 | 5.5032 | 5.0576 | 4.7317 | 6.1749 | 5.3844 | 4.8563 | 4.3755 |
| CAR (1) |  | 0.94\% | 0.71\% | 0.69\% | 0.59\% | 1.14\% | 1.02\% | 1.02\% | 0.85\% | 1.29\% | 1.20\% | 1.03\% | 0.89\% | 1.46\% | 1.18\% | 1.00\% | 0.86\% |
|  |  | 5.7252 | 4.3387 | 5.1448 | 4.6275 | 5.4468 | 5.4440 | 5.7965 | 4.9929 | 5.9736 | 5.4479 | 4.7676 | 4.4527 | 6.4665 | 5.2213 | 4.5995 | 4.0465 |
| BHAR (0) |  | 0.77\% | 0.51\% | 0.80\% | -0.26\% | 0.96\% | 1.02\% | 0.96\% | 1.11\% | 1.21\% | 1.35\% | 1.00\% | 1.03\% | 1.41\% | 1.18\% | 1.02\% | 0.88\% |
|  |  | 3.9018 | 2.1789 | 3.9152 | -0.6481 | 3.8935 | 4.7430 | 3.7109 | 4.6819 | 4.9786 | 5.8043 | 4.3378 | 4.2071 | 5.8658 | 4.9150 | 4.2057 | 3.8907 |
| BHAR (1) |  | 1.10\% | 0.80\% | 1.21\% | 0.68\% | 0.96\% | 1.06\% | 0.89\% | 1.09\% | 1.37\% | 1.21\% | 0.86\% | 0.85\% | 1.40\% | 1.11\% | 0.85\% | 0.76\% |
|  |  | 5.6540 | 3.5015 | 4.9756 | 3.0698 | 4.0904 | 5.2802 | 3.4886 | 4.5437 | 6.4803 | 5.3006 | 3.6004 | 3.6130 | 5.9771 | 5.0172 | 3.6653 | 3.4284 |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.75\% | 0.67\% | 0.39\% | 0.23\% | 1.08\% | 0.77\% | 0.45\% | 0.14\% | 0.70\% | 0.52\% | 0.13\% | -0.22\% | 0.84\% | 0.54\% | 0.12\% | -0.25\% |
|  |  | 1.4997 | 2.0403 | 1.4704 | 1.0046 | 1.8789 | 1.5892 | 1.1527 | 0.4057 | 1.2693 | 1.1375 | 0.3172 | -0.5562 | 1.4213 | 1.0484 | 0.2410 | -0.5207 |
| CAR (1) |  | 0.78\% | 0.58\% | 0.31\% | 0.14\% | 0.91\% | 0.63\% | 0.30\% | 0.01\% | 0.72\% | 0.36\% | -0.07\% | -0.40\% | 0.99\% | 0.44\% | -0.10\% | -0.38\% |
|  |  | 1.8414 | 1.9923 | 1.2730 | 0.6101 | 1.7177 | 1.4641 | 0.8193 | 0.0206 | 1.3326 | 0.8199 | -0.1768 | -0.9655 | 1.8166 | 0.8689 | -0.2081 | -0.7770 |
| BHAR (0) |  | 0.75\% | 1.04\% | 0.59\% | 0.13\% | 1.51\% | 0.85\% | 0.32\% | 0.08\% | 1.00\% | 1.06\% | -0.14\% | 0.08\% | 1.06\% | 0.27\% | 0.47\% | -0.59\% |
|  |  | 1.2099 | 2.5467 | 1.1169 | 0.2912 | 2.6178 | 1.5076 | 0.5735 | 0.1522 | 1.7008 | 1.7385 | -0.2681 | 0.1946 | 1.6918 | 0.4525 | 0.7791 | -1.0905 |
| BHAR (1) |  | 1.13\% | 1.09\% | 0.64\% | 0.36\% | 1.24\% | 0.89\% | 0.49\% | -0.07\% | 1.08\% | 1.11\% | -0.05\% | -0.13\% | 1.41\% | 0.13\% | 0.41\% | -0.22\% |
|  |  | 2.0124 | 2.6811 | 1.2300 | 0.7944 | 1.9933 | 1.8476 | 0.8990 | -0.1508 | 1.6866 | 1.7190 | -0.1086 | -0.2812 | 2.1731 | 0.2310 | 0.7029 | -0.4282 |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.72\% | 0.63\% | 0.44\% | 0.30\% | 1.17\% | 0.78\% | 0.53\% | 0.32\% | 0.86\% | 0.61\% | 0.37\% | 0.20\% | 0.88\% | 0.53\% | 0.29\% | 0.13\% |
|  |  | 3.6237 | 3.4888 | 2.7378 | 2.1487 | 4.0424 | 2.7480 | 2.2595 | 1.5350 | 2.7724 | 2.1205 | 1.4441 | 0.8606 | 2.8857 | 1.8982 | 1.1457 | 0.5245 |
| CAR (1) |  | 0.64\% | 0.65\% | 0.42\% | 0.19\% | 1.04\% | 0.64\% | 0.35\% | 0.17\% | 0.71\% | 0.44\% | 0.22\% | 0.08\% | 0.66\% | 0.39\% | 0.17\% | 0.03\% |
|  |  | 3.0816 | 3.6471 | 2.5746 | 1.3762 | 3.4457 | 2.3379 | 1.4904 | 0.7923 | 2.2505 | 1.6109 | 0.8484 | 0.3317 | 2.3922 | 1.4758 | 0.6979 | 0.1114 |
| BHAR (0) |  | 0.38\% | 0.22\% | -0.02\% | 0.44\% | 1.06\% | 0.60\% | 0.50\% | 0.28\% | 0.92\% | 0.56\% | 0.48\% | 0.28\% | 0.70\% | 0.58\% | 0.38\% | 0.55\% |
|  |  | 1.5945 | 0.7208 | -0.0751 | 1.7601 | 3.6369 | 1.9200 | 1.5010 | 1.0511 | 2.5684 | 1.3933 | 1.6160 | 0.8231 | 1.9281 | 2.2582 | 1.2160 | 1.9115 |
| BHAR (1) |  | 0.25\% | 0.18\% | 0.27\% | 0.28\% | 0.87\% | 0.58\% | 0.34\% | 0.09\% | 0.83\% | 0.23\% | 0.46\% | $\mathbf{0 . 2 2 \%}$ | 0.29\% | 0.57\% | 0.19\% | 0.41\% |
|  |  | 0.9396 | 0.6689 | 0.9788 | 1.0989 | 2.6741 | 1.9542 | 1.0362 | 0.3140 | 2.6662 | 0.6347 | 1.6239 | 0.6734 | 0.8323 | 2.2362 | 0.5840 | 1.4790 |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.33\% | 0.46\% | 0.39\% | 0.50\% | 0.73\% | 0.71\% | 0.53\% | 0.46\% | 1.01\% | 0.92\% | 0.61\% | 0.45\% | 0.87\% | 0.60\% | 0.58\% | 0.44\% |
|  |  | 1.0957 | 1.5425 | 1.4951 | 2.4619 | 1.6363 | 1.7951 | 1.5244 | 1.5141 | 2.2196 | 2.0845 | 1.5571 | 1.2877 | 1.7206 | 1.2889 | 1.3597 | 1.1766 |
| CAR (1) |  | 0.32\% | 0.28\% | 0.33\% | 0.41\% | 0.78\% | 0.63\% | 0.42\% | 0.37\% | 1.16\% | 0.78\% | 0.51\% | 0.35\% | 0.69\% | 0.55\% | 0.48\% | 0.31\% |
|  |  | 0.8785 | 0.8059 | 1.2217 | 1.8870 | 1.7688 | 1.6159 | 1.2361 | 1.2588 | 2.6768 | 1.8241 | 1.3528 | 1.0320 | 1.3706 | 1.1953 | 1.1473 | 0.8312 |
| BHAR (0) |  | 0.69\% | 0.06\% | -0.21\% | $\mathbf{0 . 5 2 \%}$ | 0.41\% | 0.70\% | -0.41\% | 1.27\% | 0.82\% | 0.51\% | 0.65\% | 0.46\% | 1.22\% | 0.95\% | 0.65\% | 0.61\% |
|  |  | 1.9239 | 0.1310 | -0.4512 | 1.1673 | 0.7825 | 1.4733 | -0.7739 | 2.5169 | 1.5109 | 0.8154 | 1.2108 | 0.9520 | 2.1983 | 1.7757 | 1.1063 | 1.1636 |
| BHAR (1) |  | 0.19\% | -0.16\% | -0.18\% | 0.22\% | 0.36\% | 0.52\% | -0.50\% | 0.92\% | 0.52\% | 0.91\% | 0.38\% | -0.06\% | 0.98\% | 0.55\% | 0.42\% | 0.36\% |
|  |  | 0.4030 | -0.2917 | -0.3906 | 0.4598 | 0.7604 | 1.0972 | -1.0076 | 1.9391 | 0.9380 | 1.6301 | 0.7300 | -0.1251 | 1.8502 | 1.0811 | 0.7618 | 0.6920 |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.01\% | 0.00\% | -0.09\% | -0.09\% | 0.05\% | 0.06\% | -0.09\% | -0.12\% | 0.27\% | 0.16\% | 0.01\% | -0.10\% | 0.26\% | 0.21\% | 0.09\% | -0.03\% |
|  |  | -0.0808 | -0.0087 | -0.6376 | -0.6955 | 0.2513 | 0.2875 | -0.4812 | -0.6668 | 1.2616 | 0.6867 | 0.0240 | -0.5096 | 1.0481 | 0.8805 | 0.4384 | -0.1512 |
| CAR (1) |  | 0.13\% | 0.06\% | -0.05\% | -0.15\% | 0.28\% | 0.09\% | -0.06\% | -0.13\% | 0.36\% | 0.09\% | -0.12\% | -0.18\% | 0.32\% | 0.20\% | 0.06\% | -0.06\% |
|  |  | 0.7378 | 0.3511 | -0.3144 | -1.0123 | 1.2955 | 0.4358 | -0.2987 | -0.7311 | 1.6476 | 0.3640 | -0.5002 | -0.8733 | 1.2711 | 0.8457 | 0.2838 | -0.2917 |
| BHAR (0) |  | 0.10\% | -0.30\% | -0.17\% | -0.18\% | 0.12\% | 0.02\% | -0.10\% | 0.12\% | 0.35\% | 0.32\% | 0.27\% | 0.39\% | 0.46\% | 0.14\% | 0.03\% | 0.00\% |
|  |  | 0.4147 | -0.8583 | -0.6323 | -0.5028 | 0.4397 | 0.0892 | -0.4014 | 0.3877 | 1.5319 | 1.3326 | 1.2138 | 1.6876 | 1.8912 | 0.5279 | 0.0956 | 0.0181 |
| BHAR (1) |  | 0.23\% | -0.16\% | -0.25\% | -0.51\% | 0.43\% | 0.29\% | -0.08\% | 0.19\% | 0.47\% | 0.18\% | 0.09\% | 0.28\% | 0.58\% | 0.24\% | -0.11\% | -0.19\% |
|  |  | 1.0332 | -0.6129 | -0.7811 | -1.4885 | 1.7554 | 0.9743 | -0.3712 | 0.6809 | 1.8479 | 0.7098 | 0.3429 | 1.0774 | 2.3311 | 0.8689 | -0.3525 | -0.5839 |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.93\% | 0.75\% | 0.76\% | 0.76\% | 1.10\% | 1.12\% | 1.04\% | 0.95\% | 1.33\% | 1.33\% | 1.16\% | 0.97\% | 1.54\% | 1.29\% | 1.09\% | 0.94\% |
|  |  | 5.2689 | 4.3772 | 5.5209 | 5.9580 | 4.6429 | 5.5652 | 5.3890 | 5.3807 | 5.5176 | 6.2610 | 5.9365 | 5.2323 | 6.1555 | 5.8520 | 5.2707 | 4.8377 |
| CAR (1) |  | 0.73\% | 0.65\% | 0.69\% | 0.66\% | 1.14\% | 1.11\% | 1.06\% | 0.89\% | 1.29\% | 1.22\% | 1.05\% | 0.86\% | 1.45\% | 1.12\% | 0.94\% | 0.84\% |
|  |  | 3.7579 | 3.8423 | 4.9201 | 5.2327 | 5.1345 | 5.8134 | 5.9562 | 5.3667 | 5.1709 | 5.8628 | 5.3464 | 4.6607 | 6.5187 | 5.1428 | 4.6359 | 4.3988 |
| BHAR (0) |  | 0.91\% | 0.77\% | 0.76\% | 0.76\% | 1.00\% | 1.04\% | 0.85\% | 0.92\% | 1.28\% | 1.27\% | 1.42\% | 1.00\% | 1.48\% | 0.96\% | 0.98\% | 0.60\% |
|  |  | 4.3106 | 3.6484 | 3.2504 | 3.5142 | 3.6273 | 3.4467 | 3.6970 | 3.5931 | 4.7752 | 4.9052 | 5.8708 | 4.7856 | 5.4109 | 3.8417 | 3.8219 | 2.3889 |
| BHAR (1) |  | 0.97\% | 0.86\% | 0.93\% | 0.72\% | 1.17\% | 1.06\% | 1.03\% | 0.87\% | 1.36\% | 1.06\% | 1.24\% | 0.83\% | 1.29\% | 1.02\% | 0.92\% | 0.64\% |
|  |  | 5.0482 | 3.8498 | 3.5552 | 3.2323 | 4.8559 | 3.7122 | 4.3227 | 3.9335 | 4.5524 | 4.0691 | 5.7023 | 3.7556 | 4.7166 | 3.8063 | 3.4267 | 2.3944 |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.26\% | 0.11\% | 0.04\% | 0.11\% | 0.22\% | 0.08\% | 0.16\% | 0.10\% | 0.10\% | 0.15\% | 0.10\% | 0.04\% | 0.25\% | 0.11\% | 0.04\% | 0.01\% |
|  |  | 1.5794 | 0.7026 | 0.2877 | 0.9121 | 0.9917 | 0.3839 | 0.8639 | 0.6080 | 0.4561 | 0.6879 | 0.5130 | 0.2215 | 1.0905 | 0.5169 | 0.2207 | 0.0511 |
| CAR (1) |  | 0.21\% | 0.07\% | 0.08\% | 0.06\% | 0.17\% | 0.13\% | 0.18\% | 0.04\% | 0.23\% | 0.19\% | 0.09\% | 0.01\% | 0.23\% | 0.07\% | 0.01\% | -0.02\% |
|  |  | 1.3370 | 0.4445 | 0.6131 | 0.5553 | 0.8056 | 0.6807 | 1.0101 | 0.2821 | 1.0607 | 0.9215 | 0.4916 | 0.0734 | 1.0425 | 0.3379 | 0.0642 | -0.0940 |
| BHAR (0) |  | 0.20\% | 0.19\% | $\mathbf{0 . 2 1 \%}$ | 0.25\% | 0.29\% | 0.20\% | 0.21\% | 0.42\% | 0.16\% | 0.26\% | 0.26\% | 0.08\% | 0.23\% | 0.15\% | 0.14\% | 0.03\% |
|  |  | 1.0010 | 0.9460 | 0.9608 | 1.2013 | 1.2182 | 0.8170 | 0.9062 | 2.0632 | 0.6512 | 1.1225 | 1.1772 | 0.4530 | 1.0076 | 0.6290 | 0.5719 | 0.1513 |
| BHAR (1) |  | 0.08\% | 0.16\% | 0.14\% | 0.30\% | 0.15\% | 0.05\% | 0.23\% | $\mathbf{0 . 2 1 \%}$ | 0.23\% | 0.33\% | 0.21\% | 0.03\% | 0.21\% | 0.04\% | -0.03\% | -0.03\% |
|  |  | 0.4549 | 0.8701 | 0.7026 | 1.6075 | 0.6704 | 0.2307 | 1.0786 | 1.0719 | 1.0249 | 1.5420 | 0.9918 | 0.1955 | 0.8843 | 0.1775 | -0.1428 | -0.1452 |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.86\% | 0.86\% | 0.80\% | 0.76\% | 1.30\% | 1.18\% | 1.10\% | 0.94\% | 1.34\% | 1.25\% | 1.05\% | 0.84\% | 1.48\% | 1.25\% | 1.03\% | 0.91\% |
|  |  | 4.5909 | 5.3114 | 5.9354 | 6.2114 | 5.4718 | 5.5354 | 5.4805 | 4.7673 | 5.0257 | 5.0540 | 4.3523 | 3.4916 | 5.5676 | 4.6932 | 4.0664 | 3.7801 |
| CAR (1) |  | 0.96\% | 0.93\% | 0.80\% | 0.70\% | 1.30\% | 1.17\% | 1.03\% | 0.83\% | 1.18\% | 1.10\% | 0.89\% | 0.74\% | 1.31\% | 1.13\% | 0.90\% | 0.82\% |
|  |  | 5.2633 | 5.8010 | 6.2380 | 5.7870 | 5.2883 | 5.3729 | 5.0202 | 4.0726 | 3.9375 | 4.3597 | 3.4289 | 3.0380 | 4.7072 | 4.1476 | 3.4511 | 3.3734 |
| BHAR (0) |  | 0.98\% | 0.92\% | 1.00\% | 0.85\% | 1.36\% | 1.37\% | 0.71\% | 1.42\% | 1.33\% | 1.44\% | 1.16\% | 0.97\% | 1.45\% | 1.37\% | 1.20\% | 0.76\% |
|  |  | 4.3099 | 4.0661 | 3.4595 | 3.1964 | 4.7295 | 5.3332 | 2.3837 | 5.8263 | 4.4719 | 5.3253 | 4.8927 | 3.8862 | 5.3412 | 4.9378 | 4.0019 | 2.6738 |
| BHAR (1) |  | 1.20\% | 0.98\% | 0.81\% | 0.80\% | 1.26\% | 1.23\% | 0.65\% | 1.26\% | 1.20\% | 0.98\% | 1.18\% | 0.89\% | 1.31\% | 1.10\% | 1.07\% | 0.65\% |
|  |  | 4.7627 | 4.6486 | 2.5232 | 3.2357 | 5.0856 | 4.7263 | 2.3697 | 5.3122 | 4.0235 | 3.3789 | 4.9798 | 3.4860 | 4.4791 | 4.1161 | 3.7122 | 2.3491 |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.58\% | 1.33\% | 0.95\% | 0.89\% | 1.73\% | 1.30\% | 1.09\% | 0.92\% | 1.57\% | 1.29\% | 1.13\% | 0.96\% | 1.87\% | 1.37\% | 1.12\% | 0.97\% |
|  |  | 2.8228 | 3.7006 | 3.5975 | 4.3081 | 4.8056 | 4.9196 | 5.3085 | 5.2935 | 5.5349 | 5.4745 | 5.1023 | 4.8334 | 4.8402 | 4.7889 | 4.6696 | 4.7705 |
| CAR (1) |  | 1.54\% | 1.15\% | 0.88\% | 0.79\% | 1.55\% | 1.14\% | 0.99\% | 0.79\% | 1.36\% | 1.12\% | 0.99\% | 0.82\% | 1.56\% | 1.14\% | 0.94\% | 0.83\% |
|  |  | 2.9901 | 3.5641 | 3.8049 | 4.2252 | 4.6718 | 4.7960 | 5.2270 | 4.8436 | 5.5653 | 5.1731 | 4.7782 | 4.2910 | 4.9165 | 4.5027 | 4.3048 | 4.3415 |
| BHAR (0) |  | 1.72\% | 1.22\% | 1.40\% | 0.50\% | 1.74\% | 1.42\% | 1.07\% | 0.97\% | 1.63\% | 1.35\% | 1.08\% | 0.73\% | 1.86\% | 1.58\% | 1.21\% | 1.05\% |
|  |  | 2.9026 | 5.1476 | 2.3385 | 2.0474 | 6.1097 | 5.4005 | 4.1464 | 3.8593 | 5.7914 | 4.8984 | 5.0005 | 3.2854 | 5.1546 | 4.8400 | 4.7583 | 4.3289 |
| BHAR (1) |  | 1.55\% | 1.00\% | 1.01\% | 0.48\% | 1.83\% | 1.10\% | 0.98\% | 0.74\% | 1.26\% | 1.21\% | 0.98\% | 0.66\% | 1.60\% | 1.17\% | 1.08\% | 1.07\% |
|  |  | 3.6680 | 3.5766 | 2.2564 | 1.7319 | 5.5546 | 3.8212 | 4.0388 | 2.5952 | 4.5900 | 4.3691 | 4.5486 | 3.1109 | 4.9679 | 3.9373 | 4.8729 | 4.4446 |


| IVOL | J = | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.47\% | 0.63\% | 0.61\% | 0.56\% | 0.79\% | 0.68\% | 0.80\% | 0.66\% | 0.88\% | 0.86\% | 0.74\% | 0.58\% | 0.81\% | 0.75\% | 0.57\% | 0.40\% |
|  |  | 1.8709 | 3.7020 | 4.5152 | 4.5432 | 2.7471 | 3.1143 | 4.1746 | 3.6508 | 2.8739 | 3.2153 | 2.9460 | 2.4477 | 2.4975 | 2.4765 | 2.0607 | 1.5128 |
| CAR (1) |  | 0.48\% | 0.63\% | 0.69\% | 0.52\% | 0.81\% | 0.82\% | 0.79\% | 0.59\% | 1.05\% | 0.85\% | 0.71\% | 0.48\% | 0.95\% | 0.62\% | 0.54\% | 0.29\% |
|  |  | 2.0343 | 4.0447 | 5.3395 | 4.1735 | 3.0285 | 3.8163 | 4.1531 | 3.2424 | 3.6274 | 3.2746 | 2.8304 | 2.0568 | 2.9820 | 2.0887 | 1.8998 | 1.1433 |
| BHAR (0) |  | 0.59\% | 0.77\% | 0.57\% | 0.90\% | 0.71\% | 0.60\% | 0.82\% | 1.05\% | 0.96\% | 0.66\% | 0.76\% | 0.75\% | 1.00\% | 1.08\% | 0.68\% | 0.15\% |
|  |  | 1.8152 | 2.0093 | 1.6432 | 2.9334 | 1.9414 | 1.5734 | 2.6886 | 4.1957 | 2.4947 | 1.9640 | 2.1775 | 2.2585 | 2.7286 | 2.6817 | 1.7092 | 0.4356 |
| BHAR (1) |  | 0.56\% | 0.98\% | 0.39\% | 0.88\% | 0.71\% | 0.51\% | 0.85\% | 0.79\% | 1.00\% | 0.68\% | 0.58\% | 0.78\% | 1.32\% | 0.93\% | 0.79\% | 0.13\% |
|  |  | 1.8117 | 3.3378 | 1.5351 | 2.8144 | 2.0059 | 1.1952 | 2.8434 | 3.1375 | 2.5742 | 1.9300 | 1.6751 | 2.4512 | 3.5351 | 2.5918 | 2.0391 | 0.3947 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.25\% | 0.42\% | 0.43\% | 0.32\% | 0.46\% | 0.46\% | 0.42\% | 0.31\% | 0.42\% | 0.33\% | 0.31\% | 0.21\% | 0.39\% | 0.44\% | 0.33\% | 0.32\% |
|  |  | 0.7275 | 1.6154 | 1.7870 | 1.4975 | 1.3657 | 1.4910 | 1.5306 | 1.2095 | 1.2878 | 1.0531 | 1.0259 | 0.7409 | 1.1862 | 1.3991 | 1.0912 | 1.1042 |
| CAR (1) |  | 0.39\% | 0.51\% | 0.43\% | 0.32\% | 0.56\% | 0.50\% | 0.36\% | 0.26\% | 0.50\% | 0.25\% | 0.23\% | 0.12\% | 0.54\% | 0.42\% | 0.35\% | 0.35\% |
|  |  | 1.1772 | 1.7189 | 1.4296 | 1.2236 | 1.6686 | 1.5586 | 1.2813 | 0.9614 | 1.5335 | 0.7753 | 0.7589 | 0.4203 | 1.6476 | 1.3112 | 1.1279 | 1.2070 |
| BHAR (0) |  | 0.10\% | 0.26\% | 0.98\% | 0.27\% | 0.52\% | 0.21\% | 0.99\% | 0.45\% | 0.36\% | 0.46\% | 0.44\% | 0.53\% | 0.53\% | 0.35\% | 0.72\% | 0.28\% |
|  |  | 0.1848 | 0.4974 | 1.8266 | 0.5091 | 1.2069 | 0.5023 | 1.7768 | 0.9640 | 1.0055 | 1.1648 | 1.1108 | 1.4938 | 1.4079 | 0.9186 | 1.7884 | 0.6892 |
| BHAR (1) |  | 0.48\% | 0.85\% | 1.35\% | 0.57\% | 0.61\% | 1.02\% | 0.94\% | 0.36\% | 0.63\% | 0.55\% | 0.27\% | 0.35\% | 0.46\% | 0.42\% | 0.65\% | 0.23\% |
|  |  | 0.9771 | 1.8681 | 2.2117 | 1.0771 | 1.4688 | 2.0311 | 1.5324 | 0.7403 | 1.6253 | 1.4272 | 0.6069 | 0.9305 | 1.3466 | 1.0629 | 1.4689 | 0.5654 |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.81\% | 0.83\% | 0.72\% | 0.57\% | 1.37\% | 1.21\% | 0.97\% | 0.78\% | 1.16\% | 1.06\% | 0.87\% | 0.71\% | 0.95\% | 0.94\% | 0.82\% | 0.59\% |
|  |  | 2.8339 | 4.0514 | 3.9289 | 3.1645 | 5.1164 | 4.7826 | 3.9999 | 3.5436 | 3.2832 | 3.2289 | 2.9746 | 2.8109 | 2.4074 | 2.8996 | 3.0447 | 2.5410 |
| CAR (1) |  | 0.75\% | 0.85\% | 0.74\% | 0.53\% | 1.33\% | 1.13\% | 0.86\% | 0.66\% | 1.15\% | 1.02\% | 0.79\% | $\mathbf{0 . 6 1 \%}$ | 0.96\% | 0.89\% | 0.71\% | 0.53\% |
|  |  | 2.7153 | 4.9074 | 4.3504 | 3.2247 | 5.1493 | 4.4526 | 3.5406 | 3.0898 | 3.2838 | 3.3202 | 2.8418 | 2.4828 | 2.4941 | 2.9720 | 2.8732 | 2.4053 |
| BHAR (0) |  | 0.77\% | 0.76\% | 0.71\% | 0.52\% | 1.38\% | 1.06\% | 0.89\% | 0.76\% | 1.05\% | 1.11\% | 0.96\% | 1.05\% | 1.25\% | 1.30\% | 1.22\% | 1.17\% |
|  |  | 2.2092 | 2.3913 | 2.6021 | 2.1574 | 4.2118 | 3.2301 | 2.5699 | 2.6350 | 2.5780 | 2.8193 | 3.3766 | 3.3299 | 2.9660 | 4.3266 | 3.7941 | 3.8323 |
| BHAR (1) |  | 0.89\% | 0.63\% | 1.25\% | 0.45\% | 1.26\% | 1.18\% | 0.86\% | 0.79\% | 1.03\% | 1.00\% | 1.00\% | 0.97\% | 1.05\% | 1.16\% | 0.90\% | 1.02\% |
|  |  | 3.1233 | 2.4825 | 4.0279 | 1.8268 | 4.0779 | 3.5749 | 2.5081 | 2.8305 | 2.7113 | 2.5863 | 3.5296 | 2.8142 | 2.5454 | 3.6194 | 2.8530 | 3.4228 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.48\% | 0.41\% | 0.45\% | 0.49\% | 0.41\% | 0.46\% | 0.61\% | 0.52\% | 0.65\% | 0.57\% | 0.58\% | 0.44\% | 0.84\% | 0.71\% | 0.69\% | 0.56\% |
|  |  | 2.7664 | 2.5927 | 3.3421 | 3.8547 | 1.5493 | 2.0106 | 3.0233 | 2.7696 | 2.1385 | 1.9868 | 2.2089 | 1.7786 | 2.5212 | 2.3296 | 2.3437 | 2.0021 |
| CAR (1) |  | 0.39\% | 0.37\% | 0.43\% | 0.42\% | 0.30\% | 0.45\% | 0.58\% | 0.44\% | 0.54\% | 0.60\% | 0.50\% | 0.34\% | 0.69\% | 0.62\% | 0.61\% | 0.53\% |
|  |  | 1.9089 | 2.2650 | 2.9414 | 3.1023 | 1.0492 | 1.9191 | 2.7307 | 2.2641 | 1.6408 | 2.1069 | 1.9341 | 1.3583 | 2.1211 | 1.9904 | 2.0745 | 1.9399 |
| BHAR (0) |  | 0.51\% | 0.09\% | 0.59\% | 0.49\% | 0.35\% | 0.51\% | 0.55\% | 0.42\% | 0.46\% | 0.38\% | 0.56\% | 0.46\% | 0.70\% | 0.82\% | 0.83\% | 0.73\% |
|  |  | 2.4275 | 0.3393 | 2.2779 | 1.4821 | 1.2499 | 1.5477 | 1.4906 | 1.2900 | 1.2664 | 0.9207 | 1.4511 | 1.5641 | 2.1416 | 2.4366 | 2.7247 | 2.4513 |
| BHAR (1) |  | 0.44\% | 0.16\% | 0.70\% | 0.49\% | 0.21\% | 0.78\% | 0.51\% | 0.35\% | 0.45\% | 0.45\% | 0.64\% | 0.43\% | 0.64\% | 0.62\% | 0.70\% | 0.59\% |
|  |  | 1.7881 | 0.5250 | 2.2886 | 1.3943 | 0.6554 | 2.6750 | 1.3379 | 1.0408 | 1.2488 | 1.0262 | 1.7898 | 1.3094 | 1.9148 | 1.8248 | 2.2567 | 1.9375 |



## Appendix 7. Cross-sectional momentum strategy - winner (loser) contains top (bottom) $\mathbf{3 0 \%}$

Panel A. The cross-sectional momentum strategy using equal-weighted return



| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.21\% | 0.31\% | 0.26\% | 0.19\% | 0.33\% | 0.32\% | 0.22\% | 0.04\% | 0.31\% | 0.23\% | 0.04\% | -0.08\% | 0.20\% | -0.01\% | -0.15\% | -0.24\% |
|  |  | 0.6442 | 1.1240 | 1.0902 | 0.8769 | 0.8623 | 0.9353 | 0.7092 | 0.1429 | 0.7824 | 0.6396 | 0.1091 | -0.2467 | 0.4802 | -0.0211 | -0.3968 | -0.6489 |
| CAR (1) |  | 0.38\% | 0.33\% | 0.29\% | 0.15\% | 0.36\% | 0.35\% | 0.18\% | -0.01\% | 0.44\% | 0.20\% | 0.01\% | -0.13\% | 0.13\% | -0.08\% | -0.21\% | -0.30\% |
|  |  | 1.1826 | 1.2604 | 1.2549 | 0.6876 | 0.9809 | 1.0522 | 0.5778 | -0.0409 | 1.1503 | 0.5540 | 0.0260 | -0.3959 | 0.3118 | -0.2111 | -0.5362 | -0.8086 |
| BHAR (0) |  | 0.12\% | 0.61\% | 0.32\% | 0.38\% | 0.38\% | 0.51\% | 0.22\% | 0.28\% | 0.42\% | 0.42\% | -0.03\% | 0.06\% | 0.27\% | -0.14\% | -0.19\% | -0.66\% |
|  |  | 0.2970 | 1.6084 | 0.9280 | 1.0502 | 0.9435 | 1.2221 | 0.5634 | 0.6274 | 1.0115 | 1.1611 | -0.0592 | 0.1709 | 0.6353 | -0.3113 | -0.4685 | -1.4044 |
| BHAR (1) |  | 0.46\% | 0.60\% | 0.26\% | 0.36\% | 0.38\% | 0.38\% | 0.14\% | 0.23\% | 0.57\% | 0.42\% | 0.23\% | -0.07\% | 0.17\% | -0.18\% | -0.27\% | -0.55\% |
|  |  | 1.1980 | 1.4898 | 0.7469 | 0.9564 | 0.9740 | 1.0178 | 0.3346 | 0.5508 | 1.4096 | 1.1173 | 0.5660 | -0.2021 | 0.3972 | -0.4116 | -0.7325 | -1.2389 |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.13\% | 0.27\% | 0.19\% | 0.06\% | 0.35\% | 0.30\% | 0.11\% | -0.07\% | 0.26\% | 0.13\% | -0.11\% | -0.31\% | 0.05\% | -0.10\% | -0.33\% | -0.47\% |
|  |  | 0.4183 | 1.2358 | 1.0198 | 0.3640 | 1.1294 | 1.0958 | 0.4393 | -0.3267 | 0.7543 | 0.4210 | -0.3684 | -1.1705 | 0.1533 | -0.3162 | -1.0867 | -1.7431 |
| CAR (1) |  | 0.18\% | 0.30\% | 0.15\% | 0.00\% | 0.39\% | 0.25\% | 0.01\% | -0.17\% | 0.17\% | 0.00\% | -0.25\% | -0.42\% | -0.04\% | -0.22\% | -0.45\% | -0.55\% |
|  |  | 0.6701 | 1.5165 | 0.8384 | -0.0134 | 1.3291 | 0.9072 | 0.0237 | -0.7541 | 0.5228 | -0.0058 | -0.8866 | -1.6491 | -0.1077 | -0.6921 | -1.5376 | -2.1364 |
| BHAR (0) |  | 0.02\% | 0.01\% | -0.12\% | 0.14\% | 0.25\% | 0.36\% | -0.05\% | 0.07\% | 0.22\% | 0.10\% | -0.04\% | -0.40\% | 0.00\% | 0.01\% | -0.30\% | -0.38\% |
|  |  | 0.0453 | 0.0254 | -0.3816 | 0.4335 | 0.6786 | 1.1515 | -0.1337 | 0.2874 | 0.5867 | 0.2622 | -0.1184 | -1.2247 | 0.0076 | 0.0326 | -0.8704 | -1.3301 |
| BHAR (1) |  | -0.12\% | -0.02\% | -0.16\% | $\mathbf{0 . 0 2 \%}$ | 0.14\% | 0.24\% | -0.22\% | -0.06\% | 0.03\% | -0.08\% | -0.23\% | -0.48\% | -0.24\% | -0.14\% | -0.42\% | -0.49\% |
|  |  | -0.3742 | -0.0508 | -0.5234 | 0.0730 | 0.4381 | 0.8425 | -0.6208 | -0.2183 | 0.0780 | -0.2148 | -0.7851 | -1.5640 | -0.6632 | -0.4472 | -1.2204 | -1.7241 |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.54\% | 0.51\% | 0.45\% | 0.46\% | 0.66\% | 0.44\% | 0.53\% | 0.50\% | 0.76\% | 0.63\% | 0.58\% | 0.44\% | 0.75\% | 0.63\% | 0.47\% | 0.32\% |
|  |  | 1.8619 | 1.7640 | 1.8572 | 2.3424 | 1.7062 | 1.2355 | 1.7785 | 1.7905 | 1.9894 | 1.7409 | 1.6904 | 1.3701 | 1.9148 | 1.5918 | 1.2348 | 0.9075 |
| CAR (1) |  | 0.84\% | 0.65\% | 0.54\% | 0.46\% | 0.70\% | 0.51\% | 0.55\% | 0.45\% | 0.86\% | 0.67\% | 0.53\% | 0.39\% | 0.73\% | 0.58\% | 0.38\% | $\mathbf{0 . 2 1 \%}$ |
|  |  | 2.8397 | 2.2760 | 2.3427 | 2.2949 | 1.8462 | 1.4741 | 1.8547 | 1.6072 | 2.2906 | 1.8183 | 1.5484 | 1.1794 | 1.7986 | 1.4408 | 1.0054 | 0.5974 |
| BHAR (0) |  | 0.58\% | -0.22\% | -0.03\% | 0.34\% | 0.55\% | 0.40\% | -0.01\% | 0.77\% | 0.63\% | 0.16\% | 1.03\% | 0.47\% | 0.94\% | 1.02\% | 0.57\% | 0.13\% |
|  |  | 1.6428 | -0.5433 | -0.0857 | 0.9011 | 1.2659 | 0.9587 | -0.0261 | 2.1144 | 1.5727 | 0.3668 | 2.8339 | 1.2481 | 2.1290 | 2.4515 | 1.3006 | 0.2947 |
| BHAR (1) |  | 0.70\% | 0.03\% | 0.05\% | 0.76\% | 0.50\% | 0.15\% | 0.10\% | 0.44\% | 0.53\% | 0.46\% | 0.71\% | 0.19\% | 0.70\% | 0.73\% | 0.32\% | -0.06\% |
|  |  | 1.8567 | 0.0913 | 0.1334 | 2.0584 | 1.2346 | 0.3418 | 0.2429 | 1.2701 | 1.3923 | 1.1876 | 1.8620 | 0.5003 | 1.7036 | 1.7028 | 0.7131 | -0.1311 |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.21\% | 0.00\% | -0.01\% | -0.04\% | 0.02\% | 0.09\% | 0.04\% | -0.07\% | 0.00\% | 0.05\% | -0.05\% | -0.16\% | -0.05\% | -0.08\% | -0.18\% | -0.27\% |
|  |  | -1.1776 | -0.0155 | -0.0408 | -0.3156 | 0.0894 | 0.4380 | 0.2148 | -0.3758 | 0.0104 | 0.1955 | -0.2184 | -0.8125 | -0.1979 | -0.3296 | -0.8093 | -1.2864 |
| CAR (1) |  | 0.02\% | 0.12\% | 0.08\% | -0.03\% | 0.26\% | 0.20\% | 0.06\% | $\mathbf{- 0 . 0 7 \%}$ | 0.20\% | 0.09\% | -0.04\% | -0.19\% | 0.00\% | -0.07\% | -0.22\% | -0.29\% |
|  |  | 0.1108 | 0.7487 | 0.5326 | -0.2387 | 1.1204 | 0.9231 | 0.3103 | -0.3976 | 0.8147 | 0.3689 | -0.1994 | -0.9801 | 0.0136 | -0.3093 | -1.0212 | -1.4304 |
| BHAR (0) |  | -0.18\% | -0.11\% | -0.21\% | -0.29\% | 0.07\% | 0.16\% | -0.01\% | 0.33\% | 0.04\% | -0.05\% | 0.12\% | -0.04\% | 0.00\% | 0.01\% | -0.10\% | -0.24\% |
|  |  | -0.9640 | -0.6011 | -0.8837 | $-1.4266$ | 0.2558 | 0.6986 | -0.0426 | 1.6613 | 0.1543 | -0.1821 | 0.5571 | -0.1642 | -0.0167 | 0.0437 | -0.3930 | -0.9504 |
| BHAR (1) |  | 0.02\% | 0.00\% | -0.14\% | -0.28\% | 0.23\% | 0.19\% | 0.01\% | 0.27\% | 0.13\% | -0.03\% | 0.06\% | -0.06\% | 0.05\% | 0.01\% | -0.12\% | -0.22\% |
|  |  | 0.1201 | 0.0021 | -0.6325 | -1.3800 | 0.9272 | 0.8488 | 0.0486 | 1.4061 | 0.5268 | -0.1191 | 0.2951 | -0.2813 | 0.1889 | 0.0450 | -0.4842 | -0.9004 |



| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.57\% | 0.52\% | 0.53\% | 0.48\% | 0.66\% | 0.66\% | 0.68\% | 0.48\% | 0.85\% | 0.81\% | 0.67\% | 0.45\% | 0.82\% | 0.60\% | 0.44\% | 0.23\% |
|  |  | 2.1763 | 2.6088 | 2.8120 | 2.5866 | 2.5345 | 2.6985 | 2.7986 | 2.0321 | 2.8585 | 2.6940 | 2.2583 | 1.6230 | 2.4037 | 1.7860 | 1.3806 | 0.7378 |
| CAR (1) |  | 0.50\% | 0.53\% | 0.55\% | 0.40\% | 0.71\% | 0.73\% | 0.64\% | 0.40\% | 0.88\% | 0.77\% | 0.58\% | 0.32\% | 0.79\% | 0.54\% | 0.33\% | 0.13\% |
|  |  | 1.9332 | 2.6331 | 2.8212 | 2.1032 | 2.7243 | 2.8888 | 2.5229 | 1.6558 | 2.8288 | 2.5057 | 1.9572 | 1.1524 | 2.2769 | 1.6285 | 1.0227 | 0.4080 |
| BHAR (0) |  | 0.65\% | 0.62\% | 0.38\% | 0.76\% | 0.56\% | 0.53\% | 0.54\% | 0.84\% | 0.84\% | 0.72\% | 0.88\% | 0.63\% | 0.80\% | 0.57\% | 0.52\% | 0.34\% |
|  |  | 2.0594 | 1.9628 | 1.3667 | 2.5694 | 1.9696 | 1.6814 | 1.8572 | 3.4014 | 2.6191 | 2.0629 | 2.8853 | 1.8057 | 2.2101 | 1.5658 | 1.6228 | 0.9256 |
| BHAR (1) |  | 0.69\% | 0.59\% | 0.57\% | 0.67\% | 0.75\% | 0.66\% | 0.53\% | 0.67\% | 0.91\% | 0.69\% | 0.76\% | 0.55\% | 0.86\% | 0.55\% | 0.55\% | 0.28\% |
|  |  | 2.3968 | 2.0739 | 2.1251 | 2.2303 | 2.7166 | 2.0043 | 1.8409 | 2.4712 | 2.8499 | 2.1413 | 2.5681 | 1.6418 | 2.4318 | 1.4920 | 1.7946 | 0.8086 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.05\% | 0.27\% | 0.38\% | 0.36\% | 0.19\% | 0.35\% | 0.38\% | 0.37\% | 0.18\% | 0.37\% | 0.39\% | 0.33\% | 0.22\% | 0.36\% | 0.32\% | 0.25\% |
|  |  | 0.1926 | 1.1826 | 1.8084 | 1.9057 | 0.5897 | 1.1442 | 1.3425 | 1.4225 | 0.5348 | 1.0980 | 1.2595 | 1.1212 | 0.5857 | 1.0132 | 0.9455 | 0.7715 |
| CAR (1) |  | 0.31\% | 0.46\% | 0.47\% | 0.44\% | 0.50\% | 0.53\% | 0.49\% | 0.43\% | 0.48\% | 0.56\% | 0.45\% | 0.36\% | 0.54\% | 0.49\% | 0.37\% | 0.29\% |
|  |  | 1.1056 | 1.9203 | 2.1537 | 2.2563 | 1.4345 | 1.7086 | 1.7373 | 1.6605 | 1.3483 | 1.6694 | 1.4751 | 1.2100 | 1.4140 | 1.3436 | 1.0625 | 0.8891 |
| BHAR (0) |  | -0.04\% | 0.43\% | 0.17\% | 0.28\% | 0.18\% | 0.46\% | 0.40\% | 0.46\% | 0.15\% | 0.53\% | 0.72\% | 0.83\% | 0.16\% | 0.13\% | 0.28\% | 0.13\% |
|  |  | -0.0988 | 1.3243 | 0.5513 | 0.8034 | 0.4894 | 1.3219 | 1.0699 | 1.3705 | 0.4092 | 1.2723 | 1.9020 | 2.3732 | 0.4005 | 0.3412 | 0.7523 | 0.3446 |
| BHAR (1) |  | 0.06\% | 0.49\% | 0.27\% | 0.35\% | $\mathbf{0 . 4 1 \%}$ | $0.55 \%$ | $0.56 \%$ | $0.45 \%$ | $0.36 \%$ | $0.60 \%$ | $0.57 \%$ | $0.78 \%$ | $0.35 \%$ | $0.31 \%$ |  | 0.13\% |
|  |  | 0.1892 | 1.5848 | 0.8334 | 1.0674 | $1.0949$ | $1.6548$ | $1.5857$ | $1.3316$ | $0.9932$ | $1.6219$ | $1.7237$ | $2.2116$ | $0.8851$ | $0.7963$ | $1.0023$ | $0.3323$ |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.43\% | 0.53\% | 0.42\% | 0.30\% | 0.58\% | 0.52\% | 0.35\% | 0.20\% | 0.43\% | 0.34\% | 0.14\% | -0.02\% | 0.28\% | 0.18\% | 0.00\% | -0.11\% |
|  |  | 1.3828 | 2.3088 | 2.0258 | 1.5933 | 1.7671 | 1.8124 | 1.3331 | 0.8507 | 1.2311 | 1.0706 | 0.4918 | -0.0677 | 0.7922 | 0.5582 | -0.0057 | -0.4157 |
| CAR (1) |  | 0.57\% | 0.59\% | 0.41\% | 0.28\% | 0.68\% | 0.52\% | 0.29\% | 0.15\% | 0.47\% | 0.27\% | 0.05\% | -0.09\% | 0.28\% | 0.12\% | -0.08\% | -0.15\% |
|  |  | 1.8581 | 2.8755 | 1.9946 | 1.4980 | 2.3264 | 1.9018 | 1.1458 | 0.6614 | 1.3846 | 0.8868 | 0.1927 | -0.3384 | 0.8452 | 0.3852 | -0.2753 | -0.5713 |
| BHAR (0) |  | 0.46\% | 0.37\% | 0.44\% | 0.45\% | 0.61\% | $\mathbf{0 . 5 8 \%}$ | 0.25\% | 0.39\% | 0.54\% | 0.34\% | 0.31\% | -0.13\% | 0.37\% | 0.33\% | 0.20\% | -0.11\% |
|  |  | 1.3738 | 1.1841 | 1.6703 | 2.1045 | 1.5967 | 1.7377 | 0.7211 | 1.4933 | 1.4310 | 0.9632 | 1.1291 | -0.3890 | 0.9734 | 1.0134 | 0.6473 | -0.3761 |
| BHAR (1) |  | 0.57\% | 0.32\% | 0.46\% | 0.35\% | 0.70\% | 0.60\% | 0.16\% | 0.34\% | $\mathbf{0 . 5 9 \%}$ | 0.23\% | 0.37\% | -0.16\% | 0.27\% | 0.27\% | -0.03\% | -0.09\% |
|  |  | 1.7353 | 1.2357 | 1.7773 | 1.7467 | 2.2870 | 2.0728 | 0.4952 | 1.3502 | 1.7568 | 0.7358 | 1.4656 | -0.5222 | 0.8005 | 0.8894 | -0.1012 | -0.2900 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.49\% | 0.43\% | 0.47\% | 0.48\% | 0.60\% | 0.60\% | 0.64\% | 0.56\% | 0.71\% | 0.70\% | 0.64\% | 0.54\% | 0.80\% | 0.71\% | 0.63\% | 0.52\% |
|  |  | 2.5929 | 2.6646 | 3.0538 | 3.3323 | 2.8735 | 2.8445 | 3.0806 | 2.9215 | 2.7790 | 2.7511 | 2.5901 | 2.3582 | 2.9267 | 2.6149 | 2.3785 | 2.0575 |
| CAR (1) |  | 0.51\% | 0.47\% | 0.51\% | 0.45\% | 0.60\% | 0.64\% | 0.62\% | 0.51\% | 0.73\% | 0.68\% | 0.59\% | 0.48\% | 0.76\% | 0.67\% | 0.56\% | 0.47\% |
|  |  | 2.9610 | 2.9711 | 3.1648 | 3.1780 | 2.8032 | 2.8756 | 2.9328 | 2.6583 | 2.7927 | 2.6167 | 2.4148 | 2.1095 | 2.8315 | 2.4914 | 2.1618 | 1.8895 |
| BHAR (0) |  | 0.29\% | 0.23\% | 0.55\% | 0.49\% | 0.43\% | 0.53\% | 0.61\% | 0.45\% | 0.66\% | 0.69\% | 0.68\% | 0.35\% | 0.75\% | 0.74\% | 0.78\% | 0.40\% |
|  |  | 1.3123 | 1.0302 | 2.3869 | 2.1335 | 1.9390 | 2.1852 | 2.0738 | 2.1760 | 2.4235 | 2.4094 | 2.7059 | 1.5171 | 2.6542 | 2.7067 | 2.7749 | 1.4515 |
| BHAR (1) |  | 0.44\% | 0.19\% | 0.50\% | 0.46\% | 0.36\% | 0.55\% | 0.56\% | 0.35\% | 0.63\% | 0.59\% | 0.50\% | 0.24\% | 0.71\% | 0.68\% | 0.69\% | 0.29\% |
|  |  | 2.1158 | 0.7651 | 2.0744 | 1.9399 | 1.5835 | 2.2301 | 1.9567 | 1.7364 | 2.3089 | 2.0255 | 1.9740 | 0.9574 | 2.6069 | 2.4856 | 2.4737 | 1.0671 |


| EW | J = | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.89\% | 0.86\% | 0.65\% | 0.63\% | 1.01\% | 0.88\% | 0.79\% | 0.64\% | 1.02\% | 0.97\% | 0.73\% | 0.55\% | 1.08\% | 0.81\% | 0.56\% | 0.42\% |
|  |  | 2.8840 | 3.2778 | 2.8985 | 3.2360 | 2.8192 | 2.7975 | 2.8512 | 2.4879 | 2.7780 | 2.8551 | 2.2553 | 1.8722 | 2.8825 | 2.2374 | 1.6430 | 1.3278 |
| CAR (1) |  | 1.06\% | 0.86\% | 0.68\% | 0.59\% | 1.10\% | 0.91\% | 0.76\% | 0.57\% | 1.07\% | 0.90\% | 0.63\% | 0.45\% | 0.98\% | 0.67\% | 0.45\% | 0.34\% |
|  |  | 3.5847 | 3.4873 | 3.2010 | 3.1598 | 3.2918 | 3.0327 | 2.7797 | 2.2914 | 2.9432 | 2.6446 | 1.9773 | 1.5706 | 2.6839 | 1.8962 | 1.3294 | 1.0981 |
| BHAR (0) |  | 1.07\% | 0.82\% | 0.75\% | 0.28\% | 1.09\% | 1.03\% | 0.72\% | 0.59\% | 1.14\% | 0.72\% | 0.80\% | 0.28\% | 1.07\% | 0.96\% | 0.66\% | 0.48\% |
|  |  | 3.1577 | 2.5254 | 2.5625 | 0.7870 | 2.9335 | 3.2238 | 1.7659 | 1.8611 | 2.8618 | 1.7623 | 2.0956 | 0.8262 | 2.7098 | 2.7242 | 1.7987 | 1.5841 |
| BHAR (1) |  | 1.07\% | 0.76\% | 0.76\% | 0.34\% | 1.13\% | 0.96\% | 0.73\% | 0.49\% | 1.05\% | 0.82\% | 0.75\% | 0.15\% | 1.04\% | 0.82\% | 0.58\% | 0.45\% |
|  |  | 3.4638 | 2.5716 | 3.0186 | 1.0198 | 3.3203 | 3.1386 | 1.8638 | 1.5690 | 2.8463 | 2.2637 | 2.0143 | 0.4163 | 2.8094 | 2.3426 | 1.6316 | 1.4623 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.77\% | 0.67\% | 0.58\% | 0.59\% | 0.92\% | 0.79\% | 0.78\% | 0.66\% | 0.94\% | 0.90\% | 0.77\% | 0.59\% | 1.02\% | 0.84\% | 0.67\% | 0.49\% |
|  |  | 3.9206 | 3.8093 | 3.4256 | 3.9109 | 4.0176 | 3.3456 | 3.4700 | 3.2944 | 3.4706 | 3.3668 | 3.0540 | 2.5664 | 3.5572 | 3.0435 | 2.5444 | 1.9951 |
| CAR (1) |  | 0.74\% | 0.63\% | 0.58\% | 0.53\% | 0.87\% | 0.77\% | 0.72\% | 0.57\% | 0.95\% | 0.85\% | 0.69\% | 0.49\% | 0.96\% | 0.75\% | 0.56\% | 0.40\% |
|  |  | 4.0643 | 3.5062 | 3.4145 | 3.5942 | 3.6705 | 3.1405 | 3.2296 | 2.8521 | 3.4279 | 3.1668 | 2.7648 | 2.1357 | 3.4117 | 2.7613 | 2.1764 | 1.6361 |
| BHAR (0) |  | 0.65\% | 0.60\% | 0.52\% | 0.50\% | 0.93\% | 0.87\% | 0.67\% | 0.93\% | 1.02\% | 0.85\% | 0.87\% | 0.74\% | 1.06\% | 0.96\% | 0.72\% | 0.55\% |
|  |  | 3.0456 | 2.2758 | 2.1122 | 1.7827 | 3.8023 | 3.2853 | 2.5581 | 4.2038 | 3.6172 | 2.7849 | 3.3253 | 2.7193 | 3.6809 | 3.4151 | 2.5207 | 1.9790 |
| BHAR (1) |  | 0.66\% | 0.47\% | 0.56\% | 0.49\% | 0.78\% | 0.80\% | 0.60\% | 0.82\% | 0.92\% | $0.75 \%$ | 0.75\% | 0.52\% | $0.91 \%$ | $0.84 \%$ | $0.55 \%$ | $0.50 \%$ |
|  |  | 3.2551 | 1.7517 | 2.3267 | 1.7809 | 3.1193 | 3.0217 | 2.4010 | 3.8854 | $3.2438$ | $2.4960$ | 2.9535 | 1.7513 | $3.2267$ | $3.1107$ | $2.0238$ | $1.8333$ |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.94\% | 0.94\% | 0.80\% | 0.79\% | 1.31\% | 1.11\% | 1.02\% | 0.88\% | 1.31\% | 1.19\% | 1.00\% | 0.81\% | 1.42\% | 1.15\% | 0.89\% | 0.70\% |
|  |  | 4.3305 | 4.9345 | 4.9220 | 5.5571 | 5.0709 | 4.7737 | 5.0413 | 4.7981 | 4.9248 | 4.8681 | 4.3719 | 3.8648 | 5.2264 | 4.4260 | 3.6744 | 3.0772 |
| CAR (1) |  | 0.95\% | 0.89\% | 0.77\% | 0.72\% | 1.23\% | 1.03\% | 0.93\% | 0.76\% | 1.21\% | 1.07\% | 0.87\% | 0.67\% | 1.25\% | 0.98\% | 0.73\% | 0.56\% |
|  |  | 4.4188 | 4.8482 | 5.0051 | 5.1498 | 5.0024 | 4.7110 | 4.7761 | 4.2558 | 4.7228 | 4.4791 | 3.8500 | 3.2559 | 4.6559 | 3.8311 | 3.0742 | 2.5419 |
| BHAR (0) |  | 0.79\% | 0.75\% | 0.89\% | 0.48\% | 1.24\% | 1.05\% | 0.84\% | 1.07\% | 1.28\% | 1.06\% | 1.03\% | 0.81\% | 1.38\% | 1.22\% | 0.87\% | 0.70\% |
|  |  | 3.1615 | 3.0715 | 3.5226 | 1.9092 | 4.5682 | 4.0411 | 3.1715 | 6.4873 | 4.5341 | 3.7353 | 4.4562 | 3.3378 | 4.8899 | 4.7788 | 3.1136 | 2.7903 |
| BHAR (1) |  | 0.91\% | 0.67\% | $\mathbf{0 . 8 1 \%}$ | 0.40\% | 1.15\% | 0.99\% | 0.82\% | 0.90\% | 1.20\% | 0.91\% | 0.82\% | 0.63\% | 1.20\% | 0.99\% | 0.60\% | 0.50\% |
|  |  | 3.9555 | 2.9620 | 3.5053 | 1.6004 | 4.6847 | 4.2425 | 3.3973 | 5.8234 | 4.6679 | 3.4472 | 3.5976 | 2.5947 | 4.5569 | 4.1476 | 2.2669 | 2.0982 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.10\% | 0.02\% | 0.08\% | 0.04\% | 0.09\% | 0.19\% | 0.16\% | 0.03\% | 0.26\% | 0.22\% | 0.08\% | -0.07\% | 0.18\% | 0.05\% | -0.08\% | -0.20\% |
|  |  | -0.5217 | 0.0988 | 0.5744 | 0.3270 | 0.3865 | 0.8736 | 0.8454 | 0.1688 | 1.0267 | 0.8917 | 0.3543 | -0.3424 | 0.6584 | 0.2082 | -0.3410 | -0.9016 |
| CAR (1) |  | -0.05\% | 0.10\% | 0.13\% | $\mathbf{0 . 0 1 \%}$ | 0.21\% | 0.27\% | 0.14\% | -0.02\% | 0.32\% | 0.19\% | 0.02\% | -0.14\% | 0.10\% | -0.02\% | -0.17\% | -0.27\% |
|  |  | -0.2710 | 0.6066 | 0.9308 | 0.0761 | 0.9559 | 1.3328 | 0.7648 | -0.1190 | 1.3281 | 0.7920 | 0.0756 | -0.6994 | 0.3789 | -0.0766 | -0.7200 | $-1.2378$ |
| BHAR (0) |  | -0.18\% | 0.03\% | $\mathbf{0 . 0 2 \%}$ | 0.03\% | 0.07\% | 0.22\% | -0.20\% | 0.30\% | 0.27\% | 0.14\% | 0.24\% | -0.03\% | 0.20\% | 0.19\% | 0.01\% | -0.18\% |
|  |  | -0.8058 | 0.1614 | 0.0732 | 0.1565 | 0.2416 | 0.8826 | -0.6921 | 1.7554 | 0.9993 | 0.4997 | 1.1527 | -0.1195 | 0.7153 | 0.7114 | 0.0248 | -0.6849 |
| BHAR (1) |  | -0.04\% | -0.04\% | -0.01\% | -0.05\% | 0.14\% | 0.24\% | -0.20\% | 0.09\% | 0.28\% | 0.00\% | 0.01\% | -0.21\% | -0.01\% | -0.01\% | -0.20\% | -0.32\% |
|  |  | -0.2083 | -0.1947 | -0.0460 | -0.2372 | 0.6130 | 1.0980 | -0.7273 | 0.5643 | 1.0744 | -0.0044 | 0.0319 | -0.8976 | -0.0267 | -0.0328 | -0.8030 | -1.2230 |

Panel B. The cross-sectional momentum strategy using market-weighted return



| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.74\% | 0.71\% | 0.50\% | 0.54\% | 0.81\% | 0.81\% | 0.61\% | 0.54\% | 1.00\% | 0.92\% | 0.73\% | 0.67\% | 0.77\% | 0.57\% | 0.43\% | 0.35\% |
|  |  | 1.1347 | 1.3385 | 1.1558 | 1.4367 | 1.1705 | 1.2938 | 1.1781 | 1.1801 | 1.4565 | 1.4695 | 1.3471 | 1.3777 | 1.1318 | 0.9310 | 0.7832 | 0.6943 |
| CAR (1) |  | 0.83\% | 0.63\% | 0.52\% | 0.51\% | 1.15\% | 0.81\% | 0.63\% | 0.54\% | 1.03\% | 0.81\% | 0.73\% | 0.61\% | 0.99\% | 0.56\% | 0.43\% | 0.30\% |
|  |  | 1.2798 | 1.2239 | 1.2372 | 1.3601 | 1.6332 | 1.3751 | 1.2797 | 1.2135 | 1.4922 | 1.3831 | 1.4290 | 1.3148 | 1.5106 | 0.9888 | 0.8284 | 0.6018 |
| BHAR (0) |  | 1.14\% | 1.57\% | 1.01\% | 1.46\% | 1.15\% | 1.16\% | 0.55\% | 0.74\% | 1.44\% | 0.62\% | 1.05\% | 0.55\% | 1.33\% | 0.76\% | 0.41\% | -0.07\% |
|  |  | 1.5031 | 2.0444 | 1.3551 | 1.8805 | 1.4823 | 1.6158 | 0.7167 | 1.0525 | 1.8253 | 0.8970 | 1.7780 | 0.9186 | 1.7781 | 1.0704 | 0.6037 | -0.1013 |
| BHAR (1) |  | 0.95\% | 1.52\% | 0.48\% | 1.77\% | 1.14\% | 0.78\% | 0.88\% | 0.57\% | 0.83\% | 0.80\% | 1.24\% | 0.04\% | 1.59\% | 0.91\% | 0.45\% | 0.11\% |
|  |  | 1.2380 | 1.6944 | 0.6582 | 2.0207 | 1.5343 | 1.1350 | 1.1387 | 0.8201 | 0.9969 | 1.0332 | 1.6572 | 0.0646 | 2.0095 | 1.2665 | 0.6891 | 0.1770 |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.45\% | 0.46\% | 0.42\% | 0.34\% | 0.66\% | 0.53\% | 0.40\% | 0.28\% | 0.54\% | 0.41\% | 0.28\% | 0.11\% | 0.61\% | 0.40\% | 0.15\% | 0.06\% |
|  |  | 1.1048 | 1.6056 | 1.6594 | 1.4472 | 1.6321 | 1.3801 | 1.1249 | 0.8643 | 1.1005 | 0.8897 | 0.6587 | 0.2804 | 1.2518 | 0.8416 | 0.3541 | 0.1556 |
| CAR (1) |  | 0.32\% | 0.47\% | 0.38\% | 0.30\% | 0.60\% | 0.47\% | 0.32\% | 0.17\% | 0.40\% | 0.29\% | 0.15\% | -0.01\% | 0.46\% | 0.28\% | 0.06\% | -0.01\% |
|  |  | 0.8489 | 1.6492 | 1.4497 | 1.2417 | 1.4102 | 1.1629 | 0.9019 | 0.5244 | 0.7853 | 0.6197 | 0.3506 | -0.0394 | 0.9414 | 0.6107 | 0.1427 | -0.0167 |
| BHAR (0) |  | 0.51\% | 0.51\% | 0.05\% | 0.51\% | 0.74\% | 0.61\% | 0.37\% | 0.27\% | 0.74\% | 0.71\% | 0.59\% | -0.03\% | 0.67\% | 0.56\% | 0.06\% | 0.00\% |
|  |  | 1.1082 | 1.1492 | 0.0916 | 1.4085 | 1.6769 | 1.2482 | 0.8409 | 0.5867 | 1.3453 | 1.2997 | 1.1353 | -0.0506 | 1.2914 | 1.1072 | 0.1210 | -0.0090 |
| BHAR (1) |  | 0.22\% | 0.45\% | -0.15\% | 0.38\% | 0.23\% | 0.23\% | -0.11\% | 0.07\% | 0.18\% | 0.35\% | 0.27\% | -0.01\% | 0.35\% | 0.41\% | 0.03\% | 0.00\% |
|  |  | 0.4975 | 1.1301 | -0.3083 | 1.0132 | 0.4832 | 0.4644 | -0.2345 | 0.1498 | 0.3298 | 0.6189 | 0.5121 | -0.0148 | 0.6576 | 0.8388 | 0.0651 | 0.0039 |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.07\% | 0.95\% | 0.51\% | 0.58\% | 1.69\% | 1.11\% | 0.83\% | 0.68\% | 1.26\% | 0.78\% | 0.44\% | $\mathbf{0 . 4 1 \%}$ | 1.02\% | 0.54\% | 0.19\% | 0.12\% |
|  |  | 1.9604 | 2.0043 | 1.1203 | 1.4909 | 2.3924 | 1.6746 | 1.3909 | 1.2528 | 1.7835 | 1.1951 | 0.7165 | 0.7103 | 1.3527 | 0.7482 | 0.2732 | 0.1959 |
| CAR (1) |  | 1.22\% | 0.83\% | 0.52\% | 0.51\% | 1.45\% | 0.96\% | 0.66\% | 0.56\% | 1.04\% | 0.48\% | 0.31\% | $\mathbf{0 . 2 9 \%}$ | 0.78\% | 0.28\% | 0.05\% | -0.06\% |
|  |  | 2.4812 | 1.7900 | 1.2070 | 1.3909 | 2.1691 | 1.4902 | 1.1508 | 1.0477 | 1.5435 | 0.7471 | 0.5160 | 0.5133 | 1.0587 | 0.3885 | 0.0739 | -0.1089 |
| BHAR (0) |  | 0.80\% | 0.26\% | -0.20\% | 0.25\% | 1.24\% | 1.05\% | -0.15\% | 1.41\% | 0.77\% | -0.03\% | 1.22\% | 0.40\% | 0.97\% | 0.60\% | 0.26\% | 0.21\% |
|  |  | 1.2587 | 0.3033 | -0.2815 | 0.2820 | 1.5043 | 1.3568 | -0.1993 | 1.9847 | 1.0640 | -0.0369 | 1.7816 | 0.5385 | 1.2141 | 0.7729 | 0.3281 | 0.2683 |
| BHAR (1) |  | 0.97\% | 0.46\% | -0.31\% | 0.58\% | 1.25\% | 0.68\% | 0.29\% | 1.20\% | 0.35\% | -0.15\% | 0.81\% | -0.01\% | 0.35\% | 0.40\% | -0.14\% | -0.03\% |
|  |  | 1.7415 | 0.6067 | -0.4628 | 0.6637 | 1.7339 | 0.8580 | 0.4353 | 1.8001 | 0.5133 | -0.1835 | 1.2126 | -0.0108 | 0.4603 | 0.5430 | -0.1700 | -0.0419 |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.48\% | 0.60\% | 0.60\% | 0.42\% | 1.11\% | 1.02\% | 0.77\% | 0.51\% | 0.95\% | 0.69\% | 0.46\% | 0.29\% | 0.89\% | 0.68\% | 0.49\% | 0.24\% |
|  |  | 1.3537 | 1.8719 | 1.9364 | 1.4826 | 2.5840 | 2.4505 | 1.8975 | 1.2593 | 1.9783 | 1.4559 | 0.9667 | 0.6285 | 1.8751 | 1.3962 | 1.0006 | 0.5053 |
| CAR (1) |  | 0.56\% | 0.65\% | 0.64\% | 0.32\% | 1.16\% | 0.99\% | 0.63\% | 0.42\% | 0.94\% | 0.56\% | 0.35\% | 0.19\% | 0.70\% | 0.57\% | 0.33\% | 0.10\% |
|  |  | 1.6351 | 1.7933 | 2.0032 | 1.0251 | 2.5662 | 2.2716 | 1.4855 | 0.9953 | 1.9415 | 1.1193 | 0.7077 | 0.4081 | 1.4427 | 1.1414 | 0.6696 | 0.2202 |
| BHAR (0) |  | -0.25\% | 0.39\% | 0.64\% | 0.31\% | 0.48\% | 1.28\% | 0.13\% | 1.49\% | 0.51\% | 0.35\% | 0.43\% | $\mathbf{0 . 4 1 \%}$ | 0.50\% | 0.58\% | 0.43\% | 0.34\% |
|  |  | -0.5378 | 0.6862 | 1.4927 | 0.8141 | 0.8648 | 2.7556 | 0.2404 | 3.8614 | 0.8977 | 0.5703 | 0.7790 | 0.6793 | 0.9876 | 1.1100 | 0.8409 | 0.5754 |
| BHAR (1) |  | 0.54\% | 0.95\% | 0.67\% | 0.37\% | 1.04\% | 1.27\% | 0.41\% | 1.27\% | 1.05\% | 0.60\% | 0.32\% | 0.89\% | 0.59\% | 0.46\% | 0.30\% | 0.26\% |
|  |  | 1.3716 | 2.0140 | 1.5747 | 0.9237 | 2.0308 | 2.8315 | 0.8220 | 2.8678 | 2.0128 | 1.0940 | 0.6023 | 1.5977 | 1.1401 | 0.8297 | 0.5675 | 0.4287 |



| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.07\% | 0.18\% | 0.29\% | 0.36\% | 0.26\% | 0.42\% | 0.50\% | 0.39\% | 0.43\% | 0.60\% | 0.62\% | 0.47\% | 0.60\% | 0.49\% | 0.42\% | 0.28\% |
|  |  | 0.2272 | 0.7386 | 1.4443 | 1.8999 | 0.7766 | 1.4320 | 1.9200 | 1.5902 | 1.1502 | 1.7619 | 1.9687 | 1.5546 | 1.5665 | 1.3238 | 1.1967 | 0.8198 |
| CAR (1) |  | 0.07\% | 0.25\% | 0.39\% | 0.32\% | 0.44\% | 0.53\% | 0.54\% | 0.35\% | 0.54\% | 0.69\% | 0.59\% | 0.38\% | 0.53\% | 0.52\% | 0.35\% | 0.21\% |
|  |  | 0.2260 | 1.0259 | 1.8787 | 1.6045 | 1.2841 | 1.7862 | 1.9764 | 1.3878 | 1.4346 | 1.9943 | 1.7837 | 1.2205 | 1.4152 | 1.4227 | 0.9904 | 0.6022 |
| BHAR (0) |  | -0.03\% | 0.29\% | 0.29\% | 0.66\% | 0.21\% | 0.41\% | 0.39\% | 0.61\% | 0.36\% | 0.47\% | 0.45\% | 0.42\% | 0.42\% | 0.49\% | 0.68\% | 0.32\% |
|  |  | -0.0680 | 0.7567 | 0.7742 | 1.6308 | 0.5384 | 1.0442 | 1.0325 | 1.7559 | 0.8126 | 1.1040 | 1.1682 | 1.0455 | 0.9823 | 1.2756 | 1.6298 | 0.7483 |
| BHAR (1) |  | -0.01\% | 0.28\% | 0.61\% | 0.57\% | 0.55\% | 0.67\% | 0.46\% | 0.47\% | 0.47\% | 0.64\% | 0.54\% | 0.25\% | 0.51\% | 0.36\% | 0.67\% | 0.28\% |
|  |  | -0.0254 | 0.7460 | 1.9704 | 1.4877 | 1.3804 | 1.8516 | 1.1702 | 1.2633 | 1.1566 | 1.7253 | 1.3908 | 0.6574 | 1.2156 | 0.9585 | 1.6869 | 0.6860 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.69\% | 0.46\% | 0.57\% | 0.58\% | 0.14\% | 0.11\% | 0.28\% | 0.24\% | 0.09\% | 0.20\% | 0.22\% | 0.20\% | 0.15\% | 0.26\% | 0.30\% | 0.30\% |
|  |  | 1.2956 | 1.1596 | 1.7205 | 1.9498 | 0.2649 | 0.2519 | 0.7449 | 0.7113 | 0.1776 | 0.4276 | 0.5271 | 0.5288 | 0.2698 | 0.5522 | 0.6729 | 0.7029 |
| CAR (1) |  | 0.84\% | 0.50\% | 0.66\% | 0.55\% | -0.01\% | 0.25\% | 0.31\% | 0.25\% | 0.16\% | 0.28\% | 0.24\% | 0.19\% | 0.30\% | 0.32\% | $\mathbf{0 . 3 2 \%}$ | 0.34\% |
|  |  | 1.7880 | 1.3248 | 2.0063 | 1.9218 | -0.0134 | 0.5969 | 0.8484 | 0.7600 | 0.3293 | 0.6523 | 0.6218 | 0.5268 | 0.5765 | 0.7121 | 0.7440 | 0.8118 |
| BHAR (0) |  | 0.69\% | 0.13\% | 0.13\% | 0.78\% | 0.15\% | 0.57\% | 0.27\% | 0.60\% | 0.05\% | 0.19\% | 0.72\% | 0.38\% | -0.07\% | 0.32\% | 0.13\% | 0.64\% |
|  |  | 1.1606 | 0.2418 | 0.3259 | 1.4221 | 0.2625 | 0.9930 | 0.5161 | 1.1506 | 0.0921 | 0.3651 | 1.4101 | 0.8943 | -0.1198 | 0.6080 | 0.2384 | 1.1180 |
| BHAR (1) |  | 1.34\% | 0.35\% | 0.34\% | 0.97\% | 0.10\% | 0.94\% | 0.53\% | 0.62\% | $0.21 \%$ | $0.22 \%$ | $0.71 \%$ | 0.34\% | $0.24 \%$ | $0.34 \%$ | $0.14 \%$ | 0.62\% |
|  |  | 2.6087 | 0.7680 | 0.9157 | 1.8552 | 0.1935 | 1.6965 | 1.0456 | 1.2346 | $0.4658$ | $0.4688$ | $1.5473$ | 0.8313 | $0.4781$ | $0.6628$ | $0.2716$ | $1.0783$ |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.08\% | 0.19\% | 0.04\% | 0.05\% | 0.22\% | 0.04\% | -0.03\% | -0.11\% | 0.07\% | 0.09\% | -0.04\% | -0.14\% | 0.06\% | -0.08\% | -0.17\% | -0.16\% |
|  |  | 0.1978 | 0.7675 | 0.1918 | 0.2434 | 0.5710 | 0.1122 | -0.0876 | -0.3618 | 0.1659 | 0.2337 | -0.1188 | -0.4467 | 0.1481 | -0.2133 | -0.4975 | -0.5001 |
| CAR (1) |  | -0.06\% | 0.18\% | 0.03\% | -0.01\% | 0.10\% | 0.01\% | -0.08\% | -0.15\% | 0.05\% | 0.05\% | -0.09\% | -0.16\% | -0.02\% | -0.14\% | -0.20\% | -0.15\% |
|  |  | -0.1343 | 0.7708 | 0.1564 | -0.0342 | 0.2537 | 0.0276 | -0.2588 | -0.5418 | 0.1082 | 0.1216 | -0.2650 | -0.5657 | -0.0555 | -0.3525 | -0.5868 | -0.5005 |
| BHAR (0) |  | -0.02\% | 0.12\% | 0.48\% | 0.02\% | 0.18\% | 0.01\% | $-0.23 \%$ | $\mathbf{0 . 0 0 \%}$ | 0.29\% | 0.15\% | 0.09\% | -0.27\% | 0.23\% | 0.13\% | 0.14\% | $0.05 \%$ |
|  |  | -0.0354 | 0.3101 | 1.6540 | 0.0511 | 0.4064 | 0.0306 | -0.4936 | -0.0103 | 0.6472 | 0.3368 | 0.2193 | -0.5604 | 0.5389 | 0.3298 | 0.3257 | $0.1492$ |
| BHAR (1) |  | -0.21\% | -0.22\% | 0.47\% | -0.06\% | -0.06\% | -0.08\% | -0.34\% | 0.11\% | 0.07\% | -0.01\% | 0.22\% | -0.38\% | 0.03\% | 0.10\% | -0.13\% | 0.09\% |
|  |  | -0.4822 | -0.5276 | 1.5870 | -0.1500 | -0.1381 | -0.2063 | -0.7265 | 0.2963 | 0.1727 | -0.0321 | 0.5733 | -0.8139 | 0.0760 | 0.2286 | -0.3098 | 0.2423 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.04\% | -0.18\% | 0.03\% | 0.22\% | -0.02\% | -0.01\% | 0.26\% | 0.31\% | 0.02\% | 0.21\% | 0.42\% | 0.45\% | 0.54\% | 0.47\% | 0.49\% | 0.53\% |
|  |  | -0.1518 | -0.6950 | 0.1437 | 1.0661 | -0.0636 | -0.0281 | 0.8639 | 1.2565 | 0.0578 | 0.5803 | 1.3109 | 1.5161 | 1.4107 | 1.2934 | 1.4191 | 1.6171 |
| CAR (1) |  | -0.11\% | -0.17\% | 0.15\% | 0.24\% | -0.04\% | 0.11\% | 0.38\% | 0.33\% | 0.24\% | 0.36\% | 0.50\% | 0.45\% | 0.54\% | 0.45\% | 0.50\% | 0.53\% |
|  |  | -0.3638 | -0.6202 | 0.5993 | 1.2400 | $-0.1230$ | 0.3213 | 1.3083 | 1.3131 | 0.5892 | 0.9750 | 1.5853 | 1.5159 | 1.4499 | 1.2510 | 1.4563 | 1.6082 |
| BHAR (0) |  | -0.54\% | -0.60\% | -0.08\% | $\mathbf{- 0 . 2 0 \%}$ | -0.49\% | -0.31\% | -0.08\% | 0.80\% | -0.38\% | 0.08\% | 0.51\% | 0.50\% | 0.48\% | 0.81\% | 0.91\% | 0.65\% |
|  |  | -1.3444 | -1.5015 | -0.1870 | -0.5135 | -1.2140 | -0.7082 | -0.1565 | 1.8185 | -0.8331 | 0.1817 | 1.4177 | 1.3109 | 1.2437 | 2.1874 | 2.2345 | 1.9096 |
| BHAR (1) |  | -0.14\% | -0.58\% | 0.00\% | 0.00\% | -0.37\% | -0.04\% | 0.01\% | 0.72\% | -0.07\% | 0.04\% | 0.41\% | 0.32\% | 0.43\% | 0.61\% | 0.82\% | 0.49\% |
|  |  | -0.3970 | -1.4424 | -0.0028 | -0.0087 | -0.8736 | -0.0960 | 0.0126 | 1.6692 | -0.1672 | 0.0976 | 1.0501 | 0.8018 | 1.1041 | 1.6421 | 1.9972 | 1.4107 |


| MW | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.81\% | 0.50\% | 0.26\% | 0.24\% | 0.70\% | 0.27\% | 0.19\% | 0.09\% | 0.48\% | 0.22\% | 0.05\% | -0.04\% | 0.13\% | -0.03\% | -0.20\% | -0.22\% |
|  |  | 1.9984 | 1.6037 | 0.9006 | 0.8648 | 1.6854 | 0.7408 | 0.5124 | 0.2464 | 0.9942 | 0.4879 | 0.1165 | -0.0791 | 0.2470 | -0.0565 | -0.3535 | -0.3908 |
| CAR (1) |  | 0.60\% | 0.34\% | 0.17\% | 0.11\% | 0.49\% | 0.24\% | 0.08\% | 0.02\% | 0.34\% | 0.06\% | -0.04\% | -0.18\% | -0.16\% | -0.20\% | -0.33\% | -0.26\% |
|  |  | 1.6734 | 1.1965 | 0.6124 | 0.3912 | 1.2500 | 0.6350 | 0.2076 | 0.0449 | 0.7463 | 0.1368 | -0.0861 | -0.3694 | -0.2885 | -0.3501 | -0.5648 | -0.4528 |
| BHAR (0) |  | 0.87\% | 0.52\% | 0.58\% | 0.02\% | 0.58\% | $\mathbf{0 . 5 1 \%}$ | 0.36\% | 0.11\% | $\mathbf{0 . 4 1 \%}$ | -0.33\% | -0.23\% | -0.34\% | 0.18\% | 0.39\% | -0.02\% | -0.14\% |
|  |  | 1.7206 | 1.0532 | 1.1913 | 0.0434 | 1.3362 | 1.2003 | 0.7507 | 0.2065 | 0.8759 | -0.6487 | -0.4566 | -0.5369 | 0.3425 | 0.6755 | -0.0388 | -0.2105 |
| BHAR (1) |  | 0.69\% | 0.34\% | 0.57\% | 0.01\% | 0.55\% | 0.42\% | 0.43\% | -0.02\% | 0.20\% | -0.26\% | -0.40\% | -0.41\% | -0.02\% | 0.20\% | -0.19\% | -0.25\% |
|  |  | 1.4784 | 0.6658 | 1.2863 | 0.0214 | 1.3433 | 0.9476 | 0.9121 | -0.0291 | 0.4318 | -0.4757 | -0.7229 | -0.6190 | -0.0357 | 0.3261 | -0.3337 | -0.3667 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.03\% | 0.25\% | 0.32\% | 0.40\% | 0.30\% | 0.41\% | 0.52\% | 0.46\% | 0.38\% | 0.49\% | 0.45\% | 0.37\% | 0.54\% | 0.50\% | 0.46\% | 0.33\% |
|  |  | -0.1231 | 1.2452 | 1.7573 | 2.4463 | 1.0471 | 1.5655 | 2.1935 | 2.1131 | 1.2769 | 1.7104 | 1.6503 | 1.4367 | 1.7891 | 1.6717 | 1.5843 | 1.2400 |
| CAR (1) |  | 0.15\% | 0.36\% | 0.43\% | 0.39\% | 0.32\% | 0.52\% | 0.56\% | 0.41\% | 0.52\% | 0.53\% | 0.45\% | 0.30\% | 0.53\% | 0.47\% | 0.38\% | 0.26\% |
|  |  | 0.6953 | 1.8412 | 2.3447 | 2.4363 | 1.2043 | 2.0091 | 2.3627 | 1.9029 | 1.7255 | 1.8643 | 1.6592 | 1.2035 | 1.7371 | 1.5670 | 1.3364 | 0.9853 |
| BHAR (0) |  | $\mathbf{- 0 . 1 1 \%}$ | 0.18\% | -0.10\% | 0.28\% | 0.20\% | 0.31\% | 0.43\% | 0.71\% | 0.36\% | 0.30\% | 0.42\% | 0.36\% | 0.61\% | 0.80\% | 0.42\% | 0.51\% |
|  |  | -0.3904 | 0.6205 | -0.3441 | 0.8675 | 0.6708 | 0.9962 | 1.4554 | 2.6519 | 1.0764 | 0.8663 | 1.4251 | 1.0690 | 1.8698 | 2.4493 | 1.3024 | 1.5679 |
| BHAR (1) |  | 0.09\% | 0.19\% | 0.10\% | 0.36\% | 0.34\% | 0.49\% | 0.51\% | 0.63\% | $0.51 \%$ | $0.41 \%$ | $0.35 \%$ | $0.11 \%$ | $0.40 \%$ | $0.62 \%$ | $0.34 \%$ | 0.30\% |
|  |  | 0.3547 | 0.6674 | 0.3431 | 1.1720 | 1.2002 | 1.6261 | 1.7585 | 2.3251 | $1.4364$ | $1.1392$ | $1.1291$ | $0.3216$ | $1.2056$ | $1.9710$ | $1.0859$ | $0.9516$ |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.00\% | 0.16\% | 0.18\% | 0.37\% | 0.07\% | 0.23\% | 0.41\% | 0.40\% | 0.15\% | 0.42\% | 0.40\% | 0.29\% | 0.51\% | 0.44\% | 0.29\% | 0.18\% |
|  |  | -0.0072 | 0.5486 | 0.6863 | 1.6152 | 0.1760 | 0.6398 | 1.2855 | 1.3850 | 0.3407 | 1.0547 | 1.0913 | 0.8679 | 1.1403 | 1.0469 | 0.7342 | 0.4986 |
| CAR (1) |  | 0.01\% | 0.18\% | 0.30\% | 0.36\% | 0.24\% | 0.37\% | 0.49\% | 0.37\% | 0.40\% | 0.50\% | 0.43\% | 0.24\% | 0.47\% | 0.37\% | 0.21\% | 0.10\% |
|  |  | 0.0144 | 0.5895 | 1.1031 | 1.5844 | 0.6369 | 1.0390 | 1.5562 | 1.3064 | 0.9382 | 1.2798 | 1.1710 | 0.7315 | 1.0653 | 0.9090 | 0.5389 | 0.2799 |
| BHAR (0) |  | -0.21\% | 0.07\% | 0.19\% | $\mathbf{0 . 1 5 \%}$ | $0.13 \%$ | $0.33 \%$ | $0.35 \%$ | $\mathbf{0 . 6 9 \%}$ | $0.03 \%$ | $0.23 \%$ | 0.45\% | 0.47\% | $0.37 \%$ | $\mathbf{0 . 4 2 \%}$ | 0.24\% | 0.32\% |
|  |  | -0.5204 | 0.1636 | 0.4928 | 0.4042 | 0.3105 | 0.8408 | 0.7766 | 2.3511 | 0.0654 | 0.4670 | 1.1621 | 1.1391 | 0.7682 | 0.9615 | 0.5210 | 0.7158 |
| BHAR (1) |  | 0.12\% | 0.09\% | 0.29\% | 0.32\% | 0.20\% | 0.33\% | 0.51\% | 0.53\% | 0.32\% | 0.29\% | 0.28\% | 0.34\% | 0.29\% | 0.13\% | -0.04\% | 0.01\% |
|  |  | 0.3042 | 0.2244 | 0.7755 | 0.9143 | 0.5305 | 0.8851 | 1.2802 | 1.7435 | 0.7543 | 0.6633 | 0.7165 | 0.8466 | 0.6405 | 0.2974 | -0.0901 | 0.0260 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.36\% | -0.11\% | 0.08\% | 0.10\% | -0.16\% | 0.14\% | 0.25\% | 0.19\% | 0.19\% | 0.31\% | 0.30\% | 0.21\% | 0.23\% | 0.24\% | 0.20\% | 0.12\% |
|  |  | -1.6250 | -0.5879 | 0.4917 | 0.6464 | -0.5719 | 0.5736 | 1.1015 | 0.8854 | 0.6539 | 1.0714 | 1.0786 | 0.7870 | 0.7258 | 0.7708 | 0.6619 | 0.4281 |
| CAR (1) |  | -0.24\% | 0.03\% | 0.17\% | 0.10\% | 0.10\% | 0.33\% | 0.32\% | 0.21\% | 0.38\% | 0.38\% | 0.31\% | 0.18\% | 0.26\% | 0.27\% | 0.19\% | 0.10\% |
|  |  | -1.0455 | 0.1765 | 1.0656 | 0.6854 | 0.3680 | 1.3278 | 1.3764 | 0.9396 | 1.2541 | 1.2819 | 1.1013 | 0.7064 | 0.8268 | 0.8539 | 0.6371 | 0.3539 |
| BHAR (0) |  | -0.53\% | -0.03\% | -0.32\% | 0.17\% | -0.22\% | 0.03\% | -0.17\% | 0.41\% | 0.15\% | 0.27\% | 0.45\% | 0.26\% | 0.33\% | 0.39\% | 0.31\% | 0.23\% |
|  |  | -1.9092 | -0.1162 | -1.0324 | 0.6179 | -0.6819 | 0.1007 | -0.5398 | 1.8696 | 0.4801 | 0.8284 | 1.6398 | 0.9114 | 1.0023 | 1.2072 | 0.9779 | 0.6942 |
| BHAR (1) |  | -0.22\% | -0.19\% | -0.25\% | 0.13\% | -0.05\% | 0.17\% | -0.11\% | 0.30\% | 0.34\% | 0.22\% | 0.31\% | 0.04\% | 0.18\% | 0.21\% | 0.14\% | 0.07\% |
|  |  | -0.8307 | -0.6383 | -0.8467 | 0.4227 | -0.1540 | 0.6573 | -0.3341 | 1.3277 | 1.0055 | 0.5909 | 1.0446 | 0.1440 | 0.5135 | 0.6339 | 0.4409 | 0.1972 |

Panel C. The cross-sectional momentum strategy using inversed volatility-weighted return


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.88\% | 0.88\% | 0.78\% | 0.76\% | 1.27\% | 1.12\% | 1.06\% | 0.91\% | 1.33\% | 1.24\% | 1.05\% | 0.87\% | 1.37\% | 1.14\% | 0.94\% | 0.76\% |
|  |  | 5.6590 | 5.8678 | 5.2885 | 5.8460 | 6.8195 | 5.9327 | 6.0028 | 5.4661 | 6.2437 | 5.8059 | 5.0372 | 4.4014 | 6.0962 | 4.9590 | 4.2141 | 3.6253 |
| CAR (1) |  | 0.87\% | 0.87\% | 0.79\% | 0.72\% | 1.24\% | 1.07\% | 0.99\% | 0.82\% | 1.31\% | 1.14\% | 0.95\% | 0.75\% | 1.24\% | 1.00\% | 0.82\% | 0.63\% |
|  |  | 5.4462 | 5.7538 | 5.3824 | 5.5833 | 6.4820 | 5.5679 | 5.6130 | 4.8975 | 5.9050 | 5.2670 | 4.5358 | 3.7996 | 5.5042 | 4.3146 | 3.7242 | 3.0619 |
| BHAR (0) |  | 0.90\% | 0.91\% | 0.67\% | 0.72\% | 1.28\% | 0.94\% | 1.08\% | 1.13\% | 1.26\% | 1.17\% | 1.13\% | 0.90\% | 1.37\% | 1.16\% | 0.90\% | 0.73\% |
|  |  | 5.0490 | 4.5060 | 3.3366 | 3.2577 | 5.9415 | 3.9510 | 4.7172 | 5.3121 | 5.6144 | 4.7542 | 4.8056 | 4.0853 | 5.3474 | 4.8428 | 3.7527 | 2.9851 |
| BHAR (1) |  | 0.88\% | 0.89\% | 0.78\% | 0.75\% | 1.19\% | 0.96\% | 0.95\% | 0.95\% | 1.24\% | 1.11\% | 1.06\% | 0.70\% | 1.30\% | 0.96\% | 0.83\% | 0.51\% |
|  |  | 5.2638 | 4.3802 | 3.6495 | 3.2952 | 6.0988 | 4.2549 | 4.3282 | 5.1135 | 5.3430 | 4.7059 | 4.8816 | 3.0589 | 5.4745 | 3.9228 | 3.4269 | 2.1365 |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.55\% | 0.55\% | 0.55\% | 0.48\% | 0.80\% | 0.74\% | 0.68\% | 0.54\% | 0.88\% | 0.77\% | 0.61\% | 0.45\% | 0.81\% | 0.63\% | 0.52\% | 0.37\% |
|  |  | 2.5043 | 3.0175 | 3.4423 | 3.2593 | 3.2738 | 3.3286 | 3.2506 | 2.6265 | 3.2875 | 2.9449 | 2.3235 | 1.7697 | 2.6640 | 2.1191 | 1.7475 | 1.3184 |
| CAR (1) |  | 0.63\% | 0.58\% | 0.56\% | 0.44\% | 0.83\% | 0.72\% | 0.64\% | 0.45\% | 0.90\% | 0.70\% | 0.51\% | 0.35\% | 0.75\% | 0.52\% | 0.41\% | 0.30\% |
|  |  | 2.9561 | 3.3997 | 3.6653 | 2.9953 | 3.5413 | 3.3584 | 2.9624 | 2.1442 | 3.3251 | 2.5924 | 1.8882 | 1.3767 | 2.4242 | 1.7083 | 1.3765 | 1.0791 |
| BHAR (0) |  | 0.33\% | 0.40\% | 0.43\% | 0.03\% | 0.82\% | 0.83\% | 0.73\% | 0.88\% | 0.90\% | 0.50\% | 0.56\% | 0.45\% | 0.79\% | 0.90\% | 0.56\% | 0.69\% |
|  |  | 1.0070 | 1.3726 | 1.8131 | 0.0735 | 2.9732 | 3.3880 | 2.9124 | 3.3210 | 3.3145 | 1.5620 | 1.8795 | 1.4516 | 2.5237 | 2.8848 | 1.7572 | 2.2256 |
| BHAR (1) |  | 0.88\% | 0.42\% | 0.59\% | 0.05\% | 1.02\% | 0.87\% | 0.68\% | 0.77\% | 0.92\% | 0.45\% | 0.39\% | 0.43\% | 0.76\% | 0.76\% | 0.30\% | 0.58\% |
|  |  | 4.0646 | 1.7108 | 2.7661 | 0.1623 | 4.1123 | 3.6850 | 2.6734 | 3.0448 | 3.3022 | 1.3738 | 1.2800 | 1.4078 | 2.4122 | 2.4376 | 0.9341 | 1.9691 |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.08\% | 0.16\% | 0.21\% | 0.36\% | 0.42\% | 0.37\% | 0.48\% | 0.47\% | 0.57\% | 0.64\% | 0.57\% | 0.37\% | 0.80\% | 0.55\% | 0.30\% | 0.25\% |
|  |  | -0.3442 | 0.7962 | 1.1488 | 2.3468 | 1.6004 | 1.4081 | 2.1197 | 2.3422 | 1.9742 | 2.4012 | 2.3035 | 1.6300 | 2.7679 | 1.8263 | 0.9939 | 0.9758 |
| CAR (1) |  | 0.25\% | 0.32\% | 0.26\% | 0.34\% | 0.54\% | 0.45\% | 0.53\% | 0.42\% | 0.73\% | 0.68\% | 0.51\% | 0.28\% | 0.75\% | 0.44\% | $\mathbf{0 . 2 1 \%}$ | 0.16\% |
|  |  | 1.0580 | 1.5456 | 1.4047 | 2.0667 | 2.1022 | 1.8866 | 2.3858 | 2.0232 | 2.6831 | 2.6154 | 2.0852 | 1.2313 | 2.5612 | 1.4383 | 0.7028 | 0.6273 |
| BHAR (0) |  | 0.21\% | -0.28\% | 0.49\% | -0.39\% | 0.43\% | 0.15\% | 0.22\% | 0.17\% | 0.50\% | 0.75\% | 0.68\% | 0.90\% | 0.88\% | 0.45\% | 0.67\% | 0.17\% |
|  |  | 0.7145 | -0.7794 | 1.4584 | -0.9883 | 1.6562 | 0.4148 | 0.7077 | 0.3716 | 1.8461 | 2.3914 | 1.9616 | 2.5851 | 2.6540 | 1.0690 | 2.3293 | 0.3526 |
| BHAR (1) |  | 0.14\% | -0.27\% | 0.41\% | -0.21\% | 0.36\% | 0.28\% | 0.40\% | 0.45\% | 0.62\% | 0.72\% | 0.43\% | 0.49\% | 0.64\% | 0.00\% | 0.49\% | -0.04\% |
|  |  | 0.5071 | -0.6845 | 1.0009 | -0.5153 | 1.2283 | 0.8600 | 1.2172 | 1.1667 | 2.2376 | 2.0770 | 1.2634 | 1.3652 | 1.9401 | -0.0063 | 1.6235 | -0.0702 |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.89\% | 0.62\% | 0.68\% | 0.63\% | 1.05\% | 0.99\% | 0.96\% | 0.83\% | 1.20\% | 1.13\% | 0.98\% | 0.76\% | 1.30\% | 1.10\% | 0.87\% | 0.71\% |
|  |  | 3.9427 | 3.1073 | 3.5703 | 3.5917 | 3.9859 | 3.9515 | 3.9617 | 3.6071 | 4.1690 | 3.9348 | 3.3625 | 2.8718 | 4.1556 | 3.5182 | 2.9086 | 2.5273 |
| CAR (1) |  | 0.92\% | 0.63\% | 0.74\% | 0.63\% | 1.10\% | 1.03\% | 0.94\% | 0.77\% | 1.23\% | 1.09\% | 0.89\% | 0.68\% | 1.22\% | 0.99\% | 0.76\% | 0.62\% |
|  |  | 4.2389 | 3.0909 | 3.8239 | 3.4615 | 4.4365 | 4.1207 | 3.8609 | 3.3998 | 4.2440 | 3.6849 | 3.0730 | 2.5666 | 3.8394 | 3.1794 | 2.5349 | 2.2398 |
| BHAR (0) |  | 0.74\% | 0.23\% | 0.40\% | -0.47\% | 1.04\% | 1.05\% | 1.00\% | 1.11\% | 1.19\% | 1.12\% | 0.96\% | 0.75\% | 1.24\% | 1.03\% | 0.91\% | 0.61\% |
|  |  | 2.7323 | 0.8069 | 1.5379 | -1.2237 | 3.5251 | 3.5134 | 2.9165 | 4.1745 | 3.6975 | 3.4490 | 3.3060 | 2.2704 | 3.9695 | 3.3806 | 2.9311 | 2.1514 |
| BHAR (1) |  | 1.02\% | 0.55\% | 0.79\% | 0.63\% | 1.01\% | 1.04\% | 0.97\% | 0.92\% | 1.17\% | 0.98\% | 0.74\% | $\mathbf{0 . 4 9 \%}$ | 1.13\% | 0.96\% | 0.67\% | 0.58\% |
|  |  | 3.9635 | 2.0809 | 3.5012 | 2.4688 | 3.7232 | 3.3812 | 2.8698 | 3.3156 | 3.8722 | 2.9544 | 2.5427 | 1.4690 | 3.6441 | 3.3157 | 2.2147 | 2.0386 |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 6 |  | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.42\% | 0.45\% | 0.35\% | 0.25\% | 0.59\% | 0.49\% | 0.33\% | 0.10\% | 0.55\% | 0.38\% | 0.11\% | -0.06\% | 0.39\% | 0.09\% | -0.10\% | -0.20\% |
|  |  | 1.1863 | 1.4929 | 1.3170 | 0.9972 | 1.4894 | 1.3408 | 0.9857 | 0.3235 | 1.3848 | 0.9947 | 0.3008 | -0.1741 | 0.9168 | 0.2203 | -0.2454 | -0.5196 |
| CAR (1) |  | 0.43\% | 0.46\% | 0.36\% | 0.21\% | 0.56\% | 0.46\% | 0.24\% | 0.02\% | 0.64\% | 0.31\% | 0.04\% | -0.13\% | 0.26\% | -0.02\% | -0.15\% | -0.24\% |
|  |  | 1.2249 | 1.5692 | 1.3756 | 0.8380 | 1.4325 | 1.3072 | 0.7438 | 0.0493 | 1.6146 | 0.8143 | 0.1132 | -0.3777 | 0.6157 | -0.0470 | -0.3716 | -0.6074 |
| BHAR (0) |  | 0.21\% | 0.78\% | 0.37\% | 0.50\% | 0.57\% | 0.63\% | 0.34\% | 0.37\% | 0.64\% | 0.46\% | 0.06\% | 0.09\% | 0.47\% | -0.13\% | -0.11\% | -0.69\% |
|  |  | 0.4649 | 2.0460 | 0.8981 | 1.3014 | 1.3753 | 1.4359 | 0.8256 | 0.7957 | 1.5466 | 1.1868 | 0.1292 | 0.2412 | 1.0594 | -0.2666 | -0.2598 | -1.4551 |
| BHAR (1) |  | 0.56\% | 0.79\% | 0.25\% | 0.64\% | 0.56\% | 0.51\% | 0.30\% | 0.21\% | 0.78\% | 0.47\% | 0.32\% | -0.06\% | 0.33\% | -0.21\% | -0.24\% | -0.58\% |
|  |  | 1.3386 | 1.8335 | 0.6203 | 1.5386 | 1.3966 | 1.2662 | 0.7045 | 0.4905 | 1.8687 | 1.1605 | 0.7826 | -0.1495 | 0.7626 | -0.4452 | -0.6399 | -1.2832 |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.38\% | 0.45\% | 0.34\% | 0.14\% | 0.64\% | 0.42\% | 0.16\% | -0.05\% | 0.52\% | 0.25\% | -0.02\% | -0.22\% | 0.26\% | 0.00\% | -0.24\% | -0.39\% |
|  |  | 1.2106 | 1.9281 | 1.6661 | 0.6833 | 1.8433 | 1.3053 | 0.5307 | -0.1644 | 1.3618 | 0.6925 | -0.0639 | -0.7295 | 0.6454 | -0.0036 | -0.7033 | -1.2749 |
| CAR (1) |  | 0.36\% | 0.46\% | 0.26\% | 0.04\% | 0.68\% | 0.42\% | 0.10\% | -0.11\% | 0.40\% | 0.09\% | -0.18\% | -0.36\% | 0.11\% | -0.15\% | -0.38\% | -0.49\% |
|  |  | 1.2640 | 2.1470 | 1.2240 | 0.2325 | 2.0613 | 1.2705 | 0.3134 | -0.3858 | 1.0340 | 0.2449 | -0.5265 | -1.1984 | 0.2811 | -0.4112 | -1.1469 | -1.6656 |
| BHAR (0) |  | 0.30\% | 0.21\% | -0.08\% | 0.20\% | 0.50\% | 0.42\% | -0.02\% | 0.18\% | 0.58\% | 0.25\% | 0.16\% | -0.24\% | 0.22\% | 0.25\% | -0.14\% | -0.21\% |
|  |  | 0.8616 | 0.5264 | -0.2329 | 0.5959 | 1.2126 | 1.1988 | -0.0452 | 0.6423 | 1.3866 | 0.5497 | 0.4384 | -0.6091 | 0.4807 | 0.6560 | -0.3614 | -0.6509 |
| BHAR (1) |  | 0.20\% | 0.03\% | -0.13\% | 0.07\% | 0.43\% | 0.35\% | -0.20\% | 0.01\% | 0.21\% | 0.05\% | -0.10\% | -0.44\% | -0.05\% | 0.10\% | -0.31\% | -0.30\% |
|  |  | 0.5719 | 0.0963 | -0.4071 | 0.2296 | 1.1304 | 1.0653 | -0.5216 | 0.0534 | 0.5260 | 0.1165 | -0.2927 | -1.2129 | -0.1128 | 0.2880 | -0.8244 | -0.9587 |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.55\% | 0.44\% | 0.47\% | 0.56\% | 0.81\% | 0.65\% | 0.78\% | 0.69\% | 0.95\% | 0.88\% | 0.76\% | 0.59\% | 0.96\% | 0.81\% | 0.64\% | 0.52\% |
|  |  | 2.0944 | 1.5689 | 2.0422 | 2.9707 | 2.3948 | 1.9813 | 2.7644 | 2.6316 | 2.6410 | 2.5562 | 2.3418 | 1.9656 | 2.5173 | 2.1528 | 1.8035 | 1.5599 |
| CAR (1) |  | 0.45\% | 0.38\% | 0.43\% | 0.43\% | 0.74\% | 0.67\% | 0.73\% | 0.56\% | 0.97\% | 0.84\% | 0.67\% | 0.51\% | 0.91\% | 0.73\% | 0.55\% | 0.42\% |
|  |  | 1.4678 | 1.3214 | 1.9318 | 2.2416 | 2.1738 | 2.0773 | 2.5636 | 2.1172 | 2.6892 | 2.4136 | 2.0864 | 1.6805 | 2.3504 | 1.9434 | 1.5452 | 1.2689 |
| BHAR (0) |  | 0.30\% | -0.23\% | -0.23\% | 0.47\% | 0.69\% | 0.55\% | 0.36\% | 0.99\% | 0.83\% | 0.50\% | 1.04\% | 0.68\% | 1.04\% | 1.28\% | 0.77\% | 0.41\% |
|  |  | 0.8578 | -0.5391 | -0.5531 | 1.1668 | 1.7859 | 1.5212 | 0.8355 | 2.8678 | 2.1656 | 1.1370 | 2.9595 | 1.8412 | 2.5012 | 3.2475 | 1.7763 | 0.9661 |
| BHAR (1) |  | 0.04\% | -0.10\% | -0.10\% | 0.57\% | 0.59\% | 0.36\% | 0.18\% | 0.71\% | 0.64\% | 0.66\% | 0.74\% | 0.35\% | 0.88\% | 1.09\% | 0.52\% | 0.27\% |
|  |  | 0.1063 | -0.2888 | -0.2552 | 1.5025 | 1.6722 | 0.9642 | 0.4630 | 2.0747 | 1.7076 | 1.7136 | 2.0175 | 0.9403 | 2.2206 | 2.7117 | 1.1627 | 0.6037 |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.05\% | -0.07\% | -0.15\% | -0.20\% | 0.19\% | 0.12\% | -0.03\% | -0.15\% | 0.30\% | 0.21\% | 0.04\% | -0.11\% | 0.25\% | 0.19\% | 0.08\% | -0.03\% |
|  |  | 0.2335 | -0.3725 | -0.8248 | -1.2171 | 0.8386 | 0.5215 | -0.1199 | -0.7455 | 1.1650 | 0.6869 | 0.1358 | -0.4480 | 0.8304 | 0.6440 | 0.2944 | -0.1353 |
| CAR (1) |  | 0.19\% | 0.00\% | -0.13\% | -0.24\% | 0.25\% | 0.10\% | -0.08\% | -0.21\% | 0.36\% | 0.11\% | -0.04\% | -0.19\% | 0.22\% | 0.14\% | 0.00\% | -0.09\% |
|  |  | 1.0275 | -0.0142 | -0.7341 | -1.4774 | 0.9890 | 0.4146 | -0.3868 | -1.0585 | 1.3905 | 0.3898 | -0.1370 | -0.8235 | 0.7302 | 0.5014 | -0.0087 | -0.3623 |
| BHAR (0) |  | -0.20\% | -0.28\% | -0.14\% | -0.84\% | 0.06\% | 0.19\% | -0.20\% | 0.35\% | 0.37\% | 0.14\% | 0.37\% | 0.14\% | 0.28\% | 0.27\% | -0.07\% | -0.09\% |
|  |  | -0.7227 | -0.9395 | -0.4836 | -2.3484 | 0.2047 | 0.6999 | -0.6675 | 1.5292 | 1.2968 | 0.4413 | 1.1705 | 0.4844 | 0.8855 | 0.9478 | -0.2554 | -0.3151 |
| BHAR (1) |  | 0.28\% | -0.21\% | -0.31\% | -0.38\% | 0.33\% | 0.28\% | 0.01\% | 0.30\% | 0.30\% | -0.04\% | 0.15\% | -0.06\% | 0.32\% | 0.23\% | -0.10\% | -0.20\% |
|  |  | 1.2537 | -0.8379 | -0.9287 | -1.4338 | 1.2166 | 0.9715 | 0.0448 | 1.2103 | 1.0560 | -0.1236 | 0.4890 | -0.2140 | 0.9995 | 0.8173 | -0.3223 | -0.6793 |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.61\% | 0.57\% | 0.62\% | 0.59\% | 0.73\% | 0.76\% | 0.76\% | 0.67\% | 0.90\% | 0.84\% | 0.76\% | 0.61\% | 0.83\% | 0.78\% | 0.67\% | 0.52\% |
|  |  | 2.9784 | 3.2160 | 4.1704 | 4.3030 | 2.9653 | 3.6008 | 4.0288 | 3.7618 | 3.7948 | 3.8105 | 3.6029 | 3.0624 | 3.3642 | 3.2923 | 2.9809 | 2.4327 |
| CAR (1) |  | 0.58\% | 0.57\% | 0.59\% | 0.53\% | 0.75\% | 0.77\% | 0.71\% | 0.59\% | 0.91\% | $\mathbf{0 . 8 1 \%}$ | 0.68\% | $\mathbf{0 . 5 2 \%}$ | 0.83\% | 0.73\% | 0.58\% | 0.47\% |
|  |  | 3.0813 | 3.3859 | 4.1552 | 4.0428 | 3.3272 | 3.9172 | 3.8860 | 3.4468 | 3.9853 | 3.7135 | 3.2491 | 2.6286 | 3.4459 | 3.1491 | 2.6438 | 2.2242 |
| BHAR (0) |  | 0.59\% | 0.54\% | 0.65\% | 0.60\% | 0.66\% | 0.62\% | 0.71\% | 0.61\% | 0.81\% | 0.74\% | 0.90\% | 0.48\% | 0.79\% | 0.69\% | 0.81\% | 0.48\% |
|  |  | 2.4341 | 2.0892 | 2.7488 | 2.6672 | 2.3735 | 2.4211 | 2.9456 | 2.7396 | 3.1911 | 3.0060 | 3.7068 | 1.9547 | 3.1745 | 2.8265 | 3.4234 | 1.9534 |
| BHAR (1) |  | 0.56\% | 0.53\% | 0.76\% | 0.65\% | 0.69\% | 0.66\% | 0.73\% | 0.52\% | 0.84\% | 0.71\% | 0.77\% | 0.24\% | 0.81\% | 0.70\% | 0.69\% | 0.51\% |
|  |  | 2.6501 | 2.2585 | 3.3073 | 2.9442 | 2.7167 | 2.6430 | 3.0820 | 2.4297 | 3.4487 | 2.9194 | 3.3334 | 0.9267 | 3.2038 | 2.8889 | 2.7941 | 2.0961 |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.06\% | -0.18\% | -0.13\% | -0.02\% | -0.32\% | -0.26\% | -0.10\% | -0.11\% | -0.27\% | -0.14\% | -0.14\% | -0.19\% | -0.10\% | -0.20\% | -0.23\% | -0.27\% |
|  |  | -0.3359 | -0.9944 | -0.8028 | -0.1616 | -1.3230 | -1.1683 | -0.5111 | -0.6282 | -1.0389 | -0.5490 | -0.5936 | -0.9320 | -0.3858 | -0.7849 | -0.9957 | -1.2806 |
| CAR (1) |  | -0.01\% | -0.14\% | -0.04\% | -0.02\% | -0.21\% | -0.12\% | -0.03\% | -0.12\% | -0.04\% | -0.03\% | -0.10\% | -0.19\% | -0.05\% | -0.20\% | -0.24\% | -0.28\% |
|  |  | -0.0815 | -0.8333 | -0.2680 | -0.1275 | -0.9039 | -0.5496 | -0.1417 | -0.6884 | -0.1534 | -0.1360 | -0.4365 | -0.9973 | -0.1960 | -0.8060 | -1.0729 | -1.3653 |
| BHAR (0) |  | -0.17\% | 0.10\% | -0.11\% | 0.14\% | -0.24\% | -0.24\% | -0.17\% | 0.13\% | -0.19\% | -0.08\% | 0.05\% | -0.03\% | -0.12\% | -0.19\% | -0.24\% | -0.26\% |
|  |  | -0.7551 | 0.4393 | -0.4572 | 0.6495 | -0.8810 | -0.8879 | -0.6659 | 0.5941 | -0.6912 | -0.3090 | 0.2361 | -0.1505 | -0.4351 | -0.7227 | -0.9666 | -1.0843 |
| BHAR (1) |  | -0.09\% | 0.08\% | -0.14\% | 0.17\% | -0.27\% | -0.43\% | -0.12\% | 0.01\% | -0.14\% | 0.02\% | -0.03\% | -0.11\% | -0.13\% | -0.36\% | -0.38\% | -0.33\% |
|  |  | -0.4552 | 0.3649 | -0.6006 | 0.8448 | -1.0602 | -1.6319 | -0.5597 | 0.0560 | -0.5314 | 0.0610 | -0.1413 | -0.5391 | -0.5144 | -1.4013 | -1.5754 | -1.3555 |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.69\% | 0.55\% | 0.58\% | 0.58\% | 0.86\% | 0.79\% | 0.82\% | 0.73\% | 1.02\% | 1.00\% | 0.89\% | 0.78\% | 1.23\% | 1.06\% | 0.94\% | 0.82\% |
|  |  | 3.4135 | 3.3720 | 3.8649 | 3.8899 | 3.9593 | 3.8909 | 4.0356 | 3.7568 | 4.1144 | 4.0243 | 3.5792 | 3.3186 | 4.4595 | 3.8480 | 3.4313 | 3.0892 |
| CAR (1) |  | 0.57\% | 0.55\% | 0.59\% | 0.51\% | 0.82\% | 0.82\% | 0.79\% | 0.66\% | 1.05\% | 0.95\% | 0.83\% | 0.70\% | 1.09\% | 0.96\% | 0.85\% | 0.76\% |
|  |  | 3.0255 | 3.3885 | 3.8939 | 3.5256 | 3.7813 | 3.9060 | 3.7922 | 3.4146 | 4.1460 | 3.7007 | 3.2870 | 2.9510 | 3.9281 | 3.4557 | 3.1021 | 2.8638 |
| BHAR (0) |  | 0.69\% | 0.45\% | 0.46\% | 0.26\% | 0.80\% | 0.71\% | 0.65\% | 0.95\% | 0.98\% | 0.83\% | 1.00\% | 0.76\% | 1.23\% | 1.15\% | 1.00\% | 0.92\% |
|  |  | 2.9614 | 1.8685 | 2.0223 | 0.9898 | 3.2193 | 3.1433 | 2.2761 | 4.7696 | 3.8415 | 2.8852 | 4.0239 | 2.9253 | 4.1153 | 3.9439 | 3.3389 | 2.9974 |
| BHAR (1) |  | 0.57\% | 0.31\% | 0.48\% | 0.22\% | 0.69\% | 0.70\% | 0.62\% | 0.77\% | 0.97\% | 0.77\% | 0.91\% | 0.58\% | 1.07\% | 1.08\% | 0.93\% | 0.88\% |
|  |  | 2.3208 | 1.2941 | 1.9453 | 0.8989 | 2.7799 | 3.1061 | 2.2873 | 3.7646 | 3.6700 | 2.7559 | 3.5767 | 2.1507 | 3.6289 | 3.5652 | 3.3291 | 2.9114 |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.49\% | 1.27\% | 0.95\% | 0.88\% | 1.41\% | 1.17\% | 0.98\% | 0.82\% | 1.32\% | 1.13\% | 0.89\% | 0.64\% | 1.33\% | 1.04\% | 0.67\% | 0.38\% |
|  |  | 2.8102 | 3.8355 | 3.9400 | 4.6265 | 6.3594 | 5.5705 | 5.4475 | 5.1616 | 5.8415 | 5.5161 | 4.7171 | 3.5432 | 5.7889 | 4.7282 | 2.8772 | 1.4729 |
| CAR (1) |  | 1.43\% | 1.13\% | 0.90\% | 0.79\% | 1.32\% | 1.07\% | 0.88\% | 0.68\% | 1.23\% | 0.99\% | 0.77\% | 0.50\% | 1.20\% | 0.85\% | 0.52\% | 0.29\% |
|  |  | 2.8876 | 3.7858 | 4.2097 | 4.6536 | 6.0070 | 5.3982 | 4.9991 | 4.3155 | 5.6237 | 5.0125 | 4.2060 | 2.6343 | 5.4352 | 3.9765 | 2.2392 | 1.1698 |
| BHAR (0) |  | 1.68\% | 0.94\% | 1.30\% | $\mathbf{0 . 3 9 \%}$ | 1.45\% | 1.37\% | 0.85\% | 0.76\% | 1.33\% | 0.97\% | 1.01\% | 0.69\% | 1.41\% | 1.15\% | 0.48\% | 0.55\% |
|  |  | 2.9398 | 4.0795 | 2.1421 | 1.7167 | 5.7404 | 5.5019 | 3.3242 | 3.7813 | 5.5788 | 4.0375 | 5.0771 | 3.4319 | 5.8380 | 4.9049 | 1.3398 | 2.3012 |
| BHAR (1) |  | 1.51\% | 0.89\% | 0.99\% | 0.43\% | 1.46\% | 1.17\% | 0.82\% | 0.57\% | 1.27\% | 1.01\% | 0.97\% | 0.60\% | 1.34\% | 0.92\% | 0.24\% | 0.55\% |
|  |  | 3.6546 | 3.0246 | 2.1834 | 1.4764 | 5.9380 | 4.7573 | 3.5090 | 2.5731 | 5.3591 | 4.2561 | 4.9275 | 2.8859 | 5.5692 | 3.7798 | 0.5120 | 2.2988 |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| H |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.52\% | 0.44\% | 0.47\% | 0.42\% | 0.71\% | 0.63\% | 0.63\% | 0.44\% | 0.93\% | 0.86\% | 0.68\% | 0.45\% | 0.94\% | 0.62\% | 0.44\% | 0.23\% |
|  |  | 2.1032 | 2.1728 | 2.3894 | 2.1938 | 2.9737 | 2.5164 | 2.5184 | 1.8379 | 3.0494 | 2.7798 | 2.2361 | 1.5528 | 2.7219 | 1.8396 | 1.3312 | 0.7067 |
| CAR (1) |  | 0.40\% | 0.44\% | 0.47\% | 0.33\% | 0.71\% | 0.68\% | 0.58\% | 0.34\% | 0.97\% | 0.80\% | 0.57\% | 0.32\% | 0.85\% | 0.53\% | 0.31\% | 0.11\% |
|  |  | 1.7443 | 2.1600 | 2.3386 | 1.7553 | 2.7387 | 2.5453 | 2.1856 | 1.3921 | 2.9813 | 2.4813 | 1.8403 | 1.0671 | 2.4068 | 1.5782 | 0.9450 | 0.3500 |
| BHAR (0) |  | 0.65\% | 0.65\% | 0.52\% | 0.77\% | 0.68\% | 0.59\% | 0.58\% | 0.92\% | 0.97\% | 0.68\% | 0.88\% | 0.47\% | 0.93\% | 0.65\% | 0.49\% | 0.28\% |
|  |  | 1.9311 | 1.6487 | 1.5901 | 2.4780 | 2.5075 | 1.8106 | 1.9297 | 3.8659 | 2.7774 | 1.7871 | 2.7549 | 1.2931 | 2.5157 | 1.7867 | 1.4584 | 0.7449 |
| BHAR (1) |  | 0.44\% | 0.44\% | 0.40\% | 0.55\% | 0.73\% | 0.62\% | 0.46\% | 0.62\% | 0.94\% | 0.63\% | 0.79\% | 0.40\% | 0.89\% | 0.66\% | 0.53\% | 0.25\% |
|  |  | 1.5752 | 1.5979 | 1.5365 | 1.8516 | 2.6850 | 1.8814 | 1.5586 | 2.4918 | 2.8056 | 1.8134 | 2.5880 | 1.1757 | 2.4690 | 1.7915 | 1.6462 | 0.6943 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.30\% | 0.52\% | 0.62\% | 0.47\% | 0.99\% | 0.94\% | 0.72\% | 0.60\% | 0.96\% | 0.73\% | 0.53\% | 0.36\% | 0.88\% | 0.62\% | 0.37\% | 0.19\% |
|  |  | 0.8024 | 1.5134 | 1.9754 | 1.6656 | 2.5188 | 2.7294 | 2.1579 | 1.9347 | 2.7048 | 1.9870 | 1.5221 | 1.0992 | 2.2201 | 1.5747 | 0.9562 | 0.5089 |
| CAR (1) |  | 0.19\% | 0.55\% | 0.48\% | 0.38\% | 0.97\% | 0.80\% | 0.61\% | 0.47\% | 0.66\% | 0.58\% | 0.35\% | 0.16\% | 0.87\% | 0.47\% | 0.21\% | 0.08\% |
|  |  | 0.5004 | 1.5732 | 1.4282 | 1.3385 | 2.5273 | 2.1648 | 1.7871 | 1.5145 | 1.7706 | 1.4753 | 0.9949 | 0.4777 | 2.2946 | 1.1914 | 0.5518 | 0.2169 |
| BHAR (0) |  | 0.25\% | 0.73\% | 0.63\% | 0.76\% | 1.14\% | 1.19\% | 0.84\% | 0.70\% | 0.98\% | 1.00\% | 1.25\% | 0.32\% | 0.86\% | 0.60\% | 0.37\% | 0.13\% |
|  |  | 0.4504 | 1.4975 | 1.2063 | 1.4186 | 2.5940 | 2.8986 | 1.4462 | 1.5079 | 2.4694 | 2.1773 | 3.0049 | 0.5843 | 2.1193 | 1.4813 | 0.8161 | 0.3254 |
| BHAR (1) |  | 0.00\% | 1.00\% | 0.82\% | 0.62\% | 1.01\% | 1.55\% | 1.04\% | 0.43\% | 0.67\% | 0.60\% | 0.79\% | -0.09\% | 0.71\% | 0.41\% | 0.35\% | 0.02\% |
|  |  | -0.0077 | 2.0227 | 1.3134 | 1.1321 | 2.1335 | 3.1107 | 1.6555 | 0.8975 | 1.5225 | 1.4184 | 1.9537 | -0.1621 | 1.8511 | 0.9462 | 0.6952 | 0.0480 |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.61\% | 0.62\% | 0.49\% | 0.29\% | 0.66\% | 0.61\% | 0.40\% | 0.21\% | 0.54\% | 0.41\% | 0.17\% | 0.03\% | 0.42\% | 0.27\% | 0.10\% | -0.03\% |
|  |  | 1.7920 | 2.6344 | 2.2870 | 1.3548 | 1.9811 | 1.9946 | 1.3528 | 0.7589 | 1.5370 | 1.2082 | 0.5351 | 0.0958 | 1.1393 | 0.7929 | 0.3071 | -0.1027 |
| CAR (1) |  | 0.52\% | 0.55\% | 0.39\% | 0.21\% | 0.68\% | 0.56\% | 0.30\% | 0.12\% | 0.55\% | 0.31\% | 0.08\% | -0.04\% | 0.38\% | 0.19\% | 0.01\% | -0.07\% |
|  |  | 1.5232 | 2.4722 | 1.7121 | 0.9904 | 2.1702 | 1.8272 | 1.0375 | 0.4483 | 1.5870 | 0.9624 | 0.2734 | -0.1519 | 1.0845 | 0.5930 | 0.0331 | -0.2455 |
| BHAR (0) |  | 0.54\% | 0.33\% | 0.42\% | $\mathbf{0 . 4 2 \%}$ | 0.59\% | 0.55\% | 0.19\% | 0.31\% | 0.64\% | 0.43\% | 0.26\% | -0.02\% | 0.46\% | 0.42\% | 0.18\% | -0.03\% |
|  |  | 1.4701 | 0.9181 | 1.4885 | 1.8340 | 1.5186 | 1.5207 | 0.5221 | 0.9543 | 1.6764 | 1.1574 | 0.8202 | -0.0651 | 1.1826 | 1.2447 | 0.5572 | -0.1075 |
| BHAR (1) |  | 0.49\% | 0.15\% | 0.36\% | 0.27\% | 0.72\% | 0.72\% | 0.04\% | 0.50\% | 0.70\% | 0.29\% | 0.35\% | 0.08\% | 0.38\% | 0.56\% | -0.03\% | 0.17\% |
|  |  | 1.4243 | 0.5450 | 1.3468 | 1.2556 | 2.1969 | 2.4433 | 0.1044 | 2.0509 | 2.0551 | 0.8732 | 1.2247 | 0.2152 | 1.0739 | 1.6541 | -0.1067 | 0.4976 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.59\% | 0.51\% | 0.61\% | 0.56\% | 0.80\% | 0.78\% | 0.76\% | 0.61\% | 0.95\% | 0.85\% | 0.76\% | 0.63\% | 0.99\% | 0.86\% | 0.76\% | 0.66\% |
|  |  | 2.7727 | 2.6916 | 3.4925 | 3.2665 | 3.4880 | 3.3510 | 3.2343 | 2.7678 | 3.4850 | 2.9794 | 2.7111 | 2.4357 | 3.2281 | 2.8231 | 2.5413 | 2.3172 |
| CAR (1) |  | 0.51\% | 0.45\% | 0.55\% | 0.47\% | 0.74\% | 0.76\% | 0.69\% | 0.52\% | 0.92\% | 0.81\% | 0.69\% | 0.56\% | 0.98\% | 0.82\% | 0.69\% | 0.61\% |
|  |  | 2.5634 | 2.5713 | 3.1493 | 3.0210 | 3.1831 | 3.1463 | 2.8976 | 2.4254 | 3.2148 | 2.7788 | 2.4852 | 2.1733 | 3.2912 | 2.7633 | 2.3910 | 2.2223 |
| BHAR (0) |  | 0.36\% | 0.40\% | 0.63\% | 0.56\% | 0.60\% | 0.61\% | 0.73\% | 0.54\% | 0.84\% | 0.88\% | 0.80\% | 0.57\% | 0.86\% | 0.83\% | 0.98\% | 0.55\% |
|  |  | 1.3336 | 1.4307 | 2.2704 | 1.8650 | 2.2085 | 2.1045 | 2.0250 | 2.1448 | 2.8276 | 2.6739 | 2.8177 | 1.9483 | 2.5603 | 2.3276 | 3.0350 | 1.6024 |
| BHAR (1) |  | 0.32\% | 0.31\% | 0.49\% | 0.26\% | 0.53\% | 0.72\% | 0.49\% | 0.39\% | 0.81\% | 0.69\% | 0.64\% | 0.31\% | 0.90\% | 0.83\% | 0.90\% | 0.50\% |
|  |  | 1.2937 | 1.0611 | 1.7803 | 0.8265 | 2.0222 | 2.8394 | 1.5972 | 1.5912 | 2.6950 | 2.0391 | 2.2184 | 1.0512 | 2.9305 | 2.6732 | 2.8274 | 1.6732 |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 6 |  | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.95\% | 0.72\% | 0.65\% | 0.69\% | 0.98\% | 0.78\% | 0.79\% | 0.62\% | 1.07\% | 0.92\% | 0.73\% | 0.53\% | 1.17\% | 0.75\% | 0.52\% | 0.42\% |
|  |  | 3.2145 | 2.3415 | 2.5993 | 3.1891 | 2.5941 | 2.1038 | 2.4775 | 2.0289 | 2.8589 | 2.3625 | 2.0140 | 1.5565 | 2.9835 | 1.7740 | 1.3105 | 1.1765 |
| CAR (1) |  | 0.82\% | 0.64\% | 0.66\% | 0.61\% | 0.94\% | 0.79\% | 0.71\% | 0.50\% | 1.00\% | 0.84\% | 0.61\% | $\mathbf{0 . 4 2 \%}$ | 0.92\% | 0.57\% | 0.39\% | 0.32\% |
|  |  | 2.7734 | 2.1874 | 2.8415 | 2.8168 | 2.6603 | 2.2831 | 2.3103 | 1.6707 | 2.5049 | 2.1779 | 1.7038 | 1.2671 | 2.2362 | 1.3325 | 1.0157 | 0.9278 |
| BHAR (0) |  | 1.16\% | 0.62\% | 0.95\% | 0.22\% | 0.96\% | 0.84\% | 0.66\% | 0.67\% | 1.17\% | 0.63\% | 0.84\% | 0.25\% | 1.12\% | 0.96\% | 0.70\% | 0.48\% |
|  |  | 3.4134 | 1.3954 | 3.0907 | 0.5800 | 2.0385 | 2.0630 | 1.3681 | 2.0391 | 2.9928 | 1.2327 | 2.1114 | 0.5811 | 2.7531 | 2.6286 | 1.8145 | 1.5201 |
| BHAR (1) |  | 0.99\% | 0.45\% | 0.63\% | 0.57\% | 1.04\% | 0.84\% | 0.67\% | 0.46\% | 1.04\% | 0.71\% | 0.75\% | 0.15\% | 1.01\% | 0.81\% | 0.60\% | 0.41\% |
|  |  | 3.2904 | 1.1021 | 2.4497 | 1.4066 | 3.0293 | 2.7179 | 1.4414 | 1.4253 | 2.7546 | 1.4923 | 1.9238 | 0.3283 | 2.5756 | 2.2673 | 1.6297 | 1.3157 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.69\% | 0.56\% | 0.50\% | 0.53\% | 0.83\% | 0.70\% | 0.70\% | 0.63\% | 0.92\% | 0.87\% | 0.75\% | 0.58\% | 1.02\% | 0.85\% | 0.67\% | 0.51\% |
|  |  | 3.4518 | 3.0309 | 2.7983 | 3.4117 | 3.4470 | 2.8087 | 3.0130 | 2.8992 | 3.1456 | 3.0435 | 2.7358 | 2.2773 | 3.3134 | 2.8550 | 2.3699 | 1.8941 |
| CAR (1) |  | 0.56\% | 0.48\% | 0.47\% | 0.46\% | 0.74\% | 0.67\% | 0.64\% | 0.53\% | 0.89\% | 0.81\% | 0.66\% | 0.46\% | 0.96\% | 0.74\% | 0.56\% | 0.41\% |
|  |  | 2.9482 | 2.5100 | 2.7215 | 2.9708 | 2.9453 | 2.5805 | 2.7595 | 2.4534 | 2.9972 | 2.8078 | 2.4277 | 1.8331 | 3.1792 | 2.5419 | 2.0207 | 1.5504 |
| BHAR (0) |  | 0.55\% | 0.50\% | 0.47\% | 0.46\% | 0.81\% | 0.72\% | 0.60\% | 0.93\% | 0.94\% | 0.74\% | 0.82\% | 0.69\% | 1.07\% | 0.92\% | 0.68\% | 0.46\% |
|  |  | 2.4208 | 1.7475 | 1.7878 | 1.5079 | 3.2855 | 2.6531 | 2.2672 | 4.0629 | 3.1207 | 2.4217 | 2.8051 | 2.2944 | 3.4948 | 3.0719 | 2.2510 | 1.5430 |
| BHAR (1) |  | 0.48\% | 0.32\% | 0.53\% | 0.43\% | 0.63\% | 0.57\% | 0.49\% | 0.80\% | 0.72\% | 0.60\% | 0.65\% | 0.43\% | 0.86\% | 0.76\% | 0.54\% | 0.42\% |
|  |  | 2.1577 | 1.0322 | 1.9864 | 1.4016 | 2.4233 | 2.1010 | 1.9121 | 3.5771 | 2.3379 | 1.8828 | 2.2702 | 1.3182 | 2.8203 | 2.5779 | 1.8082 | 1.4493 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.90\% | 0.90\% | 0.76\% | 0.79\% | 1.30\% | 1.07\% | 1.02\% | 0.88\% | 1.34\% | 1.22\% | 1.01\% | 0.81\% | 1.38\% | 1.08\% | 0.86\% | 0.70\% |
|  |  | 5.1334 | 5.5681 | 5.0053 | 5.8343 | 5.6742 | 4.8850 | 5.0881 | 4.8261 | 5.4065 | 4.9265 | 4.3082 | 3.8267 | 5.2118 | 4.0314 | 3.5677 | 3.1815 |
| CAR (1) |  | 0.81\% | 0.79\% | 0.76\% | 0.75\% | 1.16\% | 0.98\% | 0.94\% | 0.75\% | 1.25\% | 1.15\% | 0.88\% | 0.68\% | 1.21\% | 0.93\% | 0.71\% | 0.58\% |
|  |  | 4.5109 | 4.7996 | 5.2618 | 5.7375 | 5.0895 | 4.5826 | 4.7404 | 4.1684 | 5.0306 | 4.7508 | 3.8727 | 3.2934 | 4.5427 | 3.4979 | 3.0307 | 2.6604 |
| BHAR (0) |  | 0.70\% | 0.78\% | 0.92\% | 0.58\% | 1.17\% | 0.90\% | 0.84\% | 1.13\% | 1.30\% | 1.05\% | 1.06\% | 0.86\% | 1.38\% | 1.12\% | 0.92\% | 0.78\% |
|  |  | 3.3393 | 3.3383 | 3.7551 | 2.4061 | 4.6338 | 2.9546 | 3.2773 | 7.0184 | 4.8418 | 3.7205 | 4.7269 | 3.6110 | 5.2708 | 3.6246 | 3.4877 | 3.1205 |
| BHAR (1) |  | 0.86\% | 0.53\% | 1.03\% | 0.52\% | 1.03\% | 0.85\% | 0.83\% | 0.98\% | 1.27\% | 0.97\% | 1.01\% | 0.66\% | 1.07\% | 0.95\% | 0.68\% | 0.56\% |
|  |  | 3.9294 | 2.2464 | 3.7006 | 2.2598 | 3.8900 | 3.0577 | 3.5722 | 6.7179 | 4.9621 | 3.4477 | 4.3711 | 2.7966 | 3.3681 | 3.3145 | 2.7008 | 2.4231 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.24\% | -0.07\% | 0.09\% | 0.07\% | -0.07\% | 0.19\% | 0.23\% | 0.15\% | 0.24\% | 0.29\% | 0.24\% | 0.12\% | 0.23\% | 0.22\% | 0.16\% | $\mathbf{0 . 0 7 \%}$ |
|  |  | -1.2329 | -0.3935 | 0.6355 | 0.4954 | -0.3085 | 0.8830 | 1.1580 | 0.7888 | 0.9482 | 1.1821 | 0.9859 | 0.5449 | 0.7938 | 0.8204 | 0.6031 | 0.3007 |
| CAR (1) |  | -0.22\% | 0.06\% | 0.15\% | 0.07\% | 0.16\% | 0.34\% | 0.26\% | $\mathbf{0 . 1 3 \%}$ | 0.34\% | 0.31\% | 0.20\% | 0.09\% | 0.21\% | 0.20\% | 0.11\% | 0.04\% |
|  |  | -1.1775 | 0.3904 | 1.0426 | 0.5085 | 0.6951 | 1.6133 | 1.2758 | 0.7205 | 1.3251 | 1.2329 | 0.8257 | 0.4184 | 0.7536 | 0.7586 | 0.4189 | 0.1921 |
| BHAR (0) |  | -0.30\% | -0.03\% | -0.05\% | 0.08\% | 0.00\% | 0.36\% | -0.14\% | 0.58\% | 0.29\% | 0.17\% | 0.44\% | 0.17\% | 0.26\% | 0.38\% | 0.25\% | 0.18\% |
|  |  | -1.3205 | -0.1655 | -0.2002 | 0.3633 | -0.0095 | 1.4464 | -0.4438 | 3.1022 | 1.0237 | 0.5745 | 1.9357 | 0.6422 | 0.8725 | 1.3556 | 0.8965 | 0.6056 |
| BHAR (1) |  | -0.25\% | -0.10\% | -0.11\% | 0.07\% | 0.10\% | 0.38\% | -0.14\% | 0.40\% | 0.25\% | 0.06\% | 0.24\% | 0.00\% | 0.07\% | 0.21\% | 0.10\% | 0.04\% |
|  |  | -1.1824 | -0.4543 | -0.4152 | 0.2983 | 0.3913 | 1.6720 | -0.4497 | 2.0962 | 0.9235 | 0.2031 | 0.9595 | -0.0007 | 0.2409 | 0.7515 | 0.3495 | 0.1436 |

## Appendix 8. Time-series momentum strategy - winner (loser) contains stocks above (below) $0 \%$

| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| AUSTRALIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.31\% | 0.34\% | 0.29\% | 0.27\% | 0.46\% | 0.40\% | 0.35\% | 0.24\% | 0.50\% | 0.40\% | 0.28\% | 0.15\% | 0.49\% | 0.34\% | 0.19\% | 0.08\% |
|  |  | 2.2223 | 2.8968 | 3.0583 | 3.2426 | 2.8946 | 2.9784 | 3.0171 | 2.3434 | 3.0928 | 2.8340 | 2.2379 | 1.3104 | 3.1364 | 2.4277 | 1.5390 | 0.6569 |
| CAR (1) |  | 0.45\% | 0.38\% | 0.32\% | 0.24\% | 0.52\% | 0.44\% | 0.34\% | 0.20\% | 0.52\% | 0.38\% | 0.22\% | 0.08\% | 0.42\% | 0.25\% | 0.12\% | -0.01\% |
|  |  | 3.3044 | 3.5554 | 3.5876 | 3.0321 | 3.4777 | 3.5099 | 3.0467 | 2.0198 | 3.4771 | 2.8944 | 1.8838 | 0.7122 | 2.7656 | 1.9020 | 0.9460 | -0.0792 |
| BHAR (0) |  | 0.34\% | 0.40\% | 0.11\% | 0.16\% | 0.48\% | 0.37\% | 0.23\% | 0.13\% | 0.50\% | 0.37\% | 0.31\% | 0.16\% | 0.49\% | 0.35\% | 0.21\% | 0.12\% |
|  |  | 2.3198 | 2.8486 | 0.8188 | 1.1612 | 2.8506 | 2.5660 | 1.4295 | 0.9662 | 3.1058 | 2.3790 | 2.2348 | 1.2782 | 3.0091 | 2.3560 | 1.3236 | 0.8431 |
| BHAR (1) |  | 0.52\% | 0.35\% | 0.06\% | 0.10\% | 0.51\% | 0.42\% | 0.20\% | $\mathbf{0 . 0 1 \%}$ | 0.48\% | 0.32\% | 0.24\% | 0.12\% | 0.38\% | 0.21\% | 0.06\% | 0.00\% |
|  |  | 3.5322 | 2.5455 | 0.4237 | 0.7908 | 3.0732 | 3.0524 | 1.2957 | 0.0729 | 3.0416 | 2.0682 | 1.7976 | 0.9660 | 2.3599 | 1.4302 | 0.3788 | 0.0127 |
| AUSTRIA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.59\% | 0.50\% | 0.48\% | 0.48\% | 0.66\% | 0.70\% | 0.65\% | 0.58\% | 0.82\% | 0.78\% | 0.66\% | 0.54\% | 0.87\% | 0.71\% | 0.59\% | 0.48\% |
|  |  | 3.7614 | 3.7333 | 4.1223 | 4.6713 | 3.8373 | 4.3642 | 4.5450 | 4.4744 | 4.1478 | 4.1577 | 3.8886 | 3.5616 | 4.3141 | 3.7183 | 3.4494 | 3.1132 |
| CAR (1) |  | 0.63\% | 0.51\% | 0.50\% | 0.45\% | 0.74\% | 0.73\% | 0.64\% | 0.53\% | 0.93\% | 0.75\% | 0.61\% | 0.48\% | 0.87\% | 0.67\% | 0.53\% | 0.43\% |
|  |  | 3.8930 | 3.8356 | 4.3237 | 4.4477 | 4.1225 | 4.5126 | 4.5028 | 4.1315 | 4.7329 | 4.0804 | 3.7005 | 3.2296 | 4.3438 | 3.6402 | 3.2096 | 2.8463 |
| BHAR (0) |  | 0.51\% | 0.46\% | 0.40\% | 0.35\% | 0.60\% | 0.49\% | 0.56\% | 0.67\% | 0.85\% | 0.87\% | 0.66\% | 0.65\% | 0.91\% | 0.76\% | 0.54\% | 0.41\% |
|  |  | 2.4697 | 2.1632 | 1.8762 | 1.8553 | 3.1401 | 2.4685 | 3.0845 | 4.1770 | 4.0233 | 4.0603 | 3.3945 | 3.2481 | 4.3139 | 3.5927 | 2.4461 | 2.0295 |
| BHAR (1) |  | 0.72\% | 0.49\% | 0.42\% | $\mathbf{0 . 3 2 \%}$ | 0.73\% | 0.54\% | 0.63\% | 0.68\% | 0.96\% | 0.79\% | 0.61\% | 0.57\% | 0.88\% | 0.73\% | 0.36\% | 0.36\% |
|  |  | 3.5945 | 2.2958 | 1.9644 | 1.6502 | 3.7889 | 2.7258 | 3.6197 | 4.2494 | 4.5508 | 3.6771 | 3.1040 | 2.8841 | 4.1430 | 3.5083 | 1.6503 | 1.7301 |
| BELGIUM |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.39\% | 0.44\% | 0.44\% | 0.45\% | 0.63\% | 0.65\% | 0.63\% | 0.58\% | 0.76\% | 0.80\% | 0.70\% | 0.59\% | 0.88\% | 0.78\% | 0.66\% | 0.56\% |
|  |  | 3.3462 | 4.3451 | 4.9549 | 5.5477 | 4.5538 | 5.1394 | 5.4947 | 5.3820 | 4.9646 | 5.7510 | 5.4169 | 4.8359 | 5.4955 | 5.3220 | 4.7446 | 4.2397 |
| CAR (1) |  | 0.54\% | 0.48\% | 0.48\% | 0.44\% | 0.68\% | 0.69\% | 0.63\% | 0.55\% | 0.90\% | 0.79\% | 0.67\% | 0.55\% | 0.89\% | 0.74\% | 0.61\% | 0.51\% |
|  |  | 4.7058 | 4.8239 | 5.5060 | 5.5217 | 4.9690 | 5.5142 | 5.5895 | 5.1427 | 5.9411 | 5.8051 | 5.3155 | 4.5934 | 5.7233 | 5.1371 | 4.5229 | 3.9957 |
| BHAR (0) |  | 0.33\% | 0.33\% | 0.30\% | 0.28\% | 0.63\% | 0.61\% | 0.55\% | 0.59\% | 0.82\% | 0.91\% | 0.77\% | 0.76\% | 0.92\% | 0.75\% | 0.62\% | 0.45\% |
|  |  | 2.3580 | 2.2379 | 2.2860 | 1.9433 | 4.2642 | 4.2957 | 3.7595 | 4.4578 | 5.1739 | 5.6021 | 5.5770 | 4.8901 | 5.4604 | 4.6549 | 3.9571 | 2.7442 |
| BHAR (1) |  | 0.42\% | 0.32\% | 0.33\% | 0.29\% | 0.64\% | 0.63\% | 0.49\% | 0.55\% | 0.89\% | 0.77\% | 0.67\% | 0.56\% | 0.84\% | 0.71\% | 0.57\% | 0.44\% |
|  |  | 3.0897 | 2.2333 | 2.5575 | 1.9536 | 4.3616 | 4.5241 | 3.3446 | 4.1789 | 5.7341 | 4.8273 | 4.7531 | 3.6689 | 5.1151 | 4.3983 | 3.6040 | 2.6476 |
| CANADA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.48\% | 0.40\% | 0.39\% | 0.40\% | 0.63\% | 0.54\% | 0.55\% | 0.42\% | 0.76\% | 0.68\% | 0.51\% | 0.34\% | 0.83\% | 0.56\% | 0.36\% | 0.19\% |
|  |  | 3.0766 | 3.1302 | 3.4728 | 4.1752 | 3.6153 | 3.4381 | 4.0306 | 3.4218 | 4.0926 | 4.1050 | 3.3919 | 2.4338 | 4.4558 | 3.3818 | 2.3087 | 1.2980 |
| CAR (1) |  | 0.53\% | 0.44\% | 0.44\% | 0.36\% | 0.66\% | 0.59\% | 0.53\% | 0.35\% | 0.80\% | 0.63\% | 0.44\% | 0.24\% | 0.73\% | 0.45\% | 0.26\% | 0.07\% |
|  |  | 3.6365 | 3.5555 | 4.1096 | 3.9811 | 3.8170 | 3.8807 | 4.0408 | 2.9566 | 4.4485 | 4.0112 | 2.9755 | 1.7883 | 4.1069 | 2.7582 | 1.6847 | 0.5299 |
| BHAR (0) |  | 0.56\% | 0.31\% | 0.44\% | 0.35\% | 0.51\% | 0.45\% | 0.48\% | 0.37\% | 0.71\% | 0.55\% | 0.43\% | 0.28\% | 0.77\% | 0.42\% | 0.35\% | 0.08\% |
|  |  | 3.2055 | 1.8114 | 2.5703 | 2.0273 | 2.7315 | 2.5711 | 2.4686 | 2.1714 | 3.5960 | 2.8076 | 2.4266 | 1.5158 | 4.1164 | 2.4130 | 1.9925 | 0.5331 |
| BHAR (1) |  | 0.61\% | 0.33\% | 0.50\% | 0.31\% | 0.58\% | 0.62\% | 0.46\% | 0.29\% | 0.73\% | 0.53\% | 0.35\% | 0.22\% | 0.65\% | 0.34\% | 0.24\% | -0.03\% |
|  |  | 3.4915 | 2.0524 | 2.9916 | 1.8217 | 3.0389 | 3.4726 | 2.3534 | 1.6925 | 3.6982 | 2.8173 | 1.9793 | 1.1566 | 3.5901 | 1.9765 | 1.4122 | -0.2055 |






| EW | $\mathrm{J}=$ |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=3$ |  | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.62\% | 0.64\% | 0.52\% | 0.51\% | 0.78\% | 0.67\% | 0.61\% | 0.54\% | 0.80\% | 0.80\% | 0.67\% | 0.54\% | 0.93\% | 0.83\% | 0.64\% | 0.50\% |
|  |  | 3.0651 | 3.6243 | 3.2243 | 3.7255 | 3.2775 | 3.0778 | 3.2602 | 3.2274 | 3.0172 | 3.4269 | 3.2024 | 2.8290 | 3.6045 | 3.4081 | 2.8882 | 2.4161 |
| CAR (1) |  | 0.73\% | 0.66\% | 0.53\% | 0.50\% | 0.83\% | 0.70\% | 0.62\% | 0.52\% | 0.84\% | 0.78\% | 0.62\% | 0.50\% | 0.98\% | 0.76\% | 0.56\% | 0.43\% |
|  |  | 3.7860 | 3.8276 | 3.5591 | 3.7779 | 3.5196 | 3.3346 | 3.4432 | 3.1674 | 3.3743 | 3.5015 | 3.0752 | 2.6830 | 3.8874 | 3.2338 | 2.6001 | 2.1155 |
| BHAR (0) |  | 0.75\% | 0.59\% | 0.62\% | 0.29\% | 0.81\% | 0.63\% | 0.51\% | 0.38\% | 0.77\% | 0.60\% | 0.63\% | 0.13\% | 0.93\% | 0.84\% | 0.83\% | 0.42\% |
|  |  | 3.2335 | 2.9780 | 2.8837 | 1.3330 | 3.1754 | 2.4027 | 1.8905 | 1.5303 | 2.6896 | 2.1523 | 2.4031 | 0.4933 | 3.5116 | 3.2605 | 3.4440 | 1.6881 |
| BHAR (1) |  | 0.74\% | 0.57\% | 0.65\% | 0.32\% | 0.78\% | 0.61\% | 0.46\% | 0.31\% | 0.67\% | 0.55\% | 0.50\% | -0.01\% | 0.99\% | 0.87\% | 0.77\% | 0.46\% |
|  |  | 3.2515 | 2.7736 | 3.1031 | 1.5152 | 2.8739 | 2.3495 | 1.7358 | 1.3149 | 2.3773 | 2.0970 | 1.9880 | -0.0331 | 3.8540 | 3.6223 | 3.2603 | 1.8972 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.59\% | 0.53\% | 0.46\% | 0.45\% | 0.79\% | 0.65\% | 0.62\% | 0.50\% | 0.66\% | 0.67\% | 0.55\% | 0.43\% | 0.78\% | 0.61\% | 0.50\% | 0.37\% |
|  |  | 4.8313 | 5.0261 | 4.9119 | 5.4566 | 5.3407 | 4.9168 | 5.1722 | 4.5800 | 4.3399 | 4.7980 | 4.2467 | 3.5712 | 4.9882 | 4.2469 | 3.6957 | 2.8788 |
| CAR (1) |  | 0.60\% | 0.53\% | 0.46\% | 0.41\% | 0.75\% | 0.64\% | 0.57\% | 0.43\% | 0.68\% | 0.63\% | 0.49\% | 0.35\% | 0.74\% | 0.55\% | 0.43\% | 0.29\% |
|  |  | 5.2053 | 5.1558 | 5.0379 | 5.0346 | 5.2712 | 4.9602 | 4.8689 | 4.0208 | 4.5301 | 4.6137 | 3.8476 | 2.9483 | 4.9175 | 3.9376 | 3.2152 | 2.3028 |
| BHAR (0) |  | 0.56\% | 0.57\% | 0.56\% | 0.49\% | 0.77\% | 0.75\% | 0.49\% | 0.75\% | 0.64\% | 0.61\% | 0.59\% | 0.58\% | 0.82\% | 0.76\% | 0.60\% | 0.44\% |
|  |  | 4.0309 | 3.8547 | 4.0931 | 3.3619 | 4.9226 | 5.0254 | 3.4547 | 5.4510 | 3.9750 | 3.7531 | 3.8682 | 3.5736 | 5.0889 | 4.8611 | 3.7090 | 2.7339 |
| BHAR (1) |  | 0.57\% | 0.53\% | 0.61\% | 0.41\% | 0.70\% | 0.70\% | $0.42 \%$ | 0.67\% | 0.60\% | $0.53 \%$ | 0.50\% | 0.44\% | $0.73 \%$ | 0.69\% | 0.45\% | 0.40\% |
|  |  | 4.3310 | 3.8083 | 4.7330 | 2.8539 | 4.6842 | 4.7152 | $3.0309$ | 4.8339 | 3.8043 | $3.3165$ | 3.2661 | 2.6629 | $4.6328$ | 4.4226 | 2.8711 | 2.4915 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.75\% | 0.76\% | 0.64\% | 0.64\% | 1.05\% | 0.89\% | 0.81\% | 0.73\% | 1.01\% | 0.94\% | 0.81\% | 0.70\% | 1.09\% | 0.92\% | 0.76\% | 0.63\% |
|  |  | 6.5249 | 7.8459 | 7.7567 | 8.8318 | 7.9796 | 7.6642 | 8.0539 | 7.9310 | 7.5614 | 7.6579 | 7.1373 | 6.7180 | 7.9654 | 7.1871 | 6.4072 | 5.7350 |
| CAR (1) |  | 0.77\% | 0.71\% | 0.63\% | $\mathbf{0 . 5 9 \%}$ | 0.98\% | 0.82\% | 0.76\% | 0.65\% | 0.95\% | 0.86\% | 0.73\% | 0.61\% | 0.99\% | 0.82\% | 0.66\% | 0.55\% |
|  |  | 6.8898 | 7.7300 | 8.0758 | 8.4656 | 7.8545 | 7.5121 | 7.7654 | 7.2919 | 7.3418 | 7.2117 | 6.6170 | 5.9981 | 7.4866 | 6.5132 | 5.6960 | 5.0590 |
| BHAR (0) |  | 0.67\% | 0.71\% | 0.74\% | 0.56\% | 1.05\% | 0.87\% | 0.76\% | $\mathbf{0 . 8 0 \%}$ | 1.05\% | 0.93\% | 0.83\% | 0.72\% | 1.01\% | 0.91\% | 0.72\% | 0.60\% |
|  |  | 5.0422 | 5.7657 | 6.1416 | 4.4576 | 7.6496 | 6.8766 | 5.7460 | 7.5643 | 7.5989 | 6.7433 | 6.7208 | 5.9164 | 7.2025 | 7.0698 | 5.3558 | 5.0693 |
| BHAR (1) |  | 0.76\% | 0.64\% | 0.69\% | 0.52\% | 0.97\% | $\mathbf{0 . 8 2 \%}$ | 0.75\% | 0.66\% | 0.99\% | 0.84\% | 0.68\% | 0.61\% | 0.95\% | 0.78\% | 0.56\% | 0.49\% |
|  |  | 5.9748 | 5.4723 | 5.8538 | 4.2036 | 7.5625 | 6.7369 | 6.0213 | 6.4086 | 7.4410 | 6.3441 | 5.7878 | 5.2502 | 7.2951 | 6.3018 | 4.2861 | 4.3134 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.04\% | 0.04\% | 0.05\% | 0.04\% | 0.13\% | 0.15\% | 0.12\% | 0.03\% | 0.23\% | 0.18\% | 0.07\% | -0.04\% | 0.20\% | 0.08\% | -0.04\% | -0.14\% |
|  |  | -0.2780 | 0.2936 | 0.4317 | 0.3609 | 0.6890 | 0.9117 | 0.8662 | 0.2265 | 1.1670 | 1.0668 | 0.4441 | -0.2816 | 1.0540 | 0.4860 | -0.2512 | -0.9921 |
| CAR (1) |  | 0.02\% | 0.08\% | 0.08\% | $\mathbf{0 . 0 1 \%}$ | 0.18\% | 0.19\% | 0.11\% | -0.01\% | 0.27\% | 0.16\% | 0.02\% | -0.09\% | 0.15\% | 0.02\% | -0.11\% | -0.20\% |
|  |  | 0.1195 | 0.6289 | 0.7590 | 0.1572 | 1.0615 | 1.2284 | 0.8092 | -0.1119 | 1.5208 | 1.0063 | 0.1558 | -0.7212 | 0.8814 | 0.1485 | -0.7411 | $-1.4563$ |
| BHAR (0) |  | -0.11\% | 0.14\% | 0.04\% | 0.05\% | 0.08\% | 0.10\% | -0.05\% | 0.12\% | 0.24\% | 0.20\% | 0.18\% | -0.03\% | $\mathbf{0 . 1 9 \%}$ | 0.09\% | -0.01\% | -0.18\% |
|  |  | -0.6728 | 0.9476 | 0.3121 | 0.3140 | 0.4017 | 0.5832 | -0.2942 | 0.9285 | 1.1954 | 1.0827 | 1.2051 | -0.1629 | 0.9600 | 0.5047 | -0.0367 | -1.0536 |
| BHAR (1) |  | 0.02\% | 0.08\% | 0.03\% | -0.03\% | 0.17\% | 0.13\% | -0.07\% | -0.02\% | 0.27\% | 0.11\% | 0.01\% | -0.14\% | 0.10\% | -0.04\% | -0.13\% | -0.27\% |
|  |  | 0.1531 | 0.5966 | 0.2286 | -0.1852 | 0.9180 | 0.7694 | -0.4040 | -0.1579 | 1.4334 | 0.6530 | 0.0407 | -0.9341 | 0.5533 | -0.2394 | -0.7816 | -1.7483 |

Panel B. The time-series momentum strategy using market-weighted return


| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.63\% | 0.71\% | 0.60\% | 0.59\% | 0.87\% | 0.73\% | 0.68\% | 0.64\% | 0.66\% | 0.65\% | 0.57\% | 0.54\% | 0.72\% | 0.59\% | 0.46\% | 0.45\% |
|  |  | 2.8386 | 3.8000 | 3.6313 | 3.9625 | 3.2062 | 3.1570 | 3.2348 | 3.2605 | 2.3245 | 2.4997 | 2.3523 | 2.4389 | 2.5374 | 2.1921 | 1.8335 | 1.9114 |
| CAR (1) |  | 0.75\% | 0.66\% | 0.61\% | $\mathbf{0 . 5 4 \%}$ | 0.82\% | 0.73\% | 0.68\% | 0.60\% | 0.69\% | 0.64\% | 0.57\% | 0.52\% | 0.71\% | 0.57\% | 0.46\% | 0.42\% |
|  |  | 3.2823 | 3.6008 | 3.7274 | 3.6203 | 3.1106 | 3.1815 | 3.2661 | 3.0800 | 2.4917 | 2.4649 | 2.3910 | 2.3355 | 2.4857 | 2.1670 | 1.8594 | 1.7500 |
| BHAR (0) |  | 0.54\% | 0.93\% | 0.53\% | 0.82\% | 0.64\% | 0.16\% | 0.43\% | 0.26\% | 0.37\% | 0.40\% | 0.74\% | 0.34\% | 0.32\% | 0.60\% | 0.60\% | 0.53\% |
|  |  | 2.0546 | 3.1752 | 1.8617 | 2.8624 | 2.0708 | 0.5578 | 1.3941 | 0.8955 | 1.1200 | 1.1206 | 2.2980 | 1.0820 | 0.9756 | 1.9968 | 1.7564 | 1.5750 |
| BHAR (1) |  | 0.92\% | 0.90\% | 0.70\% | 0.98\% | 0.92\% | 0.46\% | 0.47\% | 0.32\% | 0.69\% | 0.81\% | 0.80\% | 0.49\% | 0.59\% | 0.59\% | 0.77\% | 0.56\% |
|  |  | 3.2414 | 3.0826 | 2.5098 | 3.3592 | 2.9815 | 1.5963 | 1.5206 | 1.1282 | 2.1401 | 2.4988 | 2.4475 | 1.5812 | 1.7207 | 1.8786 | 2.2432 | 1.6396 |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.95\% | 1.03\% | 0.97\% | 0.95\% | 1.11\% | 1.09\% | 1.06\% | 0.85\% | 1.22\% | 1.02\% | 0.96\% | 0.95\% | 0.80\% | 0.93\% | 1.07\% | 0.98\% |
|  |  | 2.4359 | 3.2428 | 3.3299 | 3.5456 | 2.2798 | 2.4064 | 2.6524 | 2.3515 | 2.2648 | 2.1145 | 2.1860 | 2.3828 | 1.4615 | 1.9400 | 2.4100 | 2.3471 |
| CAR (1) |  | 1.01\% | 1.06\% | 0.99\% | 0.88\% | 1.08\% | 1.10\% | 1.00\% | 0.84\% | 0.97\% | 0.92\% | 0.92\% | 0.88\% | 0.85\% | 1.02\% | 0.99\% | 0.97\% |
|  |  | 2.7783 | 3.3242 | 3.4249 | 3.3128 | 2.1513 | 2.4549 | 2.5323 | 2.3371 | 1.8091 | 1.9256 | 2.1118 | 2.1835 | 1.5988 | 2.1150 | 2.2130 | 2.2969 |
| BHAR (0) |  | 1.24\% | 1.34\% | 1.12\% | 0.63\% | 1.18\% | 1.53\% | 1.23\% | 0.86\% | 0.87\% | 0.82\% | 0.37\% | 1.16\% | 0.50\% | 1.34\% | 1.20\% | 1.78\% |
|  |  | 2.4562 | 2.5216 | 2.1639 | 1.1055 | 2.0808 | 2.4375 | 1.8832 | 1.3606 | 1.3663 | 1.2963 | 0.6165 | 1.9468 | 0.8355 | 2.2460 | 2.1776 | 3.2684 |
| BHAR (1) |  | 1.76\% | 1.71\% | 1.34\% | 0.75\% | 1.40\% | 1.10\% | 0.94\% | 0.49\% | 0.79\% | 0.94\% | 0.43\% | 1.04\% | 0.40\% | 1.12\% | 0.88\% | 1.80\% |
|  |  | 3.4991 | 3.2609 | 2.6325 | 1.3314 | 2.5038 | 1.7261 | 1.4621 | 0.7898 | 1.2264 | 1.4970 | 0.7038 | 1.7134 | 0.6308 | 1.8715 | 1.6150 | 3.3462 |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.23\% | 0.01\% | 0.08\% | 0.19\% | 0.04\% | 0.16\% | 0.29\% | 0.29\% | 0.19\% | 0.31\% | 0.34\% | 0.24\% | 0.15\% | 0.19\% | 0.18\% | 0.10\% |
|  |  | -1.1667 | 0.0465 | 0.5776 | 1.6403 | 0.1913 | 0.8677 | 1.8723 | 2.0339 | 0.8636 | 1.6570 | 1.9389 | 1.4431 | 0.6735 | 0.9535 | 0.9393 | 0.5579 |
| CAR (1) |  | -0.04\% | 0.13\% | 0.19\% | $\mathbf{0 . 2 0 \%}$ | 0.30\% | 0.32\% | 0.36\% | $\mathbf{0 . 2 9 \%}$ | 0.35\% | 0.35\% | 0.33\% | 0.21\% | 0.21\% | 0.22\% | 0.16\% | 0.10\% |
|  |  | -0.2430 | 0.8865 | 1.4567 | 1.7203 | 1.4449 | 1.8114 | 2.3483 | 2.0522 | 1.6589 | 1.8958 | 1.8986 | 1.2423 | 1.0284 | 1.0809 | 0.8367 | 0.5792 |
| BHAR (0) |  | -0.23\% | -0.01\% | 0.12\% | 0.11\% | 0.03\% | 0.15\% | 0.19\% | 0.55\% | 0.18\% | $0.33 \%$ | 0.30\% | 0.29\% | 0.08\% | 0.33\% | 0.19\% | 0.31\% |
|  |  | -0.9979 | -0.0450 | 0.4878 | 0.4425 | 0.1028 | 0.6097 | 0.8237 | 2.4539 | 0.7308 | 1.3788 | 1.3736 | 1.3025 | 0.3221 | 1.3678 | 0.6809 | 1.2712 |
| BHAR (1) |  | -0.09\% | 0.04\% | 0.18\% | $\mathbf{0 . 1 9 \%}$ | 0.28\% | 0.27\% | 0.20\% | 0.48\% | 0.40\% | 0.39\% | 0.33\% | 0.30\% | 0.17\% | 0.30\% | 0.18\% | 0.14\% |
|  |  | -0.3855 | 0.2133 | 0.7793 | 0.7787 | 1.1540 | 1.0762 | 0.9067 | 2.1156 | 1.6590 | 1.6865 | 1.4831 | 1.3748 | 0.6699 | 1.2727 | 0.6619 | 0.5822 |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.20\% | 0.23\% | 0.26\% | 0.21\% | 0.59\% | 0.58\% | 0.51\% | 0.36\% | 0.85\% | 0.64\% | 0.43\% | 0.27\% | 0.54\% | 0.39\% | 0.26\% | 0.17\% |
|  |  | 0.8973 | 1.2498 | 1.6676 | 1.4691 | 2.2354 | 2.4911 | 2.4176 | 1.7813 | 3.0419 | 2.4131 | 1.6890 | 1.0912 | 1.8999 | 1.4242 | 0.9687 | 0.6557 |
| CAR (1) |  | 0.33\% | 0.31\% | 0.31\% | $\mathbf{0 . 1 9 \%}$ | 0.66\% | 0.58\% | 0.44\% | $\mathbf{0 . 3 2 \%}$ | 0.79\% | 0.51\% | 0.32\% | 0.18\% | 0.46\% | 0.31\% | 0.19\% | 0.10\% |
|  |  | 1.5250 | 1.8319 | 2.0849 | 1.3781 | 2.5247 | 2.5637 | 2.0880 | 1.5909 | 2.8378 | 1.9157 | 1.2621 | 0.7218 | 1.6425 | 1.1069 | 0.7070 | 0.3671 |
| BHAR (0) |  | 0.29\% | 0.30\% | 0.30\% | -0.07\% | 0.51\% | 0.79\% | 0.30\% | 0.49\% | 0.97\% | 0.65\% | 0.51\% | 0.60\% | 0.56\% | 0.42\% | 0.11\% | 0.02\% |
|  |  | 1.0804 | 1.1821 | 1.1072 | -0.2792 | 1.7139 | 2.6657 | 0.9798 | 1.8480 | 3.2736 | 2.1171 | 1.7266 | 2.2179 | 1.8909 | 1.3857 | 0.3720 | 0.0772 |
| BHAR (1) |  | 0.46\% | 0.20\% | 0.31\% | 0.01\% | 0.68\% | 0.93\% | 0.11\% | 0.55\% | 0.84\% | 0.43\% | 0.42\% | 0.32\% | 0.40\% | 0.45\% | 0.15\% | 0.02\% |
|  |  | 1.7224 | 0.7717 | 1.1936 | 0.0511 | 2.2685 | 3.2823 | 0.3514 | 2.1002 | 2.8011 | 1.3149 | 1.3907 | 1.1120 | 1.3290 | 1.4694 | 0.5127 | 0.0551 |




| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| H $=$ |  | 36 |  | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.34\% | 0.05\% | 0.16\% | 0.26\% | 0.03\% | 0.27\% | 0.34\% | 0.32\% | 0.29\% | 0.38\% | 0.52\% | 0.41\% | 0.49\% | 0.51\% | 0.53\% | 0.38\% |
|  |  | -1.3947 | 0.2997 | 0.9988 | 1.8686 | 0.1109 | 1.0354 | 1.4912 | 1.6504 | 0.9721 | 1.5585 | 2.3663 | 2.0183 | 1.5951 | 1.8902 | 2.1851 | 1.6841 |
| CAR (1) |  | -0.26\% | 0.11\% | 0.27\% | 0.27\% | 0.14\% | 0.31\% | 0.38\% | $\mathbf{0 . 3 0 \%}$ | 0.34\% | 0.44\% | 0.54\% | 0.35\% | 0.59\% | 0.56\% | 0.48\% | 0.33\% |
|  |  | -1.0974 | 0.5868 | 1.6675 | 1.9337 | 0.4960 | 1.2654 | 1.7653 | 1.6198 | 1.2317 | 1.8727 | 2.5263 | 1.7725 | 2.0002 | 2.1188 | 2.0102 | 1.4754 |
| BHAR (0) |  | -0.44\% | 0.29\% | 0.41\% | $\mathbf{0 . 4 1 \%}$ | 0.13\% | 0.23\% | 0.40\% | 0.59\% | 0.41\% | 0.48\% | 0.43\% | $\mathbf{0 . 6 0 \%}$ | 0.51\% | 0.19\% | 0.32\% | -0.14\% |
|  |  | -1.2823 | 0.9027 | 1.1936 | 1.3149 | 0.3870 | 0.6922 | 1.1831 | 1.8389 | 1.3624 | 1.6176 | 1.5511 | 1.8884 | 1.5146 | 0.5534 | 1.0590 | -0.4070 |
| BHAR (1) |  | -0.30\% | 0.28\% | 0.58\% | 0.35\% | 0.33\% | 0.17\% | 0.52\% | $\mathbf{0 . 4 2 \%}$ | 0.46\% | 0.57\% | 0.39\% | 0.60\% | 0.74\% | 0.18\% | 0.38\% | 0.02\% |
|  |  | -0.9519 | 0.9424 | 1.7210 | 1.1632 | 0.9661 | 0.5079 | 1.6241 | 1.2987 | 1.4886 | 1.9265 | 1.3975 | 1.9292 | 2.1865 | 0.5594 | 1.3093 | 0.0637 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.50\% | 0.28\% | 0.38\% | 0.37\% | 0.00\% | 0.14\% | 0.33\% | 0.29\% | -0.10\% | 0.20\% | 0.30\% | 0.15\% | 0.15\% | 0.28\% | 0.31\% | 0.28\% |
|  |  | 1.3360 | 0.9958 | 1.6513 | 1.7430 | 0.0124 | 0.4543 | 1.1963 | 1.0984 | -0.2370 | 0.5600 | 0.9316 | 0.4745 | 0.3307 | 0.6879 | 0.8109 | 0.7520 |
| CAR (1) |  | 0.47\% | 0.30\% | 0.45\% | 0.40\% | 0.02\% | 0.29\% | 0.38\% | 0.30\% | 0.23\% | 0.42\% | 0.31\% | 0.17\% | 0.33\% | 0.37\% | 0.37\% | 0.34\% |
|  |  | 1.3260 | 1.1214 | 1.9100 | 1.8999 | 0.0522 | 0.9077 | 1.3308 | 1.1116 | 0.5328 | 1.2146 | 0.9533 | 0.5150 | 0.6884 | 0.9103 | 0.9657 | 0.8806 |
| BHAR (0) |  | 0.61\% | -0.13\% | 0.30\% | 1.00\% | -0.16\% | 0.14\% | 0.25\% | 0.56\% | 0.21\% | 0.31\% | 0.46\% | 0.17\% | 0.46\% | 0.46\% | 0.22\% | 0.21\% |
|  |  | 1.2546 | -0.2453 | 0.7379 | 1.8041 | -0.3468 | 0.2911 | 0.6268 | 1.1268 | 0.4883 | 0.7226 | 0.9838 | 0.3703 | 0.9665 | 0.9298 | 0.5197 | 0.4160 |
| BHAR (1) |  | 1.10\% | 0.08\% | 0.44\% | 1.09\% | -0.05\% | 0.46\% | 0.51\% | 0.50\% | 0.29\% | 0.23\% | 0.25\% | 0.14\% | 0.46\% | 0.61\% | 0.36\% | 0.38\% |
|  |  | 2.4324 | 0.1582 | 1.1208 | 1.9536 | -0.1072 | 0.9499 | 1.2623 | 1.0119 | 0.6887 | 0.5611 | 0.5195 | 0.3034 | 0.9473 | 1.2216 | 0.8411 | 0.7583 |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.11\% | 0.15\% | 0.03\% | 0.07\% | 0.30\% | 0.07\% | 0.04\% | 0.05\% | 0.08\% | 0.00\% | 0.08\% | 0.03\% | 0.21\% | 0.17\% | 0.08\% | 0.07\% |
|  |  | -0.4254 | 0.9643 | 0.2113 | 0.5150 | 1.2917 | 0.3319 | 0.1689 | 0.2304 | 0.2902 | 0.0129 | 0.2786 | 0.1428 | 0.6538 | 0.5451 | 0.2899 | 0.2863 |
| CAR (1) |  | 0.04\% | 0.18\% | 0.10\% | $\mathbf{0 . 1 1 \%}$ | 0.31\% | 0.04\% | 0.07\% | 0.03\% | -0.03\% | -0.01\% | 0.06\% | -0.01\% | 0.07\% | 0.12\% | 0.01\% | 0.06\% |
|  |  | 0.2077 | 1.1537 | 0.6533 | 0.8374 | 1.3112 | 0.1846 | 0.2921 | 0.1323 | -0.1180 | -0.0285 | 0.2250 | -0.0274 | 0.1992 | 0.3809 | 0.0394 | 0.2335 |
| BHAR (0) |  | 0.09\% | 0.12\% | 0.39\% | 0.05\% | 0.39\% | -0.19\% | 0.28\% | 0.07\% | 0.26\% | 0.15\% | 0.14\% | 0.15\% | 0.25\% | 0.12\% | 0.29\% | 0.35\% |
|  |  | 0.2922 | 0.3773 | 1.6799 | 0.1371 | 1.4338 | -0.5932 | 0.9153 | 0.2485 | 0.8334 | 0.4900 | 0.4072 | 0.4987 | 0.7095 | 0.3289 | 0.8431 | 1.0752 |
| BHAR (1) |  | 0.08\% | -0.38\% | 0.38\% | 0.06\% | 0.27\% | -0.19\% | 0.11\% | 0.29\% | -0.01\% | 0.10\% | 0.25\% | 0.00\% | -0.05\% | -0.01\% | 0.03\% | 0.25\% |
|  |  | 0.2539 | -1.1739 | 1.5774 | 0.1610 | 1.0032 | -0.5995 | 0.3668 | 1.0224 | -0.0259 | 0.2949 | 0.7331 | -0.0110 | -0.1233 | -0.0394 | 0.0877 | 0.8035 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.03\% | 0.09\% | 0.22\% | 0.27\% | 0.26\% | 0.22\% | 0.35\% | 0.31\% | 0.26\% | 0.44\% | 0.45\% | 0.41\% | 0.22\% | 0.37\% | 0.37\% | 0.29\% |
|  |  | -0.1175 | 0.4504 | 1.3051 | 1.8573 | 0.9712 | 0.9130 | 1.7063 | 1.7304 | 0.8424 | 1.6035 | 1.8447 | 1.8192 | 0.7227 | 1.2708 | 1.3501 | 1.0912 |
| CAR (1) |  | -0.04\% | 0.11\% | 0.28\% | 0.25\% | 0.15\% | 0.27\% | 0.36\% | 0.28\% | 0.40\% | 0.46\% | 0.44\% | 0.40\% | 0.38\% | 0.43\% | 0.39\% | 0.31\% |
|  |  | -0.1554 | 0.5854 | 1.6834 | 1.7370 | 0.5509 | 1.1178 | 1.8517 | 1.5615 | 1.2641 | 1.6879 | 1.8205 | 1.7269 | 1.3019 | 1.4909 | 1.4227 | 1.1758 |
| BHAR (0) |  | -0.26\% | -0.49\% | -0.04\% | -0.22\% | 0.18\% | 0.08\% | 0.05\% | 0.48\% | 0.22\% | 0.74\% | 0.72\% | 0.62\% | 0.24\% | 0.57\% | 0.44\% | 0.42\% |
|  |  | -0.8197 | -1.6197 | -0.1285 | -0.6612 | 0.5686 | 0.2435 | 0.1618 | 1.5327 | 0.6184 | 2.2925 | 2.3822 | 2.0855 | 0.7347 | 1.4515 | 1.2079 | 1.1822 |
| BHAR (1) |  | 0.03\% | -0.47\% | 0.07\% | -0.22\% | 0.05\% | 0.19\% | 0.13\% | 0.30\% | 0.52\% | 0.66\% | 0.82\% | 0.55\% | 0.45\% | 0.67\% | 0.46\% | 0.36\% |
|  |  | 0.0895 | -1.6143 | 0.2354 | -0.6687 | 0.1560 | 0.5513 | 0.4299 | 0.9479 | 1.4874 | 2.0061 | 2.5964 | 1.7642 | 1.4470 | 1.7675 | 1.2659 | 1.0441 |


| MW $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.18\% | 0.11\% | 0.07\% | 0.09\% | 0.11\% | -0.03\% | 0.04\% | 0.07\% | 0.10\% | 0.07\% | 0.05\% | -0.01\% | 0.10\% | 0.18\% | 0.11\% | 0.09\% |
|  | 0.6692 | 0.5021 | 0.3445 | 0.5603 | 0.3485 | -0.0979 | 0.1527 | 0.2891 | 0.3048 | 0.2418 | 0.1720 | -0.0517 | 0.2577 | 0.5373 | 0.3551 | 0.2952 |
| CAR (1) | 0.08\% | 0.06\% | 0.08\% | 0.07\% | 0.03\% | 0.05\% | 0.08\% | 0.07\% | 0.16\% | 0.12\% | 0.09\% | -0.03\% | 0.21\% | 0.16\% | 0.05\% | 0.10\% |
|  | 0.2920 | 0.2746 | 0.4574 | 0.4108 | 0.0923 | 0.1885 | 0.3578 | 0.2948 | 0.4803 | 0.4132 | 0.3384 | -0.1304 | 0.5823 | 0.4637 | 0.1709 | 0.3486 |
| BHAR (0) | 0.33\% | 0.24\% | -0.13\% | -0.06\% | 0.39\% | 0.38\% | 0.59\% | 0.19\% | 0.33\% | 0.10\% | -0.05\% | -0.28\% | 0.01\% | 0.32\% | 0.11\% | 0.39\% |
|  | 0.9410 | 0.7426 | -0.3731 | -0.1682 | 1.1733 | 1.0611 | 1.6714 | 0.5307 | 0.9043 | 0.2440 | -0.1275 | -0.7652 | 0.0294 | 0.8849 | 0.2944 | 1.0573 |
| BHAR (1) | 0.36\% | 0.05\% | -0.10\% | -0.15\% | 0.41\% | 0.36\% | 0.74\% | 0.19\% | 0.17\% | 0.10\% | -0.08\% | -0.33\% | -0.04\% | 0.16\% | 0.19\% | 0.44\% |
|  | 1.0332 | 0.1468 | -0.3053 | -0.4203 | 1.1420 | 0.9979 | 2.1249 | 0.5285 | 0.4401 | 0.2689 | -0.2179 | -0.9094 | -0.1139 | 0.4594 | 0.4984 | 1.2218 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | -0.06\% | 0.17\% | 0.19\% | 0.24\% | 0.18\% | 0.33\% | 0.39\% | 0.30\% | 0.25\% | 0.39\% | 0.32\% | 0.25\% | 0.47\% | 0.38\% | 0.28\% | 0.18\% |
|  | -0.3232 | 1.1022 | 1.3754 | 2.0455 | 0.8468 | 1.7264 | 2.2402 | 1.8946 | 1.1550 | 1.9194 | 1.7392 | 1.4145 | 2.0493 | 1.8497 | 1.4288 | 0.9761 |
| CAR (1) | 0.08\% | 0.25\% | 0.28\% | 0.23\% | 0.31\% | 0.41\% | 0.43\% | 0.27\% | 0.40\% | 0.40\% | 0.33\% | 0.19\% | 0.37\% | 0.32\% | 0.22\% | 0.11\% |
|  | 0.4168 | 1.6051 | 2.0828 | 1.9998 | 1.4840 | 2.1152 | 2.5667 | 1.6937 | 1.8132 | 2.0236 | 1.7881 | 1.1105 | 1.6449 | 1.5446 | 1.1386 | 0.5975 |
| BHAR (0) | -0.05\% | 0.23\% | 0.10\% | 0.38\% | 0.20\% | 0.35\% | 0.24\% | 0.51\% | 0.06\% | 0.08\% | 0.30\% | 0.34\% | 0.43\% | 0.61\% | 0.32\% | 0.40\% |
|  | -0.2037 | 0.9452 | 0.4466 | 1.4202 | 0.8223 | 1.4123 | 0.9749 | 1.9739 | 0.2646 | 0.3249 | 1.1564 | 1.4799 | 1.7200 | 2.4352 | 1.2934 | 1.6192 |
| BHAR (1) | 0.12\% | 0.39\% | 0.20\% | 0.42\% | 0.35\% | 0.40\% | 0.28\% | 0.49\% | 0.29\% | 0.33\% | 0.23\% | 0.30\% | 0.27\% | 0.32\% | 0.26\% | 0.16\% |
|  | 0.5069 | 1.6299 | 0.9081 | 1.6245 | 1.4545 | 1.6079 | 1.1690 | 1.8990 | 1.1770 | 1.3883 | 0.9357 | 1.3153 | 1.1030 | 1.3193 | 1.1236 | 0.6416 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | -0.14\% | 0.02\% | 0.10\% | 0.24\% | 0.03\% | 0.17\% | 0.27\% | 0.29\% | 0.11\% | 0.28\% | 0.29\% | 0.21\% | 0.45\% | 0.35\% | 0.24\% | 0.16\% |
|  | -0.8434 | 0.1689 | 0.7712 | 2.0839 | 0.1714 | 0.9965 | 1.6757 | 2.0027 | 0.5016 | 1.4286 | 1.5425 | 1.2408 | 2.0285 | 1.6673 | 1.2378 | 0.8881 |
| CAR (1) | -0.08\% | 0.07\% | 0.18\% | 0.23\% | 0.10\% | 0.25\% | 0.33\% | 0.27\% | 0.24\% | 0.33\% | 0.26\% | 0.16\% | 0.38\% | 0.30\% | 0.16\% | 0.11\% |
|  | -0.4597 | 0.4905 | 1.4008 | 2.0906 | 0.5329 | 1.4227 | 2.0843 | 1.8723 | 1.0962 | 1.6769 | 1.4465 | 0.9286 | 1.7282 | 1.4566 | 0.8273 | 0.6253 |
| BHAR (0) | -0.38\% | -0.16\% | 0.09\% | 0.02\% | 0.11\% | 0.14\% | 0.22\% | 0.31\% | 0.17\% | 0.19\% | 0.10\% | $\mathbf{0 . 3 2 \%}$ | 0.51\% | 0.35\% | 0.15\% | 0.16\% |
|  | -1.7654 | -0.8208 | 0.4088 | 0.1117 | 0.4849 | 0.6771 | 1.0117 | 1.5898 | 0.7392 | 0.8265 | 0.4979 | 1.5072 | 2.0608 | 1.4558 | 0.6581 | 0.6832 |
| BHAR (1) | -0.08\% | -0.09\% | 0.16\% | 0.26\% | 0.09\% | 0.20\% | 0.32\% | 0.13\% | 0.22\% | 0.16\% | -0.06\% | 0.20\% | 0.45\% | 0.13\% | -0.04\% | 0.06\% |
|  | -0.3741 | -0.4566 | 0.7517 | 1.2437 | 0.4431 | 0.9509 | 1.5110 | 0.6749 | 0.9699 | 0.7070 | -0.2953 | 0.9608 | 1.8800 | 0.5578 | -0.1655 | 0.2539 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | -0.24\% | -0.01\% | 0.08\% | 0.10\% | 0.00\% | 0.13\% | 0.17\% | 0.16\% | 0.19\% | 0.26\% | 0.23\% | 0.17\% | 0.23\% | 0.21\% | 0.15\% | 0.10\% |
|  | -1.5037 | -0.0503 | 0.6721 | 0.9649 | 0.0106 | 0.7282 | 1.1074 | 1.1232 | 0.8984 | 1.3439 | 1.3298 | 1.0712 | 1.0596 | 1.0566 | 0.8380 | 0.6005 |
| CAR (1) | -0.11\% | 0.08\% | 0.14\% | 0.12\% | 0.12\% | 0.21\% | 0.21\% | 0.15\% | 0.32\% | 0.30\% | 0.23\% | 0.15\% | 0.23\% | 0.20\% | 0.15\% | 0.07\% |
|  | -0.6921 | 0.6152 | 1.2100 | 1.2114 | 0.6245 | 1.2138 | 1.4108 | 1.0881 | 1.5284 | 1.6083 | 1.3727 | 0.9895 | 1.1606 | 1.0456 | 0.8142 | 0.4106 |
| BHAR (0) | -0.31\% | 0.09\% | -0.12\% | 0.07\% | -0.01\% | -0.01\% | -0.01\% | 0.28\% | 0.24\% | 0.39\% | 0.27\% | 0.22\% | 0.22\% | 0.14\% | 0.13\% | 0.11\% |
|  | -1.5830 | 0.5094 | -0.6924 | 0.3662 | -0.0302 | -0.0425 | -0.0626 | 1.7035 | 1.0647 | 1.9327 | 1.4167 | 1.2043 | 0.9695 | 0.6521 | 0.6474 | 0.5509 |
| BHAR (1) | -0.15\% | -0.02\% | -0.05\% | 0.08\% | 0.04\% | 0.13\% | 0.00\% | 0.18\% | 0.36\% | 0.36\% | 0.19\% | 0.08\% | 0.10\% | 0.01\% | 0.02\% | -0.04\% |
|  | -0.7351 | -0.1338 | -0.2765 | 0.4120 | 0.1820 | 0.6536 | 0.0212 | 1.1318 | 1.5639 | 1.6732 | 0.9790 | 0.4041 | 0.4504 | 0.0600 | 0.0978 | -0.1918 |

Panel C. The time-series momentum strategy using inversed volatility-weighted return


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.69\% | 0.70\% | 0.62\% | 0.60\% | 0.92\% | 0.81\% | 0.77\% | 0.70\% | 0.95\% | 0.92\% | 0.81\% | 0.71\% | 1.03\% | 0.96\% | 0.80\% | 0.70\% |
|  |  | 7.0522 | 7.6194 | 7.4266 | 7.7340 | 8.2095 | 7.1764 | 6.9134 | 6.5577 | 6.9903 | 6.6735 | 6.1813 | 5.7108 | 7.1508 | 6.7193 | 5.6528 | 5.0435 |
| CAR (1) |  | 0.68\% | 0.66\% | 0.64\% | 0.59\% | 0.87\% | 0.78\% | 0.75\% | 0.65\% | 0.97\% | 0.88\% | 0.77\% | 0.64\% | 0.96\% | 0.87\% | 0.74\% | 0.61\% |
|  |  | 7.4985 | 7.6158 | 7.9684 | 7.4136 | 7.6961 | 6.7721 | 6.6860 | 6.1233 | 7.2114 | 6.3900 | 5.8412 | 5.1428 | 6.6424 | 6.0247 | 5.1450 | 4.4098 |
| BHAR (0) |  | 0.77\% | 0.74\% | 0.65\% | 0.73\% | 0.87\% | 0.80\% | 0.73\% | 0.85\% | 0.83\% | 0.79\% | 0.73\% | 0.70\% | 0.93\% | 0.99\% | 0.82\% | 0.68\% |
|  |  | 6.0836 | 5.6506 | 4.7278 | 5.5520 | 6.6497 | 5.2477 | 4.8699 | 5.5799 | 5.6093 | 4.6715 | 4.8376 | 4.4308 | 5.9831 | 6.1028 | 4.8731 | 3.7570 |
| BHAR (1) |  | 0.74\% | 0.80\% | 0.73\% | 0.80\% | 0.89\% | 0.88\% | 0.70\% | 0.84\% | 0.98\% | 0.85\% | 0.79\% | 0.68\% | 0.99\% | 0.96\% | 0.81\% | 0.60\% |
|  |  | 5.2705 | 5.8842 | 4.7562 | 5.9560 | 6.7690 | 5.6872 | 4.9049 | 5.5840 | 6.7844 | 5.3445 | 5.2593 | 4.4955 | 6.1270 | 5.7146 | 4.7159 | 3.2765 |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.81\% | 0.63\% | 0.52\% | 0.50\% | 0.74\% | 0.58\% | 0.53\% | 0.49\% | 0.52\% | 0.45\% | 0.47\% | 0.43\% | 0.56\% | 0.47\% | 0.50\% | 0.46\% |
|  |  | 5.3910 | 4.5970 | 4.3471 | 4.5909 | 3.8691 | 3.2400 | 3.2200 | 3.2381 | 1.9988 | 1.9628 | 2.3102 | 2.3805 | 1.8633 | 1.8916 | 2.2848 | 2.2959 |
| CAR (1) |  | 0.78\% | 0.59\% | 0.52\% | 0.50\% | 0.70\% | 0.57\% | 0.54\% | 0.44\% | 0.52\% | 0.42\% | 0.45\% | 0.40\% | 0.49\% | 0.44\% | 0.46\% | 0.41\% |
|  |  | 5.0569 | 4.3677 | 4.3681 | 4.4097 | 3.9178 | 3.1530 | 3.2632 | 2.9367 | 2.0822 | 1.8634 | 2.2506 | 2.2376 | 1.6959 | 1.8494 | 2.1605 | 2.0751 |
| BHAR (0) |  | 0.90\% | 0.68\% | 0.26\% | 0.59\% | 0.71\% | 0.51\% | 0.31\% | 0.40\% | 0.40\% | 0.06\% | 0.27\% | 0.11\% | 0.63\% | 0.70\% | 0.48\% | 0.69\% |
|  |  | 4.2277 | 2.8962 | 1.3436 | 2.1676 | 2.8275 | 1.5344 | 0.8378 | 1.0543 | 1.2428 | 0.1669 | 0.8837 | 0.3525 | 1.9433 | 2.6647 | 1.8983 | 2.8278 |
| BHAR (1) |  | $\mathbf{0 . 8 4 \%}$ | 0.58\% | 0.36\% | 0.49\% | $\mathbf{0 . 8 1 \%}$ | $0.37 \%$ | $0.21 \%$ | 0.26\% | $0.33 \%$ | $0.00 \%$ | $0.20 \%$ | 0.08\% | $0.40 \%$ | $0.66 \%$ | 0.40\% | 0.59\% |
|  |  | $4.6396$ | 3.0650 | 1.8796 | 1.9952 | $3.3915$ | $1.0372$ | $0.5824$ | 0.6945 | $0.9956$ | $0.0084$ | $0.6853$ | 0.2583 | $1.1586$ | $2.4357$ | 1.5548 | 2.4249 |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.12\% | 0.21\% | 0.12\% | 0.16\% | 0.35\% | 0.34\% | 0.29\% | 0.23\% | 0.31\% | 0.51\% | 0.32\% | 0.22\% | 0.54\% | 0.50\% | 0.32\% | 0.24\% |
|  |  | 0.6394 | 0.8717 | 0.4509 | 0.5864 | 2.2629 | 1.4453 | 1.1146 | 0.8777 | 1.7621 | 2.1456 | 1.2629 | 0.9762 | 3.2925 | 2.2545 | 1.6680 | 1.3774 |
| CAR (1) |  | 0.29\% | 0.22\% | 0.07\% | 0.05\% | 0.46\% | 0.33\% | 0.31\% | 0.20\% | 0.52\% | 0.58\% | 0.33\% | 0.23\% | 0.63\% | 0.45\% | 0.27\% | 0.21\% |
|  |  | 1.7110 | 0.8560 | 0.2619 | 0.1839 | 2.8133 | 1.4420 | 1.2315 | 0.7603 | 2.9774 | 2.4625 | 1.3334 | 1.0373 | 3.9638 | 2.1850 | 1.5099 | 1.2516 |
| BHAR (0) |  | 0.09\% | $-0.25 \%$ | 0.02\% | -0.51\% | $0.07 \%$ | 0.49\% | 0.03\% | -0.03\% | 0.22\% | 0.18\% | 0.69\% | 0.19\% | 0.32\% | 0.74\% | 0.12\% | 0.58\% |
|  |  | 0.4355 | -0.5952 | 0.0464 | -0.9901 | 0.3958 | 1.4145 | 0.1142 | -0.0700 | 1.5000 | 0.6934 | 1.8165 | 0.5375 | 2.0264 | 2.3192 | 0.3553 | 1.5927 |
| BHAR (1) |  | 0.29\% | 0.01\% | 0.28\% | -0.42\% | 0.57\% | 0.88\% | 0.37\% | 0.31\% | 0.70\% | 0.49\% | 0.69\% | 0.26\% | 0.98\% | 0.82\% | 0.09\% | 0.57\% |
|  |  | 1.1542 | 0.0143 | 0.6462 | -0.7460 | 2.2019 | 2.4493 | 1.1644 | 0.8183 | 2.7087 | 1.3328 | 1.7024 | 0.6499 | 3.6121 | 2.2690 | 0.2761 | 1.4999 |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.49\% | 0.50\% | 0.46\% | 0.59\% | 0.68\% | 0.76\% | 0.83\% | 0.76\% | 0.79\% | 0.88\% | 0.84\% | 0.73\% | 0.93\% | 0.85\% | 0.73\% | 0.60\% |
|  |  | 4.2206 | 3.3247 | 3.1831 | 4.0021 | 5.4130 | 5.1024 | 5.3461 | 4.7709 | 5.8442 | 5.5168 | 5.0178 | 4.6266 | 6.4691 | 5.1655 | 4.5507 | 4.2694 |
| CAR (1) |  | 0.50\% | 0.52\% | 0.59\% | 0.63\% | 0.72\% | 0.78\% | 0.82\% | 0.72\% | 0.82\% | 0.86\% | 0.77\% | 0.67\% | 0.90\% | 0.75\% | 0.65\% | 0.52\% |
|  |  | 4.1170 | 3.4830 | 3.8718 | 4.0825 | 5.8882 | 5.4433 | 5.3153 | 4.6484 | 6.2854 | 5.4809 | 4.8069 | 4.2836 | 6.3997 | 4.6989 | 4.0089 | 3.7055 |
| BHAR (0) |  | 0.49\% | 0.27\% | 0.46\% | 0.09\% | 0.59\% | 0.69\% | 0.65\% | 0.87\% | 0.73\% | 0.91\% | 0.92\% | 0.82\% | 0.78\% | 0.77\% | 0.93\% | 0.40\% |
|  |  | 3.0728 | 1.1834 | 2.0654 | 0.2687 | 3.6206 | 4.1351 | 3.7380 | 3.9231 | 4.7724 | 4.2214 | 4.0384 | 3.8823 | 5.0646 | 4.4694 | 4.0379 | 3.0110 |
| BHAR (1) |  | 0.48\% | 0.58\% | 0.85\% | 1.36\% | 0.51\% | 0.68\% | 0.58\% | 0.91\% | 0.78\% | 0.91\% | 0.81\% | 0.70\% | 0.83\% | 0.82\% | 0.79\% | 0.40\% |
|  |  | 3.4840 | 3.2224 | 3.9215 | 3.2851 | 3.9199 | 3.1065 | 3.8843 | 3.5353 | 5.8058 | 4.5068 | 3.3760 | 3.3363 | 5.7625 | 4.7189 | 3.4250 | 3.0488 |




| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 6 |  | 9 | 12 | 6 |  | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.19\% | 0.31\% | 0.35\% | 0.33\% | 0.46\% | 0.34\% | 0.36\% | 0.31\% | 0.60\% | 0.48\% | 0.40\% | 0.31\% | 0.53\% | 0.36\% | 0.33\% | 0.19\% |
|  |  | 1.1899 | 2.4774 | 3.0865 | 3.2824 | 2.7801 | 1.9367 | 2.3203 | 2.2376 | 3.0499 | 2.5765 | 2.3759 | 1.9983 | 2.4571 | 1.7839 | 1.8379 | 1.1052 |
| CAR (1) |  | 0.18\% | 0.36\% | 0.40\% | 0.30\% | 0.44\% | 0.37\% | 0.38\% | 0.28\% | 0.59\% | 0.41\% | 0.37\% | $\mathbf{0 . 2 1 \%}$ | 0.55\% | 0.30\% | 0.28\% | 0.12\% |
|  |  | 1.2361 | 2.8746 | 3.5566 | 2.9536 | 2.6941 | 2.2464 | 2.5960 | 2.1105 | 3.0797 | 2.3629 | 2.2949 | 1.4254 | 2.8135 | 1.6452 | 1.6581 | 0.7684 |
| BHAR (0) |  | 0.20\% | 0.52\% | 0.56\% | $\mathbf{0 . 6 1 \%}$ | 0.57\% | 0.29\% | 0.34\% | 0.60\% | 0.68\% | 0.28\% | 0.44\% | 0.26\% | 0.72\% | 0.27\% | 0.09\% | -0.09\% |
|  |  | 0.8804 | 2.0023 | 2.1235 | 3.0892 | 2.5365 | 1.2881 | 1.5997 | 2.8767 | 2.8565 | 0.9982 | 1.8412 | 0.9156 | 2.9825 | 1.3197 | 0.3392 | -0.4527 |
| BHAR (1) |  | 0.38\% | 0.41\% | 0.35\% | $\mathbf{0 . 5 1 \%}$ | 0.38\% | 0.14\% | 0.26\% | 0.37\% | 0.53\% | 0.23\% | 0.37\% | 0.18\% | 0.65\% | 0.27\% | 0.26\% | 0.03\% |
|  |  | 2.0363 | 2.2539 | 1.6081 | 2.7759 | 1.9980 | 0.6276 | 1.2735 | 1.7998 | 2.5551 | 1.0785 | 1.6682 | 0.8243 | 3.0411 | 1.3019 | 1.2283 | 0.1580 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.26\% | 0.20\% | 0.24\% | 0.18\% | 0.35\% | 0.16\% | 0.15\% | 0.14\% | 0.29\% | -0.03\% | -0.06\% | -0.03\% | 0.24\% | -0.01\% | -0.04\% | 0.08\% |
|  |  | 0.8478 | 0.6083 | 0.7275 | 0.5476 | 1.1900 | 0.4902 | 0.4460 | 0.4223 | 0.9431 | -0.0772 | -0.1809 | -0.0833 | 0.7790 | -0.0200 | -0.1180 | 0.2230 |
| CAR (1) |  | 0.36\% | 0.33\% | 0.23\% | 0.18\% | 0.37\% | 0.18\% | 0.17\% | 0.17\% | 0.31\% | 0.01\% | 0.00\% | 0.03\% | 0.32\% | -0.01\% | 0.04\% | 0.14\% |
|  |  | 1.2082 | 1.0100 | 0.6837 | 0.5441 | 1.3032 | 0.5558 | 0.5013 | 0.5146 | 0.9509 | 0.0348 | 0.0033 | 0.0793 | 1.0259 | -0.0200 | 0.1057 | 0.4287 |
| BHAR (0) |  | 0.50\% | 0.05\% | 0.24\% | 0.66\% | 0.49\% | 0.25\% | 0.37\% | 0.22\% | 0.30\% | 0.18\% | 0.20\% | 0.08\% | 0.42\% | 0.04\% | 0.05\% | -0.26\% |
|  |  | 1.0368 | 0.0922 | 0.4349 | 1.3855 | 1.4381 | 0.7489 | 0.6713 | 0.5610 | 0.9654 | 0.4332 | 0.4878 | 0.1982 | 1.3256 | 0.0900 | 0.1254 | -0.5437 |
| BHAR (1) |  | 0.33\% | 0.35\% | 0.26\% | 0.25\% | 0.17\% | 0.25\% | 0.23\% | -0.11\% | 0.61\% | 0.43\% | 0.28\% | 0.08\% | 0.12\% | -0.20\% | 0.24\% | -0.08\% |
|  |  | 0.7830 | 0.7562 | 0.4836 | 0.5440 | 0.4845 | 0.6766 | 0.4700 | -0.2757 | 1.4212 | 0.9259 | 0.5500 | 0.1958 | 0.3145 | -0.4455 | 0.5335 | -0.1592 |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.41\% | 0.58\% | 0.50\% | 0.36\% | 0.75\% | 0.65\% | 0.46\% | 0.38\% | 0.57\% | 0.52\% | 0.41\% | 0.34\% | 0.45\% | 0.44\% | 0.36\% | 0.29\% |
|  |  | 2.1674 | 3.7557 | 3.7241 | 2.8396 | 4.0628 | 3.5344 | 2.6166 | 2.3598 | 2.6640 | 2.3929 | 2.0359 | 1.8720 | 1.7166 | 1.8512 | 1.6705 | 1.4597 |
| CAR (1) |  | 0.45\% | 0.58\% | 0.50\% | 0.37\% | 0.78\% | 0.61\% | 0.44\% | 0.34\% | 0.58\% | 0.50\% | 0.37\% | 0.31\% | 0.44\% | 0.40\% | 0.31\% | 0.26\% |
|  |  | 2.5722 | 4.1359 | 4.1485 | 3.2945 | 4.3850 | 3.3511 | 2.6443 | 2.2563 | 2.6189 | 2.3175 | 1.8916 | 1.7337 | 1.7122 | 1.7265 | 1.4519 | 1.3671 |
| BHAR (0) |  | 0.40\% | 0.55\% | 0.32\% | 0.56\% | 0.66\% | 0.53\% | 0.21\% | 0.48\% | 0.58\% | 0.55\% | 0.64\% | 0.36\% | 0.62\% | 0.63\% | 0.55\% | 0.36\% |
|  |  | 1.7803 | 2.3150 | 1.5747 | 2.4632 | 2.6225 | 2.0362 | 0.7885 | 1.7806 | 2.3827 | 2.2338 | 2.8886 | 1.5742 | 2.2933 | 2.5930 | 2.2291 | 1.4964 |
| BHAR (1) |  | 0.43\% | 0.39\% | 0.50\% | 0.47\% | 0.73\% | 0.65\% | 0.26\% | 0.60\% | 0.57\% | 0.47\% | 0.53\% | 0.35\% | 0.44\% | 0.61\% | 0.37\% | 0.39\% |
|  |  | 2.0526 | 1.9709 | 3.1697 | 3.5716 | 3.3654 | 2.9601 | 1.0655 | 3.3131 | 2.2942 | 1.9403 | 2.3326 | 1.5245 | 1.6429 | 2.5188 | 1.5260 | 1.6124 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.51\% | 0.34\% | 0.48\% | 0.56\% | 0.50\% | 0.67\% | 0.72\% | 0.62\% | 0.90\% | 0.94\% | 0.84\% | 0.74\% | 0.99\% | 0.93\% | 0.87\% | 0.76\% |
|  |  | 3.6063 | 2.4455 | 3.7384 | 4.1635 | 3.3264 | 4.2880 | 4.5548 | 4.1623 | 5.4503 | 5.1861 | 5.1655 | 4.8765 | 5.6672 | 5.4687 | 5.2979 | 4.7134 |
| CAR (1) |  | 0.44\% | 0.42\% | 0.53\% | 0.53\% | 0.44\% | 0.67\% | 0.68\% | 0.56\% | 0.86\% | 0.83\% | 0.74\% | 0.67\% | 0.89\% | 0.87\% | 0.79\% | 0.68\% |
|  |  | 3.3184 | 3.2433 | 3.9468 | 4.0400 | 3.0534 | 4.1045 | 4.2814 | 3.8479 | 5.1842 | 4.7849 | 4.6792 | 4.5067 | 5.1440 | 5.1202 | 4.7524 | 4.3728 |
| BHAR (0) |  | 0.66\% | 0.24\% | 0.43\% | 0.15\% | 0.41\% | 0.61\% | 0.87\% | 0.50\% | 0.89\% | 0.87\% | 0.68\% | 0.64\% | 1.04\% | 1.03\% | 0.72\% | 0.88\% |
|  |  | 3.4049 | 1.1170 | 1.8251 | 0.6376 | 2.2417 | 3.4334 | 3.5719 | 2.2340 | 4.3774 | 3.6941 | 3.4996 | 2.7789 | 4.8464 | 4.2751 | 3.6315 | 3.7545 |
| BHAR (1) |  | 0.27\% | 0.34\% | 0.71\% | 0.44\% | 0.37\% | 0.68\% | 0.42\% | 0.36\% | 0.81\% | 0.81\% | 0.46\% | 0.64\% | 0.83\% | 0.83\% | 0.71\% | 0.71\% |
|  |  | 1.3916 | 1.6139 | 3.0045 | 1.9522 | 2.3565 | 4.5587 | 2.3825 | 1.6485 | 4.5202 | 3.3391 | 2.3104 | 2.6931 | 4.2924 | 4.0527 | 3.0272 | 3.5576 |


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 6 |  | 9 | 12 | 6 |  | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.56\% | 0.45\% | 0.38\% | 0.39\% | 0.70\% | 0.53\% | 0.48\% | 0.41\% | 0.73\% | 0.66\% | 0.53\% | 0.42\% | 0.85\% | 0.66\% | 0.51\% | 0.44\% |
|  |  | 2.9467 | 2.0566 | 1.7245 | 1.7509 | 3.0997 | 2.1321 | 1.9441 | 1.6722 | 2.9927 | 2.5837 | 2.0828 | 1.6558 | 3.3706 | 2.4614 | 1.9410 | 1.9791 |
| CAR (1) |  | 0.55\% | 0.44\% | 0.42\% | $\mathbf{0 . 4 1 \%}$ | 0.63\% | 0.51\% | 0.45\% | 0.35\% | 0.75\% | 0.63\% | 0.47\% | $\mathbf{0 . 3 9 \%}$ | 0.84\% | 0.57\% | 0.45\% | 0.38\% |
|  |  | 3.1318 | 2.0636 | 1.9377 | 1.8491 | 2.8943 | 2.1232 | 1.8867 | 1.4623 | 3.1544 | 2.4993 | 1.8791 | 1.7057 | 3.3867 | 2.2224 | 1.9411 | 1.8644 |
| BHAR (0) |  | 0.59\% | 0.47\% | 0.47\% | 0.19\% | 0.62\% | 0.50\% | 0.39\% | 0.42\% | 0.57\% | 0.45\% | 0.56\% | $\mathbf{0 . 1 1 \%}$ | 0.75\% | 0.73\% | 0.61\% | 0.30\% |
|  |  | 2.2016 | 1.7214 | 1.5693 | 0.7072 | 2.0317 | 1.5305 | 1.1904 | 1.4163 | 1.8146 | 1.4358 | 1.6606 | 0.3221 | 2.3352 | 2.2381 | 2.0031 | 0.8341 |
| BHAR (1) |  | 0.80\% | 0.44\% | 0.62\% | 0.45\% | 0.69\% | 0.57\% | 0.37\% | 0.28\% | 0.75\% | 0.45\% | 0.48\% | 0.03\% | 0.94\% | 0.85\% | 0.51\% | 0.39\% |
|  |  | 3.7642 | 1.4574 | 2.0825 | 1.5005 | 2.9132 | 2.3577 | 1.1353 | 0.9461 | 3.0477 | 1.4430 | 2.0108 | 0.0981 | 3.9133 | 3.6719 | 1.7188 | 1.8107 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.41\% | 0.36\% | 0.32\% | 0.34\% | 0.60\% | 0.50\% | 0.49\% | 0.41\% | 0.50\% | 0.52\% | 0.45\% | 0.35\% | 0.65\% | 0.51\% | 0.42\% | 0.33\% |
|  |  | 4.3618 | 4.0537 | 4.0193 | 4.7712 | 5.1564 | 4.3760 | 4.6301 | 4.3590 | 3.7142 | 4.1771 | 3.9183 | 3.2360 | 4.7628 | 4.0298 | 3.4277 | 2.8661 |
| CAR (1) |  | 0.34\% | 0.33\% | 0.31\% | 0.30\% | 0.54\% | 0.48\% | 0.45\% | 0.34\% | 0.52\% | 0.51\% | 0.39\% | 0.27\% | 0.61\% | 0.45\% | 0.36\% | 0.27\% |
|  |  | 3.7955 | 3.8958 | 4.1421 | 4.2160 | 4.6926 | 4.3348 | 4.3645 | 3.6019 | 3.9058 | 4.1163 | 3.4659 | 2.5410 | 4.6348 | 3.6242 | 3.0371 | 2.3703 |
| BHAR (0) |  | 0.42\% | 0.37\% | 0.50\% | 0.39\% | 0.60\% | 0.59\% | 0.48\% | 0.64\% | 0.50\% | 0.39\% | 0.44\% | 0.53\% | 0.69\% | 0.60\% | 0.44\% | 0.35\% |
|  |  | 3.7982 | 2.9407 | 3.9358 | 3.0534 | 4.8086 | 4.5369 | 3.7656 | 4.8930 | 3.4267 | 2.3409 | 3.0453 | 3.4568 | 4.9351 | 4.4138 | 3.1739 | 2.4900 |
| BHAR (1) |  | 0.40\% | 0.33\% | 0.57\% | 0.36\% | 0.49\% | 0.39\% | 0.36\% | 0.55\% | 0.31\% | 0.26\% | 0.32\% | 0.38\% | 0.56\% | 0.51\% | 0.32\% | 0.30\% |
|  |  | 3.6893 | 2.6203 | 4.3881 | 2.7328 | 3.7715 | 2.5440 | 2.8307 | 4.2831 | 1.8502 | 1.5906 | 2.2443 | 2.5705 | 4.1790 | 3.7160 | 2.3039 | 2.1082 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.61\% | 0.57\% | 0.50\% | 0.53\% | 0.79\% | 0.65\% | 0.65\% | 0.62\% | 0.92\% | 0.87\% | 0.78\% | 0.67\% | 1.06\% | 0.90\% | 0.74\% | 0.65\% |
|  |  | 5.5865 | 4.9689 | 4.3910 | 4.7772 | 6.5363 | 5.3776 | 5.2609 | 4.9153 | 7.3289 | 6.5150 | 5.5101 | 5.2693 | 8.1768 | 5.8687 | 5.1767 | 4.8884 |
| CAR (1) |  | 0.59\% | 0.51\% | 0.51\% | 0.51\% | 0.73\% | 0.62\% | 0.63\% | 0.58\% | 0.88\% | 0.82\% | 0.72\% | 0.60\% | 0.99\% | 0.80\% | 0.64\% | 0.57\% |
|  |  | 5.8701 | 4.7271 | 4.7416 | 4.6239 | 6.3932 | 5.2008 | 5.1987 | 4.6033 | 6.9680 | 6.1983 | 5.2174 | 4.7865 | 7.6888 | 5.2905 | 4.5799 | 4.3521 |
| BHAR (0) |  | 0.64\% | 0.56\% | 0.71\% | 0.51\% | 0.83\% | 0.54\% | 0.65\% | 0.68\% | 0.96\% | 0.86\% | 0.77\% | 0.68\% | 0.96\% | 0.90\% | 0.73\% | 0.60\% |
|  |  | 4.4467 | 4.3710 | 4.3439 | 3.4678 | 5.7206 | 3.0522 | 3.7728 | 3.6135 | 6.5200 | 5.2749 | 3.8170 | 4.0295 | 8.0689 | 4.0525 | 6.1154 | 3.4572 |
| BHAR (1) |  | 0.64\% | 0.34\% | 0.68\% | 0.44\% | 0.61\% | 0.65\% | 0.66\% | 0.58\% | 0.95\% | 0.97\% | 0.82\% | 0.59\% | 1.02\% | 0.75\% | 0.52\% | 0.52\% |
|  |  | 4.2325 | 2.0043 | 4.2268 | 3.1282 | 3.6433 | 3.5735 | 3.8846 | 4.9541 | 5.4525 | 3.9253 | 4.0458 | 3.4900 | 4.7852 | 3.4266 | 3.7511 | 3.0749 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.26\% | 0.41\% | 0.36\% | 0.36\% | 0.59\% | 0.53\% | 0.51\% | 0.36\% | 0.57\% | 0.51\% | 0.39\% | 0.23\% | 0.56\% | 0.34\% | 0.18\% | 0.00\% |
|  |  | 1.0182 | 1.7912 | 1.7784 | 1.9045 | 1.8997 | 1.9031 | 1.9725 | 1.5242 | 1.8157 | 1.7499 | 1.4469 | 0.9366 | 1.8630 | 1.2471 | 0.7313 | 0.0176 |
| CAR (1) |  | 0.45\% | 0.40\% | 0.37\% | 0.35\% | 0.63\% | 0.51\% | 0.44\% | 0.29\% | 0.60\% | 0.44\% | 0.30\% | 0.13\% | 0.42\% | 0.23\% | 0.06\% | -0.08\% |
|  |  | 1.7320 | 1.8074 | 1.8554 | 1.9099 | 1.8918 | 1.7950 | 1.7325 | 1.2544 | 1.9964 | 1.5925 | 1.1852 | 0.5582 | 1.4957 | 0.8959 | 0.2408 | -0.3913 |
| BHAR (0) |  | -0.09\% | 0.61\% | 0.01\% | 0.18\% | 0.47\% | 0.64\% | 0.48\% | 0.41\% | 0.55\% | 0.60\% | 0.06\% | $\mathbf{0 . 4 1 \%}$ | 0.75\% | 0.52\% | -0.01\% | 0.09\% |
|  |  | -0.2879 | 1.9738 | 0.0437 | 0.6200 | 1.2021 | 1.6368 | 1.1895 | 1.4283 | 1.6220 | 1.8408 | 0.1884 | 1.2439 | 2.2786 | 1.5484 | -0.0416 | 0.2448 |
| BHAR (1) |  | -0.01\% | 0.60\% | -0.14\% | 0.15\% | 0.72\% | 0.70\% | 0.19\% | 0.26\% | 0.50\% | 0.44\% | -0.05\% | 0.19\% | 0.35\% | 0.27\% | -0.22\% | -0.18\% |
|  |  | -0.0280 | 1.9120 | -0.4909 | 0.5919 | 2.1423 | 2.1367 | 0.6077 | 0.9246 | 1.5270 | 1.3908 | -0.1719 | 0.6192 | 1.1121 | 0.8748 | -0.7173 | -0.5781 |

## Appendix 9. Time-series momentum strategy - winner (loser) contains stocks above (below) contemporaneous market-weighted index

Panel A. The time-series momentum strategy using equal-weighted return







Panel B. The time-series momentum strategy using market-weighted return



| MW | J | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.18\% | 0.21\% | 0.18\% | 0.16\% | 0.34\% | 0.30\% | 0.28\% | 0.26\% | 0.15\% | 0.11\% | 0.15\% | 0.20\% | 0.16\% | 0.20\% | 0.25\% | 0.26\% |
|  |  | 0.5201 | 0.6989 | 0.6806 | 0.6562 | 0.8696 | 0.8111 | 0.8271 | 0.8615 | 0.3358 | 0.2577 | 0.3972 | 0.5903 | 0.3522 | 0.4870 | 0.6421 | 0.7082 |
| CAR (1) |  | 0.34\% | 0.31\% | 0.23\% | $\mathbf{0 . 2 1 \%}$ | 0.37\% | 0.33\% | 0.26\% | $\mathbf{0 . 3 1 \%}$ | 0.15\% | 0.10\% | 0.20\% | 0.27\% | 0.14\% | 0.26\% | 0.27\% | 0.30\% |
|  |  | 0.9223 | 1.0412 | 0.8447 | 0.8448 | 0.9051 | 0.8586 | 0.7721 | 1.0407 | 0.3224 | 0.2476 | 0.5342 | 0.8076 | 0.3132 | 0.6427 | 0.7135 | 0.8358 |
| BHAR (0) |  | 0.53\% | 0.26\% | 0.11\% | 0.17\% | $\mathbf{0 . 6 1 \%}$ | 0.48\% | 0.16\% | 0.06\% | 0.28\% | -0.05\% | 0.25\% | 0.16\% | 0.37\% | 0.16\% | 0.13\% | -0.13\% |
|  |  | 1.1034 | 0.5480 | 0.2307 | 0.3742 | 1.2292 | 0.9589 | 0.3348 | 0.1409 | 0.5631 | -0.0983 | 0.5578 | 0.4063 | 0.7030 | 0.3537 | 0.3083 | -0.3171 |
| BHAR (1) |  | 0.30\% | 0.34\% | -0.10\% | 0.44\% | 0.33\% | 0.04\% | 0.02\% | -0.05\% | 0.13\% | -0.04\% | 0.47\% | -0.01\% | 0.19\% | 0.23\% | 0.16\% | -0.07\% |
|  |  | 0.6044 | 0.7572 | -0.2146 | 0.9658 | 0.6620 | 0.0739 | 0.0478 | -0.1366 | 0.2694 | -0.0881 | 1.1827 | -0.0337 | 0.3676 | 0.5195 | 0.3988 | -0.1789 |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.31\% | 0.24\% | 0.20\% | 0.15\% | 0.36\% | 0.28\% | 0.19\% | 0.13\% | 0.43\% | 0.24\% | 0.16\% | 0.10\% | 0.32\% | 0.25\% | 0.16\% | 0.10\% |
|  |  | 1.2028 | 1.2198 | 1.1624 | 0.9431 | 1.2871 | 1.1638 | 0.8812 | 0.6318 | 1.4976 | 0.8913 | 0.6348 | 0.4528 | 1.0622 | 0.8926 | 0.6401 | 0.4355 |
| CAR (1) |  | 0.19\% | 0.24\% | 0.16\% | 0.10\% | 0.29\% | 0.25\% | 0.15\% | 0.09\% | 0.30\% | 0.18\% | 0.10\% | 0.07\% | 0.27\% | 0.24\% | 0.12\% | 0.08\% |
|  |  | 0.7495 | 1.2679 | 0.9549 | 0.6208 | 1.0625 | 1.0345 | 0.6571 | 0.4267 | 1.0197 | 0.6523 | 0.4069 | 0.3283 | 0.9088 | 0.8658 | 0.5053 | 0.3382 |
| BHAR (0) |  | 0.22\% | 0.25\% | -0.14\% | 0.13\% | 0.31\% | 0.15\% | -0.01\% | -0.11\% | 0.47\% | 0.25\% | 0.33\% | $\mathbf{0 . 0 1 \%}$ | 0.48\% | 0.44\% | 0.33\% | 0.30\% |
|  |  | 0.7092 | 0.8290 | -0.4372 | 0.5369 | 1.0472 | 0.5169 | -0.0462 | -0.4170 | 1.4617 | 0.7942 | 1.0994 | 0.0391 | 1.5420 | 1.4061 | 1.0173 | 0.9635 |
| BHAR (1) |  | -0.06\% | 0.19\% | -0.36\% | 0.00\% | -0.04\% | -0.18\% | -0.34\% | -0.19\% | 0.07\% | -0.02\% | 0.11\% | 0.17\% | 0.16\% | 0.33\% | 0.31\% | 0.24\% |
|  |  | -0.2072 | 0.6516 | -1.1562 | -0.0190 | -0.1275 | -0.6385 | -1.0869 | -0.7373 | 0.2282 | -0.0770 | 0.3847 | 0.5804 | 0.5127 | 1.0909 | 0.9947 | 0.7897 |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.76\% | 0.79\% | 0.49\% | 0.45\% | 1.09\% | 0.84\% | 0.68\% | 0.53\% | 0.96\% | 0.69\% | 0.49\% | 0.41\% | 0.94\% | 0.65\% | 0.38\% | 0.24\% |
|  |  | 2.1318 | 2.5318 | 1.6393 | 1.6498 | 2.5508 | 2.0706 | 1.7481 | 1.4149 | 2.0724 | 1.5331 | 1.1475 | 1.0026 | 1.9905 | 1.4052 | 0.8562 | 0.5545 |
| CAR (1) |  | 0.97\% | 0.75\% | 0.50\% | 0.40\% | 0.99\% | 0.71\% | 0.58\% | 0.43\% | 0.69\% | 0.57\% | 0.39\% | 0.34\% | 0.83\% | 0.48\% | 0.25\% | 0.08\% |
|  |  | 2.8168 | 2.4273 | 1.7003 | 1.4757 | 2.2908 | 1.7342 | 1.4824 | 1.1561 | 1.4919 | 1.2866 | 0.9185 | 0.8384 | 1.7652 | 1.0576 | 0.5757 | 0.1881 |
| BHAR (0) |  | 0.47\% | 0.34\% | -0.55\% | 0.47\% | 0.64\% | 0.81\% | 0.41\% | 0.69\% | 0.92\% | 0.46\% | 0.99\% | 0.76\% | 0.85\% | 0.52\% | 0.02\% | 0.50\% |
|  |  | 0.9953 | 0.6683 | -1.1402 | 0.9012 | 1.3469 | 1.7678 | 0.8040 | 1.2902 | 1.8552 | 0.9090 | 1.9391 | 1.4432 | 1.7401 | 1.0247 | 0.0347 | 0.9406 |
| BHAR (1) |  | 0.84\% | 0.71\% | -0.38\% | 0.58\% | 0.63\% | 0.72\% | 0.55\% | 0.41\% | 0.49\% | 0.28\% | 0.73\% | 0.40\% | 0.43\% | 0.43\% | -0.23\% | 0.46\% |
|  |  | 1.8095 | 1.3840 | -0.8066 | 1.1294 | 1.3197 | 1.5176 | 1.1114 | 0.7924 | 0.9727 | 0.5432 | 1.4559 | 0.7583 | 0.8930 | 0.8751 | -0.4659 | 0.8805 |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.60\% | 0.52\% | 0.59\% | 0.49\% | 0.56\% | 0.58\% | 0.53\% | 0.51\% | 1.10\% | 0.85\% | 0.90\% | 0.90\% | 0.88\% | 0.83\% | 0.91\% | 0.88\% |
|  |  | 1.5978 | 2.0420 | 2.8563 | 2.4391 | 1.5159 | 1.9964 | 1.9897 | 1.9632 | 2.6967 | 2.2309 | 2.6102 | 2.6908 | 2.1104 | 2.1845 | 2.4436 | 2.4152 |
| CAR (1) |  | 0.53\% | 0.57\% | 0.57\% | 0.44\% | 0.45\% | 0.56\% | 0.43\% | 0.49\% | 0.99\% | 0.78\% | 0.87\% | 0.84\% | 0.74\% | 0.88\% | 0.94\% | 0.83\% |
|  |  | 1.5290 | 2.3514 | 2.7489 | 2.0841 | 1.1538 | 1.9193 | 1.5904 | 1.8532 | 2.4399 | 2.1613 | 2.5285 | 2.4973 | 1.7269 | 2.2577 | 2.4572 | 2.2253 |
| BHAR (0) |  | 0.16\% | 0.16\% | 0.81\% | 0.92\% | 0.18\% | 0.48\% | 0.36\% | 0.82\% | 0.76\% | 0.54\% | 1.33\% | 0.96\% | 0.32\% | 0.78\% | 0.90\% | 0.81\% |
|  |  | 0.3395 | 0.3622 | 1.8965 | 2.3202 | 0.3874 | 1.0862 | 0.7762 | 2.0197 | 1.6333 | 1.1481 | 3.0164 | 2.0679 | 0.6627 | 1.6596 | 2.0386 | 1.6416 |
| BHAR (1) |  | 0.46\% | 0.75\% | 0.80\% | 0.95\% | 0.40\% | 0.44\% | 0.50\% | 0.69\% | 0.75\% | 0.86\% | 1.16\% | 0.87\% | 0.57\% | 0.76\% | 0.89\% | 0.80\% |
|  |  | 1.0751 | 1.8758 | 1.9072 | 2.4060 | 0.9645 | 1.0072 | 1.2051 | 1.6635 | 1.8365 | 2.1380 | 2.6252 | 2.2384 | 1.2298 | 1.5835 | 1.9813 | 1.6028 |



| MW | J H | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $\mathrm{H}=$ | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.05\% | 0.06\% | 0.14\% | 0.12\% | -0.04\% | 0.10\% | 0.10\% | 0.02\% | 0.19\% | 0.22\% | 0.09\% | -0.05\% | 0.31\% | 0.12\% | -0.02\% | -0.13\% |
|  |  | -0.2288 | 0.4045 | 1.0656 | 1.0102 | -0.1588 | 0.4467 | 0.5582 | 0.1529 | 0.7331 | 0.9579 | 0.4315 | -0.2607 | 1.1681 | 0.4888 | -0.0912 | -0.6626 |
| CAR (1) |  | -0.09\% | 0.15\% | 0.15\% | 0.12\% | 0.11\% | 0.19\% | 0.13\% | 0.00\% | 0.31\% | 0.20\% | 0.03\% | -0.10\% | 0.27\% | 0.02\% | -0.11\% | -0.20\% |
|  |  | -0.4506 | 0.9493 | 1.1521 | 0.9804 | 0.4247 | 0.8671 | 0.7296 | 0.0264 | 1.1600 | 0.8616 | 0.1651 | -0.5052 | 1.0156 | 0.0825 | -0.5223 | -0.9614 |
| BHAR (0) |  | -0.03\% | 0.16\% | 0.05\% | 0.46\% | -0.05\% | -0.04\% | -0.07\% | $\mathbf{0 . 2 1 \%}$ | 0.18\% | $\mathbf{0 . 1 1 \%}$ | 0.23\% | -0.03\% | 0.36\% | 0.07\% | -0.09\% | -0.15\% |
|  |  | -0.0952 | 0.6132 | 0.1890 | 1.6826 | -0.1836 | -0.1513 | -0.2381 | 0.8365 | 0.6152 | 0.3741 | 0.8731 | -0.1156 | 1.2964 | 0.2847 | -0.3011 | $-0.5623$ |
| BHAR (1) |  | 0.04\% | 0.29\% | 0.11\% | 0.46\% | 0.24\% | 0.14\% | 0.01\% | 0.00\% | 0.24\% | 0.08\% | 0.29\% | -0.20\% | 0.34\% | 0.05\% | -0.29\% | -0.20\% |
|  |  | 0.1771 | 1.1657 | 0.4448 | 1.7117 | 0.8500 | 0.5031 | 0.0259 | 0.0158 | 0.8287 | 0.2655 | 1.0766 | -0.6810 | 1.2490 | 0.2126 | -1.0243 | -0.7363 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.46\% | 0.23\% | 0.22\% | 0.20\% | 0.23\% | 0.17\% | 0.18\% | 0.11\% | -0.04\% | 0.01\% | 0.08\% | 0.05\% | -0.03\% | 0.13\% | 0.11\% | 0.08\% |
|  |  | 1.1385 | 0.7022 | 0.8534 | 1.0206 | 0.5456 | 0.5102 | 0.6499 | 0.4385 | -0.1080 | 0.0220 | 0.2565 | 0.1573 | -0.0725 | 0.3683 | 0.3249 | 0.2337 |
| CAR (1) |  | 0.36\% | 0.19\% | 0.24\% | 0.18\% | 0.15\% | 0.22\% | 0.18\% | 0.06\% | -0.18\% | 0.05\% | 0.09\% | 0.03\% | 0.11\% | 0.19\% | 0.13\% | 0.13\% |
|  |  | 0.9625 | 0.6223 | 1.0618 | 0.9055 | 0.3889 | 0.6671 | 0.6385 | 0.2481 | -0.4393 | 0.1437 | 0.2594 | 0.0862 | 0.2795 | 0.5312 | 0.3875 | 0.3798 |
| BHAR (0) |  | 0.10\% | -0.42\% | 0.12\% | $\mathbf{0 . 3 9 \%}$ | 0.00\% | 0.00\% | 0.05\% | 0.20\% | -0.08\% | 0.07\% | 0.18\% | -0.17\% | 0.06\% | 0.43\% | 0.42\% | 0.34\% |
|  |  | 0.2167 | -0.9665 | 0.3089 | 0.8758 | -0.0052 | 0.0095 | 0.1217 | 0.4509 | -0.1866 | 0.1643 | 0.4307 | -0.3735 | 0.1487 | 0.9434 | 1.0036 | 0.7646 |
| BHAR (1) |  | 0.72\% | -0.09\% | 0.29\% | 0.52\% | 0.30\% | 0.42\% | 0.19\% | 0.27\% | -0.27\% | -0.04\% | 0.01\% | -0.02\% | 0.23\% | 0.43\% | 0.59\% | 0.36\% |
|  |  | 1.6907 | -0.2108 | 0.7388 | 1.1917 | 0.6702 | 0.9118 | 0.4295 | 0.6215 | -0.6310 | -0.0972 | 0.0346 | -0.0545 | 0.5506 | 1.0293 | 1.4253 | 0.8179 |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.04\% | -0.05\% | -0.12\% | -0.11\% | 0.05\% | -0.07\% | -0.14\% | -0.17\% | -0.13\% | -0.22\% | -0.25\% | -0.28\% | -0.12\% | -0.16\% | -0.25\% | -0.28\% |
|  |  | -0.1448 | -0.2687 | -0.7277 | -0.7318 | 0.2095 | -0.3251 | -0.6169 | -0.8232 | -0.4358 | -0.7607 | -0.9056 | -1.1607 | -0.3757 | -0.5567 | -0.8729 | -1.0956 |
| CAR (1) |  | -0.24\% | -0.09\% | -0.14\% | -0.16\% | -0.03\% | -0.10\% | -0.13\% | -0.21\% | -0.18\% | -0.20\% | -0.28\% | -0.29\% | -0.14\% | -0.18\% | -0.29\% | -0.27\% |
|  |  | -0.9377 | -0.5042 | -0.8576 | -1.0590 | -0.1314 | -0.4193 | -0.5617 | -1.0322 | -0.5689 | -0.7001 | -1.0413 | -1.2631 | -0.4452 | -0.6034 | -1.0147 | $-1.1058$ |
| BHAR (0) |  | -0.13\% | -0.10\% | 0.06\% | -0.26\% | -0.12\% | 0.02\% | -0.43\% | 0.16\% | -0.07\% | -0.04\% | -0.15\% | -0.47\% | 0.09\% | -0.03\% | -0.06\% | 0.01\% |
|  |  | -0.4212 | -0.3250 | 0.2207 | -0.8007 | -0.3927 | 0.0817 | -1.3537 | 0.5951 | -0.2007 | -0.1228 | -0.4772 | -1.4675 | 0.2734 | -0.0739 | -0.1752 | 0.0317 |
| BHAR (1) |  | -0.54\% | -0.49\% | 0.04\% | -0.32\% | -0.18\% | 0.09\% | -0.40\% | 0.32\% | -0.23\% | -0.12\% | -0.03\% | -0.54\% | -0.13\% | -0.09\% | -0.32\% | -0.06\% |
|  |  | -1.7092 | -1.4959 | 0.1340 | -0.9617 | -0.5928 | 0.3625 | -1.2352 | 1.1826 | -0.6880 | -0.3619 | -0.0979 | -1.6465 | -0.4130 | -0.2613 | -0.9878 | -0.1796 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.19\% | -0.21\% | -0.03\% | 0.08\% | -0.23\% | -0.18\% | 0.03\% | 0.05\% | -0.05\% | 0.07\% | 0.20\% | 0.19\% | 0.12\% | 0.18\% | 0.20\% | 0.18\% |
|  |  | -0.7415 | -0.9879 | -0.1811 | 0.5680 | -0.8241 | -0.7155 | 0.1540 | 0.3138 | -0.1861 | 0.2587 | 0.8893 | 0.9471 | 0.4397 | 0.6937 | 0.8513 | 0.8003 |
| CAR (1) |  | -0.34\% | -0.22\% | 0.00\% | 0.06\% | -0.39\% | -0.10\% | 0.07\% | 0.07\% | 0.04\% | 0.17\% | 0.25\% | $\mathbf{0 . 2 1 \%}$ | 0.14\% | 0.23\% | 0.22\% | 0.19\% |
|  |  | -1.3444 | -1.0377 | 0.0134 | 0.4629 | -1.3834 | -0.3843 | 0.3377 | 0.4031 | 0.1457 | 0.6743 | 1.1937 | 1.0553 | 0.4838 | 0.8889 | 0.9371 | 0.8534 |
| BHAR (0) |  | -0.34\% | -0.61\% | -0.21\% | -0.28\% | -0.41\% | -0.47\% | -0.09\% | $\mathbf{0 . 4 1 \%}$ | -0.14\% | -0.05\% | 0.35\% | $\mathbf{0 . 4 4 \%}$ | 0.11\% | 0.38\% | 0.36\% | 0.25\% |
|  |  | -1.1440 | -1.9955 | -0.7096 | -0.9623 | -1.2783 | -1.5276 | -0.2933 | 1.3966 | -0.4345 | -0.1491 | 1.2908 | 1.6378 | 0.3601 | 1.2727 | 1.2332 | 0.8682 |
| BHAR (1) |  | -0.37\% | -0.61\% | -0.17\% | -0.12\% | -0.46\% | -0.37\% | -0.07\% | 0.46\% | -0.03\% | 0.04\% | 0.39\% | 0.37\% | 0.09\% | 0.32\% | 0.33\% | 0.15\% |
|  |  | -1.2350 | -2.0394 | -0.6016 | -0.4142 | -1.4674 | -1.1533 | -0.2282 | 1.5358 | -0.0953 | 0.1206 | 1.3944 | 1.3701 | 0.2845 | 1.0575 | 1.1396 | 0.5034 |


| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.52\% | 0.34\% | 0.19\% | 0.16\% | 0.64\% | 0.41\% | 0.21\% | 0.13\% | 0.38\% | 0.18\% | 0.06\% | -0.02\% | 0.43\% | 0.19\% | 0.07\% | -0.02\% |
|  |  | 1.8558 | 1.4859 | 0.8608 | 0.8645 | 1.9453 | 1.3619 | 0.7939 | 0.5219 | 1.1066 | 0.5760 | 0.1981 | -0.0695 | 1.2584 | 0.5650 | 0.1968 | -0.0489 |
| CAR (1) |  | 0.37\% | 0.26\% | 0.14\% | 0.11\% | 0.56\% | 0.33\% | 0.17\% | 0.06\% | 0.16\% | 0.04\% | -0.02\% | -0.08\% | 0.28\% | 0.12\% | -0.03\% | -0.09\% |
|  |  | 1.3809 | 1.1620 | 0.6986 | 0.5921 | 1.6785 | 1.1493 | 0.6554 | 0.2200 | 0.4844 | 0.1297 | -0.0606 | -0.2898 | 0.7986 | 0.3526 | -0.0902 | -0.2780 |
| BHAR (0) |  | 0.56\% | 0.37\% | 0.24\% | -0.48\% | 0.88\% | 0.37\% | -0.01\% | -0.33\% | 0.27\% | -0.38\% | -0.12\% | -0.66\% | 0.39\% | 0.01\% | 0.12\% | 0.03\% |
|  |  | 1.6421 | 1.1769 | 0.6701 | -1.3077 | 2.5198 | 1.0070 | -0.0186 | -0.9379 | 0.7761 | -1.0741 | -0.3262 | -1.8084 | 1.1115 | 0.0326 | 0.2964 | 0.0928 |
| BHAR (1) |  | 0.45\% | 0.24\% | 0.11\% | -0.47\% | 0.83\% | 0.34\% | 0.19\% | -0.31\% | 0.13\% | -0.34\% | -0.31\% | -0.57\% | 0.20\% | -0.06\% | 0.05\% | 0.06\% |
|  |  | 1.3432 | 0.7476 | 0.3257 | -1.3480 | 2.2493 | 0.9383 | 0.5484 | -0.8924 | 0.3561 | -0.9257 | -0.8059 | -1.4647 | 0.5407 | -0.1468 | 0.1158 | 0.1815 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.22\% | -0.02\% | 0.06\% | 0.13\% | -0.02\% | 0.12\% | 0.21\% | 0.22\% | 0.12\% | 0.21\% | 0.24\% | 0.21\% | 0.27\% | 0.26\% | 0.22\% | 0.17\% |
|  |  | -1.1465 | -0.1332 | 0.4776 | 1.0781 | -0.1170 | 0.6184 | 1.1816 | 1.3486 | 0.5271 | 0.9243 | 1.1379 | 1.0705 | 1.0996 | 1.1181 | 1.0038 | 0.8223 |
| CAR (1) |  | -0.13\% | 0.04\% | 0.15\% | $\mathbf{0 . 1 1 \%}$ | 0.11\% | 0.25\% | 0.26\% | 0.22\% | 0.24\% | 0.26\% | 0.27\% | 0.18\% | 0.27\% | 0.26\% | 0.20\% | 0.13\% |
|  |  | -0.6867 | 0.2663 | 1.1259 | 0.9785 | 0.5378 | 1.2553 | 1.4936 | 1.3755 | 1.0172 | 1.1468 | 1.2860 | 0.9242 | 1.1189 | 1.1558 | 0.9175 | 0.6316 |
| BHAR (0) |  | -0.16\% | -0.11\% | -0.37\% | 0.10\% | -0.04\% | 0.06\% | 0.03\% | 0.25\% | 0.09\% | -0.01\% | 0.16\% | -0.04\% | 0.28\% | 0.24\% | 0.10\% | 0.02\% |
|  |  | -0.6593 | -0.4760 | -1.5407 | 0.4424 | -0.1852 | 0.2635 | 0.1242 | 1.1033 | 0.3554 | -0.0557 | 0.6429 | -0.1678 | 1.1014 | 0.9159 | 0.3907 | 0.0901 |
| BHAR (1) |  | $-\mathbf{0 . 1 8 \%}$ | -0.04\% | -0.24\% | 0.06\% | 0.10\% | 0.32\% | 0.08\% | 0.25\% | 0.20\% | 0.03\% | 0.07\% | -0.13\% | 0.18\% | 0.26\% | 0.04\% | 0.03\% |
|  |  | $-0.7925$ | -0.1818 | -1.0031 | 0.2798 | 0.4373 | 1.3091 | 0.3553 | 1.1056 | 0.7895 | 0.1059 | 0.2888 | -0.5199 | 0.7391 | 1.0487 | 0.1509 | 0.1181 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.10\% | 0.01\% | 0.06\% | 0.15\% | -0.04\% | 0.06\% | 0.17\% | 0.20\% | 0.02\% | 0.18\% | 0.20\% | 0.13\% | 0.26\% | 0.25\% | 0.17\% | 0.12\% |
|  |  | -0.5625 | 0.0493 | 0.4582 | 1.4613 | -0.2061 | 0.3006 | 1.0379 | 1.3157 | 0.0781 | 0.9117 | 1.0941 | 0.8079 | 1.1636 | 1.1989 | 0.9012 | 0.6994 |
| CAR (1) |  | -0.07\% | 0.04\% | 0.12\% | 0.16\% | -0.01\% | 0.13\% | 0.21\% | 0.16\% | 0.13\% | 0.22\% | 0.20\% | 0.10\% | 0.24\% | 0.21\% | 0.13\% | 0.07\% |
|  |  | -0.3809 | 0.3092 | 0.9776 | 1.5255 | -0.0413 | 0.7150 | 1.3180 | 1.1369 | 0.6048 | 1.1176 | 1.1383 | 0.6403 | 1.1246 | 1.0733 | 0.7195 | 0.4164 |
| BHAR (0) |  | -0.26\% | -0.14\% | 0.12\% | -0.06\% | -0.12\% | $0.10 \%$ | $0.01 \%$ | $\mathbf{0 . 4 1 \%}$ | $-\mathbf{0 . 0 2 \%}$ | 0.13\% | $0.18 \%$ | 0.28\% | 0.22\% | 0.29\% | $0.10 \%$ | 0.15\% |
|  |  | -1.2152 | -0.7085 | 0.6311 | -0.3130 | $-0.5320$ | 0.4689 | 0.0447 | 2.2835 | -0.0794 | 0.5278 | 0.9123 | 1.3874 | 0.9133 | 1.4265 | 0.5006 | 0.7074 |
| BHAR (1) |  | -0.01\% | -0.18\% | 0.13\% | 0.08\% | -0.12\% | 0.20\% | 0.13\% | 0.27\% | 0.11\% | 0.10\% | 0.09\% | 0.14\% | 0.14\% | 0.18\% | -0.01\% | 0.02\% |
|  |  | -0.0236 | -0.9732 | 0.6538 | 0.4053 | -0.5289 | 0.9293 | 0.5809 | 1.5100 | 0.4636 | 0.4286 | 0.4570 | 0.6740 | 0.6271 | 0.8607 | -0.0345 | 0.0809 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.18\% | -0.04\% | 0.08\% | 0.09\% | -0.05\% | 0.09\% | 0.17\% | 0.12\% | 0.15\% | 0.22\% | 0.20\% | 0.11\% | 0.24\% | 0.20\% | 0.15\% | 0.10\% |
|  |  | -1.0034 | -0.2607 | 0.5780 | 0.7356 | -0.2586 | 0.4913 | 0.9877 | 0.7543 | 0.6866 | 1.0626 | 1.0195 | 0.6289 | 1.0404 | 0.9210 | 0.7380 | 0.4882 |
| CAR (1) |  | -0.11\% | 0.05\% | 0.14\% | 0.10\% | 0.03\% | 0.18\% | 0.19\% | $\mathbf{0 . 1 1 \%}$ | 0.29\% | 0.26\% | 0.20\% | $\mathbf{0 . 1 1 \%}$ | 0.22\% | 0.20\% | 0.13\% | 0.08\% |
|  |  | -0.6213 | 0.3350 | 1.0664 | 0.8478 | 0.1329 | 0.9889 | 1.1122 | 0.6872 | 1.3191 | 1.2972 | 1.0370 | 0.6155 | 1.0161 | 0.9044 | 0.6515 | 0.3814 |
| BHAR (0) |  | -0.28\% | 0.07\% | -0.08\% | 0.17\% | -0.07\% | 0.02\% | -0.09\% | 0.27\% | 0.12\% | 0.13\% | 0.31\% | 0.03\% | 0.25\% | 0.23\% | 0.09\% | 0.11\% |
|  |  | -1.3262 | 0.3559 | -0.3942 | 0.7993 | -0.3116 | 0.0910 | -0.4024 | 1.4494 | 0.5052 | 0.5603 | 1.4562 | 0.1185 | 1.0228 | 1.0249 | 0.3586 | 0.4878 |
| BHAR (1) |  | -0.09\% | -0.03\% | -0.02\% | 0.13\% | -0.07\% | 0.08\% | -0.10\% | 0.18\% | 0.24\% | 0.08\% | 0.19\% | -0.11\% | 0.09\% | 0.13\% | -0.05\% | -0.03\% |
|  |  | -0.4338 | -0.1680 | -0.1240 | 0.6054 | -0.2958 | 0.3616 | -0.4438 | 0.9864 | 1.0029 | 0.3392 | 0.8660 | -0.4705 | 0.3827 | 0.6005 | -0.2229 | -0.1375 |

Panel C. The time-series momentum strategy using inversed volatility-weighted return


| IVOL $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.65\% | 0.61\% | 0.56\% | 0.51\% | 0.93\% | 0.82\% | 0.73\% | 0.59\% | 0.90\% | 0.80\% | 0.62\% | 0.48\% | 0.89\% | 0.69\% | 0.52\% | 0.38\% |
|  | 6.2412 | 6.4185 | 6.4857 | 6.5912 | 7.3374 | 6.7222 | 6.4876 | 5.5492 | 6.7001 | 5.9730 | 4.7745 | 3.8768 | 6.1859 | 5.0264 | 3.9106 | 2.9341 |
| CAR (1) | 0.52\% | 0.52\% | 0.51\% | $\mathbf{0 . 4 3 \%}$ | 0.84\% | 0.75\% | 0.63\% | 0.48\% | 0.85\% | 0.69\% | 0.52\% | 0.38\% | 0.77\% | 0.57\% | 0.40\% | 0.28\% |
|  | 5.2656 | 5.5299 | 5.9850 | 5.6466 | 6.6506 | 6.0273 | 5.5809 | 4.5325 | 6.2792 | 5.0564 | 3.9432 | 3.0945 | 5.4741 | 4.1579 | 3.0091 | 2.1832 |
| BHAR (0) | 0.61\% | 0.40\% | 0.32\% | 0.30\% | 0.92\% | 0.71\% | 0.71\% | 0.80\% | 0.84\% | 0.76\% | 0.82\% | 0.55\% | 0.86\% | 0.72\% | 0.51\% | 0.27\% |
|  | 4.7913 | 2.9528 | 2.4948 | 2.1926 | 6.2834 | 4.5102 | 4.6195 | 5.6270 | 5.7317 | 4.8524 | 5.1681 | 3.1954 | 5.2738 | 4.5860 | 3.2148 | 1.6305 |
| BHAR (1) | 0.39\% | 0.33\% | 0.25\% | 0.30\% | 0.77\% | 0.69\% | 0.54\% | 0.71\% | 0.85\% | 0.57\% | 0.71\% | 0.33\% | 0.80\% | 0.60\% | 0.41\% | 0.14\% |
|  | 2.8852 | 2.5222 | 1.8005 | 2.0765 | 5.8319 | 4.5156 | 3.6995 | 5.3785 | 5.6672 | 3.5487 | 4.4996 | 1.8926 | 5.1662 | 3.8272 | 2.6239 | 0.8475 |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.41\% | 0.44\% | 0.41\% | 0.37\% | 0.67\% | 0.66\% | 0.58\% | 0.47\% | 0.80\% | 0.75\% | 0.61\% | 0.45\% | 0.80\% | 0.61\% | 0.45\% | 0.35\% |
|  | 1.8882 | 2.4504 | 2.5933 | 2.5966 | 2.8794 | 3.0215 | 2.8341 | 2.3569 | 2.8556 | 2.8393 | 2.3830 | 1.8238 | 2.6044 | 2.0474 | 1.5494 | 1.2710 |
| CAR (1) | 0.42\% | 0.40\% | 0.38\% | 0.29\% | 0.59\% | 0.59\% | 0.53\% | 0.38\% | 0.77\% | 0.69\% | 0.52\% | 0.36\% | 0.63\% | 0.49\% | 0.34\% | 0.29\% |
|  | 2.0096 | 2.2588 | 2.4699 | 2.0982 | 2.6198 | 2.8026 | 2.6097 | 1.9465 | 2.7930 | 2.6183 | 2.0317 | 1.4687 | 2.0519 | 1.6277 | 1.1729 | 1.0585 |
| BHAR (0) | 0.22\% | 0.33\% | 0.43\% | 0.18\% | 0.51\% | 0.76\% | 0.65\% | 0.83\% | 0.72\% | 0.52\% | 0.59\% | 0.38\% | 0.81\% | 0.92\% | 0.50\% | 0.60\% |
|  | 0.7167 | 0.9930 | 1.6670 | 0.5055 | 1.9119 | 2.8923 | 2.5066 | 3.2366 | 2.3224 | 1.5629 | 1.8292 | 1.2783 | 2.4282 | 2.7991 | 1.4958 | 1.9156 |
| BHAR (1) | 0.70\% | 0.33\% | 0.50\% | 0.08\% | 0.71\% | 0.81\% | 0.64\% | 0.72\% | $0.73 \%$ | 0.36\% | 0.37\% | 0.26\% | $0.68 \%$ | $0.76 \%$ | $0.28 \%$ | $0.46 \%$ |
|  | 2.7319 | 1.2221 | 2.0214 | 0.2727 | 2.8720 | $3.1665$ | $2.5418$ | 2.9302 | $2.3552$ | 1.1176 |  | 0.8750 | $2.0615$ | $2.3807$ | $0.8591$ |  |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.19\% | 0.12\% | 0.18\% | 0.27\% | 0.45\% | 0.31\% | 0.36\% | 0.31\% | 0.52\% | 0.44\% | 0.33\% | 0.25\% | 0.65\% | 0.38\% | 0.29\% | 0.21\% |
|  | 0.8525 | 0.5819 | 0.9090 | 1.3824 | 1.9873 | 1.1366 | 1.2719 | 1.1636 | 2.1141 | 1.5085 | 1.1502 | 1.0287 | 2.6781 | 1.4292 | 1.2022 | 0.9844 |
| CAR (1) | 0.22\% | 0.09\% | 0.16\% | 0.23\% | 0.49\% | 0.30\% | 0.32\% | 0.26\% | 0.61\% | 0.44\% | 0.21\% | 0.13\% | 0.56\% | 0.23\% | 0.18\% | 0.14\% |
|  | 1.0350 | 0.4281 | 0.7723 | 1.1850 | 2.2732 | 1.1040 | 1.1083 | 1.0629 | 2.5928 | 1.5172 | 0.7841 | 0.5383 | 2.3990 | 0.9322 | 0.7998 | 0.6697 |
| BHAR (0) | 0.50\% | -0.69\% | 0.71\% | -0.26\% | 0.42\% | -0.26\% | 0.66\% | 0.31\% | 0.58\% | 0.89\% | 0.11\% | 0.86\% | 0.85\% | 0.28\% | 0.73\% | 0.11\% |
|  | 1.5973 | -1.6972 | 1.6690 | $-0.5255$ | 1.6944 | -0.6282 | 2.1296 | 0.6990 | 2.5579 | 2.9261 | 0.2708 | 2.3342 | 3.4998 | 0.7500 | 1.9693 | 0.2618 |
| BHAR (1) | 0.00\% | -0.87\% | 0.30\% | -0.31\% | 0.16\% | -0.15\% | -0.20\% | 0.62\% | 0.34\% | 0.36\% | -0.31\% | 0.02\% | 0.31\% | -0.10\% | 0.55\% | -0.12\% |
|  | -0.0024 | -2.0943 | 0.7342 | -0.6050 | 0.5185 | -0.3682 | -0.5034 | 1.4555 | 1.1195 | 0.8768 | -0.7030 | 0.0438 | 0.9731 | -0.2405 | 1.4531 | -0.2904 |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.61\% | 0.32\% | 0.35\% | 0.21\% | 0.64\% | 0.55\% | 0.45\% | 0.34\% | 0.72\% | 0.65\% | 0.50\% | 0.31\% | 0.83\% | 0.62\% | 0.38\% | 0.27\% |
|  | 3.5970 | 2.1388 | 3.0302 | 1.9229 | 3.8478 | 3.6798 | 3.0278 | 2.2835 | 3.6280 | 3.1553 | 2.3754 | 1.6374 | 4.2387 | 2.8802 | 1.8692 | 1.5221 |
| CAR (1) | 0.57\% | 0.35\% | 0.40\% | 0.24\% | 0.58\% | 0.54\% | 0.43\% | 0.32\% | 0.75\% | 0.59\% | 0.42\% | 0.24\% | 0.75\% | 0.50\% | 0.27\% | 0.21\% |
|  | 3.8059 | 2.6252 | 3.5041 | 2.2578 | 3.5729 | 3.3616 | 2.6850 | 2.0383 | 3.9739 | 2.9591 | 2.0579 | 1.2699 | 3.8934 | 2.3932 | 1.3859 | 1.1835 |
| BHAR (0) | 0.24\% | -0.07\% | -0.08\% | -0.60\% | 0.38\% | 0.55\% | 0.35\% | 0.30\% | 0.78\% | 0.60\% | 0.56\% | 0.34\% | 0.83\% | 0.71\% | 0.45\% | 0.22\% |
|  | 1.1029 | -0.2704 | -0.3635 | -1.8393 | 1.8553 | 2.9092 | 1.5426 | 1.3012 | 3.8322 | 2.3824 | 2.2572 | 1.3182 | 4.2414 | 3.4538 | 1.7448 | 1.2586 |
| BHAR (1) | 0.64\% | 0.21\% | 0.29\% | -0.16\% | 0.44\% | 0.61\% | 0.42\% | 0.14\% | 0.73\% | 0.43\% | 0.32\% | 0.16\% | 0.74\% | 0.66\% | 0.26\% | 0.22\% |
|  | 3.4120 | 0.9153 | 1.3167 | -0.5103 | 2.4009 | 2.5614 | 2.0600 | 0.5445 | 3.7569 | 1.7107 | 1.2464 | 0.6152 | 3.8188 | 3.2551 | 1.0349 | 1.2569 |





| IVOL | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=3$ |  | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.76\% | 0.47\% | 0.49\% | 0.59\% | 0.81\% | 0.58\% | 0.60\% | 0.41\% | 0.87\% | 0.62\% | 0.39\% | 0.26\% | 0.95\% | 0.50\% | 0.31\% | 0.28\% |
|  |  | 3.3147 | 2.4227 | 2.9959 | 4.2971 | 3.2874 | 2.7621 | 3.3996 | 2.3756 | 3.5015 | 2.7257 | 1.7361 | 1.1599 | 3.9059 | 2.1104 | 1.3016 | 1.3147 |
| CAR (1) |  | 0.50\% | 0.40\% | 0.50\% | 0.50\% | 0.57\% | 0.50\% | 0.49\% | 0.30\% | 0.71\% | 0.47\% | 0.26\% | 0.18\% | 0.61\% | 0.30\% | 0.20\% | 0.18\% |
|  |  | 2.4593 | 1.9162 | 3.2542 | 3.5284 | 2.3964 | 2.1717 | 2.7413 | 1.6056 | 2.9376 | 1.9227 | 1.0777 | 0.7752 | 2.5007 | 1.1752 | 0.8339 | 0.8592 |
| BHAR (0) |  | 0.90\% | 0.22\% | 0.72\% | 0.29\% | 1.03\% | 0.77\% | 0.36\% | $\mathbf{0 . 5 3 \%}$ | 1.00\% | 0.34\% | 0.69\% | 0.04\% | 1.08\% | 0.93\% | 0.43\% | 0.42\% |
|  |  | 2.8742 | 0.7676 | 1.9789 | 1.0956 | 3.2586 | 2.4686 | 1.0794 | 1.9134 | 3.1966 | 1.0727 | 2.1264 | 0.1202 | 3.6566 | 3.0510 | 1.3673 | 1.3856 |
| BHAR (1) |  | 0.54\% | 0.37\% | 0.86\% | 0.53\% | 0.65\% | 0.57\% | 0.36\% | 0.40\% | 0.77\% | 0.37\% | 0.53\% | -0.02\% | 0.71\% | 0.63\% | 0.26\% | 0.21\% |
|  |  | 2.1772 | 1.2368 | 2.7998 | 1.8352 | 2.5239 | 2.3348 | 1.0953 | 1.4466 | 3.1515 | 1.2111 | 2.1314 | -0.0502 | 2.9264 | 2.6394 | 0.8240 | 1.0653 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.46\% | 0.33\% | 0.30\% | 0.31\% | 0.55\% | 0.47\% | 0.44\% | 0.41\% | 0.57\% | 0.57\% | 0.51\% | 0.41\% | 0.76\% | 0.62\% | 0.50\% | 0.39\% |
|  |  | 3.2176 | 2.7554 | 2.7828 | 3.2932 | 3.4667 | 3.1352 | 3.2620 | 3.3489 | 3.3134 | 3.4200 | 3.3582 | 2.9058 | 4.3181 | 3.7032 | 3.1006 | 2.5521 |
| CAR (1) |  | 0.32\% | 0.27\% | 0.28\% | 0.26\% | 0.47\% | 0.43\% | 0.40\% | 0.36\% | 0.55\% | 0.53\% | 0.46\% | 0.34\% | 0.69\% | 0.54\% | 0.43\% | 0.32\% |
|  |  | 2.4025 | 2.2719 | 2.6814 | 2.9368 | 2.9122 | 2.8697 | 2.9785 | 2.9156 | 3.2369 | 3.2325 | 3.0724 | 2.4101 | 3.9858 | 3.2514 | 2.7153 | 2.0931 |
| BHAR (0) |  | 0.37\% | 0.36\% | 0.29\% | 0.38\% | 0.50\% | 0.44\% | 0.24\% | 0.52\% | 0.57\% | 0.51\% | 0.52\% | 0.46\% | 0.79\% | 0.64\% | 0.58\% | 0.36\% |
|  |  | 2.0603 | 1.8511 | 1.8433 | 2.1787 | 2.9879 | 2.6432 | 1.5652 | 3.5763 | 3.1578 | 2.5681 | 3.0571 | 2.4951 | 4.3690 | 3.6330 | 3.4363 | 2.0060 |
| BHAR (1) |  | 0.31\% | 0.20\% | 0.34\% | 0.30\% | 0.38\% | 0.33\% | 0.12\% | 0.46\% | 0.42\% | 0.39\% | 0.39\% | 0.26\% | 0.66\% | 0.55\% | 0.51\% | 0.32\% |
|  |  | 1.8572 | 1.0839 | 2.1896 | 1.6844 | 2.2338 | 1.7733 | 0.7853 | 3.0969 | 2.1617 | 1.9418 | 2.3098 | 1.3966 | 3.7320 | 3.1572 | 3.0647 | 1.8352 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.54\% | 0.61\% | 0.51\% | 0.52\% | 0.88\% | 0.76\% | 0.65\% | 0.57\% | 0.93\% | 0.84\% | 0.66\% | 0.56\% | 0.97\% | 0.78\% | 0.62\% | 0.52\% |
|  |  | 4.6939 | 5.9485 | 5.8130 | 6.9008 | 7.3585 | 6.5617 | 6.1916 | 5.6427 | 7.1472 | 6.3899 | 4.6817 | 4.0572 | 7.0422 | 4.9263 | 4.4629 | 4.1137 |
| CAR (1) |  | 0.46\% | 0.53\% | 0.50\% | $\mathbf{0 . 5 2 \%}$ | 0.80\% | 0.68\% | 0.61\% | $\mathbf{0 . 5 0 \%}$ | 0.86\% | 0.79\% | 0.60\% | 0.48\% | 0.84\% | 0.64\% | 0.52\% | 0.44\% |
|  |  | 4.1104 | 5.7360 | 5.8246 | 6.8183 | 7.3712 | 6.3871 | 6.0006 | 5.2019 | 6.6673 | 6.1883 | 4.2982 | 3.5265 | 6.2549 | 4.2763 | 3.7982 | 3.4903 |
| BHAR (0) |  | 0.33\% | 0.57\% | 0.56\% | 0.64\% | 0.78\% | 0.82\% | 0.38\% | 0.75\% | 0.99\% | 0.69\% | 0.63\% | 0.56\% | 0.96\% | 0.85\% | 0.64\% | 0.58\% |
|  |  | 2.2400 | 3.7991 | 2.8620 | 4.0354 | 5.8727 | 5.3678 | 2.2068 | 5.2626 | 7.1301 | 4.3476 | 3.4448 | 3.2731 | 7.3863 | 3.6798 | 4.6137 | 3.3610 |
| BHAR (1) |  | 0.55\% | 0.33\% | 0.59\% | 0.51\% | 0.83\% | 0.66\% | 0.34\% | 0.75\% | 0.91\% | 0.57\% | 0.55\% | 0.42\% | 0.74\% | 0.77\% | 0.58\% | 0.47\% |
|  |  | 3.0304 | 2.1526 | 3.0491 | 3.3971 | 5.5897 | 4.0359 | 2.0718 | 6.3180 | 5.2995 | 2.3660 | 2.9957 | 2.4189 | 3.2683 | 3.3438 | 3.7649 | 2.8124 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.20\% | 0.41\% | 0.34\% | 0.35\% | 0.51\% | 0.39\% | 0.37\% | 0.28\% | 0.35\% | 0.33\% | 0.24\% | 0.12\% | 0.38\% | 0.17\% | 0.11\% | -0.03\% |
|  |  | 0.6786 | 1.5739 | 1.5159 | 1.7216 | 1.4737 | 1.2362 | 1.2900 | 1.0710 | 1.0765 | 1.0737 | 0.8693 | 0.4629 | 1.1157 | 0.5743 | 0.3673 | -0.1285 |
| CAR (1) |  | 0.36\% | 0.33\% | 0.35\% | 0.31\% | 0.39\% | 0.31\% | 0.29\% | 0.19\% | 0.44\% | 0.26\% | 0.17\% | 0.02\% | $\mathbf{0 . 2 1 \%}$ | 0.09\% | 0.00\% | -0.12\% |
|  |  | 1.2723 | 1.3665 | 1.6463 | 1.6193 | 1.1218 | 0.9875 | 1.0392 | 0.7421 | 1.4019 | 0.8957 | 0.6515 | 0.0976 | 0.6660 | 0.3043 | -0.0097 | -0.4487 |
| BHAR (0) |  | -0.34\% | 0.58\% | 0.17\% | $\mathbf{0 . 1 9 \%}$ | 0.53\% | 0.52\% | 0.04\% | 0.32\% | 0.09\% | 0.25\% | 0.05\% | -0.15\% | 0.43\% | 0.29\% | 0.21\% | 0.04\% |
|  |  | -0.7908 | 1.7403 | 0.5825 | 0.6426 | 1.3478 | 1.2859 | 0.1124 | 1.2113 | 0.2768 | 0.7056 | 0.1465 | -0.3921 | 1.1843 | 0.7872 | 0.4977 | 0.1076 |
| BHAR (1) |  | -0.29\% | 0.50\% | 0.12\% | 0.18\% | 0.52\% | 0.52\% | -0.15\% | 0.09\% | 0.06\% | 0.02\% | -0.09\% | -0.39\% | 0.02\% | 0.13\% | -0.06\% | -0.11\% |
|  |  | -0.9331 | 1.4561 | 0.4206 | 0.6924 | 1.4395 | 1.5205 | -0.4860 | 0.3465 | 0.1921 | 0.0532 | -0.2661 | -1.0404 | 0.0445 | 0.3692 | -0.1555 | -0.2899 |

## Appendix 10. Cross-sectional momentum strategy - winner (loser) contains top (bottom) $\mathbf{5 0 \%}$



| EW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.67\% | 0.66\% | 0.59\% | 0.57\% | 0.85\% | 0.77\% | 0.73\% | 0.63\% | 0.93\% | 0.89\% | 0.76\% | 0.65\% | 0.98\% | 0.84\% | 0.71\% | 0.59\% |
|  |  | 6.1661 | 6.6577 | 6.6453 | 7.0775 | 6.4284 | 6.2889 | 6.4715 | 5.9644 | 6.7814 | 6.7687 | 6.0568 | 5.5373 | 6.8578 | 6.0615 | 5.2882 | 4.6492 |
| CAR (1) |  | 0.71\% | 0.64\% | 0.60\% | $\mathbf{0 . 5 3 \%}$ | 0.84\% | 0.77\% | 0.69\% | 0.56\% | 0.95\% | 0.84\% | 0.71\% | 0.59\% | 0.92\% | 0.77\% | 0.63\% | 0.51\% |
|  |  | 6.5248 | 6.5506 | 6.7921 | 6.5393 | 6.4469 | 6.3000 | 6.1328 | 5.3251 | 6.8544 | 6.4072 | 5.6372 | 4.9850 | 6.4786 | 5.5723 | 4.7649 | 4.0898 |
| BHAR (0) |  | 0.73\% | 0.76\% | 0.42\% | $\mathbf{0 . 6 2 \%}$ | 0.79\% | 0.70\% | 0.69\% | 0.76\% | 0.87\% | 0.82\% | 0.78\% | 0.62\% | 1.01\% | 0.91\% | 0.74\% | 0.58\% |
|  |  | 6.0372 | 5.8287 | 3.3975 | 5.1785 | 5.5952 | 4.7576 | 4.8989 | 6.4925 | 5.9939 | 5.3559 | 5.5792 | 4.1731 | 6.9032 | 6.0249 | 4.9330 | 3.8228 |
| BHAR (1) |  | 0.70\% | 0.68\% | 0.51\% | 0.60\% | 0.76\% | 0.67\% | 0.66\% | $\mathbf{0 . 6 9 \%}$ | 0.93\% | 0.78\% | 0.77\% | 0.51\% | 0.90\% | 0.79\% | 0.71\% | 0.40\% |
|  |  | 5.7996 | 5.3821 | 3.9840 | 5.0141 | 5.6199 | 4.6328 | 4.8410 | 5.9157 | 6.3790 | 5.2137 | 5.4598 | 3.4188 | 6.2637 | 5.3020 | 4.8302 | 2.7296 |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.43\% | 0.42\% | 0.43\% | 0.37\% | 0.52\% | 0.54\% | 0.50\% | 0.40\% | 0.69\% | 0.57\% | 0.43\% | 0.30\% | 0.62\% | 0.45\% | 0.32\% | 0.22\% |
|  |  | 2.6464 | 3.1989 | 3.5838 | 3.4817 | 2.7538 | 3.2425 | 3.2818 | 2.8289 | 3.3206 | 3.0601 | 2.4556 | 1.8372 | 2.8575 | 2.2204 | 1.6958 | 1.2320 |
| CAR (1) |  | 0.47\% | 0.43\% | 0.42\% | 0.34\% | 0.58\% | 0.55\% | 0.49\% | 0.35\% | 0.72\% | 0.52\% | 0.36\% | 0.23\% | 0.52\% | 0.33\% | 0.23\% | 0.15\% |
|  |  | 2.9267 | 3.3278 | 3.5241 | 3.2749 | 3.1798 | 3.4071 | 3.2457 | 2.5091 | 3.5754 | 2.8309 | 2.0694 | 1.4758 | 2.4312 | 1.6627 | 1.2164 | 0.8802 |
| BHAR (0) |  | 0.43\% | 0.32\% | 0.33\% | 0.17\% | 0.40\% | 0.68\% | 0.43\% | 0.66\% | 0.67\% | 0.34\% | 0.30\% | 0.23\% | 0.50\% | 0.58\% | 0.25\% | 0.35\% |
|  |  | 2.1697 | 1.5861 | 1.8217 | 0.7966 | 1.9391 | 3.9288 | 2.1673 | 3.5308 | 3.0398 | 1.5184 | 1.5005 | 1.1187 | 2.2144 | 2.6743 | 1.1753 | 1.7404 |
| BHAR (1) |  | 0.65\% | 0.29\% | 0.35\% | 0.23\% | 0.59\% | 0.69\% | 0.44\% | 0.52\% | 0.62\% | 0.30\% | 0.20\% | 0.15\% | 0.46\% | 0.46\% | 0.05\% | 0.29\% |
|  |  | 3.3626 | 1.4688 | 1.9264 | 1.0647 | 2.8983 | 3.8901 | 2.2128 | 2.8193 | 2.8634 | 1.3331 | 0.9998 | 0.7421 | 2.0330 | 2.1509 | 0.2387 | 1.5060 |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.03\% | 0.21\% | 0.24\% | 0.28\% | 0.31\% | 0.37\% | 0.42\% | 0.38\% | 0.34\% | 0.45\% | 0.41\% | 0.34\% | 0.43\% | 0.43\% | 0.36\% | 0.29\% |
|  |  | 0.1684 | 1.7368 | 2.3685 | 3.3777 | 1.8861 | 2.5973 | 3.5671 | 3.5465 | 2.0364 | 3.0140 | 3.0259 | 2.6905 | 2.5980 | 2.8303 | 2.5227 | 2.1276 |
| CAR (1) |  | 0.33\% | 0.32\% | 0.34\% | 0.32\% | 0.49\% | 0.49\% | 0.47\% | 0.38\% | 0.53\% | 0.51\% | 0.43\% | 0.31\% | 0.53\% | 0.45\% | 0.34\% | 0.26\% |
|  |  | 2.3130 | 2.8313 | 3.6342 | 3.9531 | 3.1171 | 3.6704 | 4.1528 | 3.6363 | 3.3443 | 3.5810 | 3.2755 | 2.5719 | 3.3110 | 3.0380 | 2.4597 | 2.0079 |
| BHAR (0) |  | 0.00\% | 0.07\% | 0.26\% | $\mathbf{0 . 0 3 \%}$ | 0.33\% | 0.40\% | 0.22\% | 0.34\% | 0.36\% | 0.40\% | 0.47\% | 0.37\% | 0.41\% | 0.44\% | 0.43\% | 0.27\% |
|  |  | -0.0149 | 0.4061 | 1.9563 | 0.2351 | 1.9281 | 2.6339 | 1.4454 | 2.7490 | 2.1030 | 2.3770 | 3.1710 | 2.5090 | 2.4884 | 2.9112 | 2.8546 | 1.8496 |
| BHAR (1) |  | 0.25\% | 0.07\% | 0.31\% | 0.10\% | 0.44\% | 0.48\% | 0.27\% | 0.34\% | 0.49\% | 0.39\% | 0.46\% | 0.22\% | 0.48\% | 0.43\% | 0.34\% | 0.27\% |
|  |  | 1.5040 | 0.4883 | 2.3263 | 0.7074 | 2.6182 | 3.1572 | 1.8012 | 2.7800 | 2.8968 | 2.3926 | 3.2012 | 1.5163 | 2.9736 | 2.9402 | 2.2236 | 1.8659 |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.56\% | 0.50\% | 0.47\% | 0.46\% | 0.65\% | 0.59\% | 0.59\% | 0.50\% | 0.75\% | 0.70\% | 0.60\% | 0.49\% | 0.77\% | 0.65\% | 0.53\% | 0.42\% |
|  |  | 3.0823 | 3.2862 | 3.5238 | 4.0622 | 3.2314 | 3.2735 | 3.8015 | 3.6163 | 3.6119 | 3.8569 | 3.5962 | 3.2548 | 3.8809 | 3.5702 | 3.1488 | 2.7390 |
| CAR (1) |  | 0.64\% | 0.52\% | 0.48\% | $\mathbf{0 . 4 3 \%}$ | 0.68\% | 0.60\% | 0.56\% | $\mathbf{0 . 4 4 \%}$ | 0.79\% | 0.68\% | 0.56\% | 0.43\% | 0.77\% | 0.60\% | 0.47\% | 0.37\% |
|  |  | 3.7532 | 3.5977 | 3.8682 | 4.0122 | 3.5145 | 3.5261 | 3.7660 | 3.3711 | 4.0178 | 3.8980 | 3.5252 | 2.9884 | 4.0908 | 3.4350 | 2.9449 | 2.4902 |
| BHAR (0) |  | 0.51\% | 0.42\% | 0.45\% | $\mathbf{0 . 2 2 \%}$ | 0.62\% | 0.58\% | 0.55\% | 0.52\% | 0.77\% | 0.68\% | 0.63\% | 0.44\% | 0.75\% | 0.65\% | 0.53\% | 0.23\% |
|  |  | 2.5506 | 2.2297 | 2.8076 | 1.1711 | 3.0193 | 3.0155 | 2.6463 | 3.2275 | 3.5582 | 3.3343 | 3.4550 | 2.3558 | 3.7470 | 3.4373 | 2.9160 | 1.3646 |
| BHAR (1) |  | 0.59\% | 0.32\% | 0.45\% | 0.16\% | 0.63\% | 0.60\% | 0.54\% | $\mathbf{0 . 4 1 \%}$ | 0.79\% | 0.57\% | 0.52\% | 0.30\% | 0.74\% | 0.55\% | 0.38\% | 0.24\% |
|  |  | 2.9991 | 1.7929 | 2.8880 | 0.8684 | 3.1158 | 3.1711 | 2.6644 | 2.5669 | 3.7521 | 2.9244 | 2.9253 | 1.6462 | 3.7897 | 3.0465 | 2.2399 | 1.4975 |





| EW | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=3$ |  | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.64\% | 0.60\% | 0.45\% | 0.43\% | 0.69\% | 0.59\% | 0.53\% | 0.43\% | 0.68\% | 0.61\% | 0.47\% | 0.35\% | 0.71\% | 0.53\% | 0.38\% | 0.27\% |
|  |  | 3.0420 | 3.2431 | 2.8337 | 3.3815 | 2.8008 | 2.7206 | 2.9650 | 2.7095 | 2.7642 | 2.8787 | 2.3830 | 1.9010 | 3.0127 | 2.4262 | 1.8194 | 1.3836 |
| CAR (1) |  | 0.75\% | 0.58\% | 0.45\% | 0.39\% | 0.75\% | 0.59\% | 0.51\% | 0.37\% | 0.71\% | 0.57\% | 0.40\% | 0.28\% | 0.66\% | 0.45\% | 0.30\% | 0.22\% |
|  |  | 3.6504 | 3.2637 | 3.1272 | 3.1830 | 3.1267 | 2.9183 | 3.0092 | 2.4153 | 3.0446 | 2.7686 | 2.0932 | 1.5827 | 2.9247 | 2.0932 | 1.4274 | 1.0954 |
| BHAR (0) |  | 0.70\% | 0.48\% | 0.53\% | 0.09\% | 0.70\% | 0.58\% | 0.48\% | 0.31\% | 0.72\% | 0.42\% | 0.53\% | 0.16\% | 0.79\% | 0.70\% | 0.54\% | 0.38\% |
|  |  | 3.0148 | 2.3231 | 2.5770 | 0.4050 | 2.8657 | 2.4884 | 1.8124 | 1.3721 | 2.7851 | 1.7068 | 2.1252 | 0.6556 | 3.3106 | 3.0221 | 2.3252 | 1.8102 |
| BHAR (1) |  | 0.68\% | 0.49\% | 0.54\% | 0.14\% | 0.75\% | 0.52\% | 0.48\% | 0.21\% | 0.68\% | 0.49\% | 0.48\% | 0.04\% | 0.75\% | 0.63\% | 0.45\% | 0.32\% |
|  |  | 2.9464 | 2.3482 | 2.7389 | 0.6493 | 3.0042 | 2.2077 | 1.8971 | 0.9476 | 2.7242 | 2.1064 | 1.9830 | 0.1762 | 3.2538 | 2.8260 | 1.9594 | 1.5825 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.57\% | 0.46\% | 0.40\% | 0.40\% | 0.60\% | 0.52\% | 0.51\% | 0.43\% | 0.59\% | 0.59\% | 0.51\% | 0.40\% | 0.68\% | 0.56\% | 0.44\% | 0.33\% |
|  |  | 4.2193 | 4.0193 | 3.9294 | 4.6243 | 3.7946 | 3.5690 | 3.9430 | 3.7179 | 3.5948 | 3.9032 | 3.6402 | 3.1002 | 4.1723 | 3.6010 | 3.0112 | 2.3364 |
| CAR (1) |  | 0.52\% | 0.43\% | 0.39\% | 0.36\% | 0.57\% | 0.52\% | 0.48\% | 0.38\% | 0.60\% | 0.57\% | 0.47\% | 0.33\% | 0.64\% | 0.49\% | 0.37\% | 0.26\% |
|  |  | 3.8967 | 3.7212 | 3.9043 | 4.1686 | 3.6378 | 3.6145 | 3.7673 | 3.2922 | 3.7439 | 3.8495 | 3.4085 | 2.5826 | 3.9544 | 3.2195 | 2.5631 | 1.8509 |
| BHAR (0) |  | 0.49\% | 0.41\% | 0.39\% | 0.39\% | 0.58\% | 0.53\% | 0.35\% | 0.61\% | 0.61\% | 0.60\% | 0.55\% | 0.50\% | 0.71\% | 0.64\% | 0.51\% | 0.35\% |
|  |  | 3.1580 | 2.5438 | 2.7353 | 2.7489 | 3.5075 | 3.3316 | 2.4357 | 4.6458 | 3.5894 | 3.4900 | 3.6617 | 3.0374 | 4.2525 | 3.8801 | 3.0701 | 2.1702 |
| BHAR (1) |  | 0.49\% | 0.33\% | 0.41\% | 0.36\% | 0.50\% | 0.49\% | 0.30\% | 0.57\% | 0.61\% | 0.55\% | 0.48\% | 0.34\% | 0.60\% | 0.56\% | 0.39\% | 0.31\% |
|  |  | 3.2644 | 2.0629 | 2.8849 | 2.4922 | 3.0394 | 3.0657 | 2.1482 | 4.2470 | 3.6013 | 3.2290 | 3.1629 | 1.9872 | 3.6370 | 3.4102 | 2.3975 | 1.9463 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.64\% | 0.64\% | 0.53\% | 0.53\% | 0.92\% | 0.77\% | 0.70\% | 0.61\% | 0.92\% | 0.83\% | 0.69\% | 0.57\% | 0.99\% | 0.80\% | 0.63\% | 0.49\% |
|  |  | 5.2228 | 6.2603 | 6.0367 | 6.8732 | 6.6268 | 6.1872 | 6.3706 | 6.1975 | 6.3119 | 6.1851 | 5.6731 | 5.1727 | 6.7532 | 5.8645 | 5.0296 | 4.2935 |
| CAR (1) |  | 0.63\% | 0.59\% | 0.51\% | 0.48\% | 0.86\% | 0.70\% | 0.63\% | 0.53\% | 0.84\% | 0.74\% | 0.60\% | 0.47\% | $\mathbf{0 . 8 7 \%}$ | 0.68\% | 0.52\% | 0.40\% |
|  |  | 5.2168 | 6.0442 | 6.0188 | 6.4748 | 6.4487 | 5.9192 | 5.9784 | 5.5815 | 5.8892 | 5.6939 | 5.1176 | 4.4398 | 6.1100 | 5.2215 | 4.3088 | 3.6172 |
| BHAR (0) |  | 0.55\% | 0.49\% | 0.56\% | 0.34\% | 0.90\% | 0.76\% | 0.60\% | 0.75\% | 0.92\% | 0.75\% | 0.75\% | 0.57\% | 0.95\% | 0.86\% | 0.60\% | 0.51\% |
|  |  | 3.9202 | 3.6102 | 4.2166 | 2.6498 | 6.1832 | 5.6245 | 4.1793 | 7.7154 | 5.9940 | 4.8860 | 5.9965 | 4.4326 | 6.1865 | 6.2240 | 4.2024 | 3.9076 |
| BHAR (1) |  | 0.62\% | 0.42\% | 0.52\% | 0.30\% | 0.84\% | 0.70\% | 0.57\% | 0.62\% | 0.85\% | 0.65\% | 0.60\% | 0.46\% | 0.84\% | 0.72\% | 0.43\% | 0.40\% |
|  |  | 4.6105 | 3.2936 | 4.0485 | 2.3638 | 6.0679 | 5.3292 | 4.2474 | 6.4768 | 5.7884 | 4.4568 | 4.8825 | 3.6907 | 5.7975 | 5.4534 | 3.0854 | 3.1743 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.10\% | -0.01\% | 0.05\% | 0.03\% | 0.03\% | 0.11\% | 0.11\% | 0.02\% | 0.19\% | 0.16\% | 0.07\% | -0.03\% | 0.14\% | 0.06\% | -0.03\% | -0.11\% |
|  |  | -0.6487 | -0.0911 | 0.4874 | 0.3128 | 0.1511 | 0.7532 | 0.8567 | 0.2043 | 1.0463 | 1.0456 | 0.5466 | -0.2139 | 0.8413 | 0.3964 | -0.2089 | -0.8576 |
| CAR (1) |  | -0.08\% | 0.05\% | 0.08\% | 0.00\% | 0.11\% | 0.17\% | 0.10\% | -0.01\% | 0.22\% | 0.14\% | 0.03\% | -0.08\% | 0.08\% | 0.01\% | -0.09\% | -0.15\% |
|  |  | -0.5631 | 0.4162 | 0.8317 | 0.0510 | 0.6640 | 1.2326 | 0.8588 | -0.0991 | 1.3491 | 0.9764 | 0.2212 | -0.6466 | 0.5310 | 0.0791 | -0.6607 | -1.2327 |
| BHAR (0) |  | -0.14\% | 0.00\% | 0.02\% | 0.04\% | -0.01\% | 0.14\% | -0.15\% | 0.24\% | 0.20\% | 0.11\% | 0.19\% | 0.01\% | 0.16\% | 0.14\% | 0.03\% | -0.11\% |
|  |  | -0.8448 | 0.0190 | 0.1104 | 0.2677 | -0.0807 | 0.8855 | -0.8781 | 2.1850 | 1.0790 | 0.6788 | 1.4085 | 0.0540 | 0.8657 | 0.8844 | 0.1821 | -0.6948 |
| BHAR (1) |  | -0.07\% | -0.06\% | -0.01\% | -0.02\% | 0.05\% | 0.16\% | -0.15\% | 0.10\% | 0.20\% | 0.01\% | 0.02\% | -0.13\% | 0.01\% | 0.00\% | -0.12\% | -0.21\% |
|  |  | -0.4261 | -0.4133 | -0.0585 | -0.1683 | 0.2812 | 1.0656 | -0.9286 | 0.9348 | 1.1128 | 0.0859 | 0.1814 | -0.9294 | 0.0603 | 0.0203 | -0.8240 | -1.4266 |

Panel B. The time-series momentum strategy using market-weighted return


| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| H= |  | 36 |  | 9 | 12 | 6 |  | 9 | 12 | 36 |  | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.64\% | 0.65\% | 0.54\% | 0.52\% | 0.79\% | 0.69\% | 0.56\% | 0.47\% | 0.73\% | 0.74\% | 0.59\% | 0.54\% | 0.90\% | 0.69\% | 0.58\% | 0.48\% |
|  |  | 3.0620 | 3.5206 | 3.1632 | 3.4267 | 3.2590 | 3.1303 | 2.7509 | 2.5326 | 2.7758 | 3.0035 | 2.4714 | 2.4157 | 3.3026 | 2.5671 | 2.2155 | 1.8973 |
| CAR (1) |  | 0.81\% | 0.61\% | 0.55\% | 0.49\% | 0.73\% | 0.64\% | 0.51\% | 0.41\% | 0.76\% | 0.67\% | 0.53\% | 0.50\% | 0.74\% | 0.57\% | 0.49\% | 0.40\% |
|  |  | 3.7514 | 3.2868 | 3.2308 | 3.3071 | 3.0546 | 2.8492 | 2.5281 | 2.2246 | 2.8703 | 2.7052 | 2.2079 | 2.2537 | 2.5980 | 2.0834 | 1.8544 | 1.5891 |
| BHAR (0) |  | 0.39\% | 0.65\% | 0.20\% | 0.48\% | 0.52\% | 0.64\% | 0.66\% | 0.47\% | 0.54\% | 0.57\% | 0.50\% | 0.15\% | 0.71\% | 0.92\% | 0.65\% | 0.59\% |
|  |  | 1.5721 | 2.4460 | 0.7634 | 1.7472 | 1.9078 | 2.2783 | 2.3263 | 1.7945 | 1.9417 | 1.9088 | 1.7076 | 0.5090 | 2.4277 | 3.0646 | 2.1299 | 1.9866 |
| BHAR (1) |  | 0.65\% | 0.56\% | 0.39\% | 0.63\% | 0.65\% | 0.80\% | 0.54\% | 0.41\% | 0.72\% | 0.63\% | 0.45\% | 0.11\% | 0.66\% | 0.72\% | 0.66\% | 0.44\% |
|  |  | 2.5003 | 2.0774 | 1.4459 | 2.3165 | 2.3175 | 2.7523 | 1.9261 | 1.5615 | 2.4236 | 2.1633 | 1.5426 | 0.3890 | 2.1809 | 2.3162 | 2.2158 | 1.4596 |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.46\% | 0.86\% | 0.92\% | 0.84\% | 1.06\% | 1.19\% | 1.16\% | 1.06\% | 1.40\% | 1.31\% | 1.16\% | 1.04\% | 1.26\% | 1.22\% | 1.09\% | 0.94\% |
|  |  | 1.1586 | 2.8859 | 3.2704 | 3.1952 | 2.5115 | 3.0785 | 3.2039 | 3.1860 | 2.9860 | 3.0749 | 2.8175 | 2.7051 | 2.6723 | 2.7058 | 2.5136 | 2.3173 |
| CAR (1) |  | 0.69\% | 0.92\% | 0.91\% | 0.80\% | 1.12\% | 1.22\% | 1.18\% | 1.05\% | 1.25\% | 1.22\% | 1.06\% | 0.91\% | 1.22\% | 1.09\% | 0.96\% | 0.88\% |
|  |  | 1.9322 | 3.0948 | 3.2758 | 3.0337 | 2.6323 | 3.0987 | 3.2196 | 3.1317 | 2.7726 | 2.8419 | 2.5921 | 2.3573 | 2.6126 | 2.3774 | 2.2090 | 2.1437 |
| BHAR (0) |  | 0.09\% | 0.65\% | 1.40\% | 0.54\% | 0.59\% | 1.45\% | 1.22\% | 1.59\% | 1.24\% | 1.36\% | 0.49\% | 1.12\% | 0.66\% | 1.23\% | 0.56\% | 1.39\% |
|  |  | 0.2058 | 1.2728 | 3.0237 | 1.0206 | 1.2004 | 3.0134 | 2.5155 | 3.2628 | 2.4429 | 2.5940 | 0.9306 | 2.2093 | 1.2878 | 2.3286 | 1.0812 | 2.7413 |
| BHAR (1) |  | 0.84\% | 0.99\% | 1.31\% | 0.66\% | 1.06\% | 1.32\% | 1.19\% | 1.32\% | 1.17\% | 1.30\% | 0.49\% | 0.96\% | 0.79\% | 1.04\% | 0.32\% | 1.38\% |
|  |  | 1.7687 | 1.9273 | 2.8462 | 1.2660 | 2.1523 | 2.6865 | 2.4520 | 2.7194 | 2.2529 | 2.4589 | 0.9277 | 1.8269 | 1.4889 | 1.9833 | 0.6152 | 2.7857 |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.33\% | -0.07\% | 0.03\% | 0.13\% | -0.19\% | 0.01\% | 0.16\% | 0.16\% | -0.05\% | 0.15\% | 0.21\% | 0.17\% | 0.09\% | 0.13\% | 0.11\% | 0.08\% |
|  |  | -1.7345 | -0.4536 | 0.2106 | 1.1477 | -0.8799 | 0.0562 | 1.0002 | 1.0611 | -0.2298 | 0.7426 | 1.1436 | 0.9382 | 0.3781 | 0.5878 | 0.5617 | 0.4222 |
| CAR (1) |  | -0.14\% | 0.06\% | 0.13\% | 0.14\% | 0.03\% | 0.20\% | 0.25\% | 0.17\% | 0.13\% | 0.25\% | 0.24\% | 0.15\% | 0.11\% | 0.15\% | 0.10\% | 0.06\% |
|  |  | -0.8067 | 0.3947 | 1.0609 | 1.2313 | 0.1497 | 1.0719 | 1.5414 | 1.0892 | 0.5775 | 1.2778 | 1.3295 | 0.8490 | 0.4656 | 0.7209 | 0.5051 | 0.3317 |
| BHAR (0) |  | -0.41\% | -0.12\% | -0.16\% | 0.12\% | -0.13\% | -0.03\% | 0.04\% | 0.03\% | 0.00\% | 0.09\% | 0.36\% | 0.23\% | 0.15\% | 0.09\% | 0.20\% | 0.25\% |
|  |  | -1.8546 | -0.5900 | -0.7834 | 0.5037 | -0.6145 | -0.1335 | 0.1791 | 0.1688 | 0.0053 | 0.3641 | 1.6852 | 1.1053 | 0.6496 | 0.3864 | 0.8732 | 1.2102 |
| BHAR (1) |  | -0.21\% | -0.09\% | -0.06\% | 0.19\% | -0.05\% | 0.09\% | 0.15\% | 0.07\% | 0.08\% | 0.21\% | 0.34\% | 0.19\% | 0.16\% | 0.03\% | 0.13\% | 0.18\% |
|  |  | -0.9420 | -0.4496 | -0.3143 | 0.8599 | -0.2289 | 0.4330 | 0.7643 | 0.3664 | 0.3182 | 0.9371 | 1.6169 | 0.9411 | 0.6603 | 0.1171 | 0.5798 | 0.9191 |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.27\% | 0.25\% | 0.29\% | 0.26\% | 0.35\% | 0.35\% | 0.37\% | 0.29\% | 0.45\% | 0.40\% | 0.34\% | 0.26\% | 0.39\% | 0.32\% | 0.28\% | 0.20\% |
|  |  | 1.2540 | 1.3627 | 1.8773 | 1.8869 | 1.3505 | 1.5218 | 1.8572 | 1.5462 | 1.6839 | 1.6380 | 1.4440 | 1.1795 | 1.3929 | 1.2140 | 1.1188 | 0.8262 |
| CAR (1) |  | 0.36\% | 0.30\% | 0.34\% | 0.23\% | 0.32\% | 0.37\% | 0.35\% | 0.26\% | 0.53\% | 0.40\% | 0.33\% | 0.23\% | 0.39\% | 0.31\% | 0.25\% | 0.15\% |
|  |  | 1.6519 | 1.7423 | 2.2378 | 1.7051 | 1.2522 | 1.6884 | 1.7534 | 1.3974 | 2.0063 | 1.6508 | 1.4814 | 1.0624 | 1.4068 | 1.1969 | 1.0281 | 0.6383 |
| BHAR (0) |  | 0.28\% | 0.34\% | 0.34\% | -0.05\% | 0.22\% | 0.46\% | 0.25\% | 0.28\% | 0.45\% | 0.34\% | 0.40\% | 0.43\% | 0.42\% | 0.38\% | 0.39\% | 0.14\% |
|  |  | 1.1705 | 1.4801 | 1.5176 | -0.2048 | 0.7927 | 1.6487 | 0.9559 | 1.1811 | 1.6363 | 1.3238 | 1.4792 | 1.7674 | 1.4825 | 1.3026 | 1.3960 | 0.5207 |
| BHAR (1) |  | 0.36\% | 0.33\% | 0.30\% | -0.05\% | 0.31\% | 0.54\% | 0.26\% | 0.28\% | 0.48\% | 0.34\% | 0.37\% | 0.22\% | 0.39\% | 0.34\% | 0.42\% | 0.16\% |
|  |  | 1.4698 | 1.4443 | 1.3803 | -0.2443 | 1.0886 | 2.0302 | 0.9524 | 1.1804 | 1.6980 | 1.2419 | 1.3340 | 0.8749 | 1.3071 | 1.1654 | 1.5574 | 0.5955 |


| MW | $\begin{aligned} & \mathrm{J}= \\ & \mathrm{H}= \end{aligned}$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| GREECE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.57\% | 0.51\% | 0.31\% | 0.34\% | 0.39\% | 0.25\% | 0.25\% | 0.36\% | 0.57\% | 0.58\% | 0.52\% | 0.49\% | 0.49\% | 0.46\% | 0.54\% | 0.52\% |
|  |  | 1.1599 | 1.2838 | 0.9345 | 1.2475 | 0.7702 | 0.5667 | 0.6803 | 1.1305 | 1.0444 | 1.2250 | 1.2225 | 1.2698 | 0.8909 | 0.9339 | 1.1937 | 1.1915 |
| CAR (1) |  | 0.66\% | 0.44\% | 0.36\% | 0.33\% | 0.42\% | 0.27\% | 0.31\% | 0.38\% | 0.59\% | 0.52\% | 0.53\% | 0.47\% | 0.48\% | 0.49\% | 0.57\% | 0.51\% |
|  |  | 1.3146 | 1.1308 | 1.1328 | 1.2491 | 0.8262 | 0.6222 | 0.8746 | 1.2304 | 1.1123 | 1.1400 | 1.2936 | 1.2278 | 0.8900 | 0.9965 | 1.2387 | 1.1380 |
| BHAR (0) |  | 1.21\% | 0.76\% | 0.68\% | $\mathbf{0 . 8 0 \%}$ | 1.02\% | 0.97\% | 0.81\% | 0.67\% | 0.92\% | 0.70\% | 0.39\% | $\mathbf{0 . 3 9 \%}$ | 0.56\% | 0.81\% | -0.04\% | 0.35\% |
|  |  | 2.1168 | 1.3236 | 1.5464 | 1.4786 | 1.8273 | 1.6598 | 1.3806 | 1.3627 | 1.5424 | 1.1902 | 0.7326 | 0.7163 | 0.9642 | 1.4635 | -0.0737 | 0.6920 |
| BHAR (1) |  | 0.81\% | 0.61\% | 0.70\% | 1.18\% | 0.47\% | 0.55\% | 0.91\% | 0.83\% | 0.71\% | 0.86\% | 0.50\% | 0.12\% | 0.70\% | 0.98\% | 0.22\% | 0.47\% |
|  |  | 1.3343 | 1.0349 | 1.5631 | 2.0661 | 0.7915 | 0.9194 | 1.5442 | 1.7151 | 1.1549 | 1.4141 | 0.9075 | 0.2153 | 1.1616 | 1.8280 | 0.3924 | 0.9472 |
| HONGKONG |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.09\% | 0.21\% | 0.21\% | 0.20\% | 0.28\% | 0.27\% | 0.24\% | 0.16\% | 0.41\% | 0.32\% | 0.25\% | 0.11\% | 0.40\% | 0.20\% | 0.07\% | 0.02\% |
|  |  | 0.3249 | 1.0717 | 1.2759 | 1.3546 | 0.9290 | 1.0783 | 1.0915 | 0.7567 | 1.3748 | 1.1889 | 0.9648 | 0.4506 | 1.2849 | 0.6794 | 0.2679 | 0.0817 |
| CAR (1) |  | -0.01\% | 0.21\% | 0.20\% | 0.17\% | 0.25\% | 0.30\% | 0.20\% | 0.11\% | 0.37\% | 0.25\% | 0.16\% | 0.06\% | 0.25\% | 0.10\% | 0.01\% | -0.03\% |
|  |  | -0.0343 | 1.1188 | 1.2634 | 1.1778 | 0.8943 | 1.1997 | 0.8901 | 0.5140 | 1.2960 | 0.9356 | 0.6124 | 0.2521 | 0.8088 | 0.3254 | 0.0363 | -0.1278 |
| BHAR (0) |  | -0.28\% | 0.05\% | -0.26\% | 0.26\% | 0.27\% | -0.04\% | -0.03\% | -0.19\% | 0.53\% | 0.30\% | 0.46\% | -0.01\% | 0.44\% | 0.48\% | 0.14\% | 0.15\% |
|  |  | -0.8787 | 0.1680 | -0.8224 | 1.0144 | 0.8489 | -0.1167 | -0.1023 | -0.6791 | 1.6210 | 0.9397 | 1.4955 | -0.0322 | 1.3399 | 1.4236 | 0.4042 | 0.4984 |
| BHAR (1) |  | $-0.39 \%$ | 0.05\% | -0.31\% | 0.16\% | -0.10\% | -0.28\% | -0.37\% | -0.27\% | 0.11\% | -0.01\% | 0.27\% | 0.06\% | 0.06\% | 0.26\% | 0.14\% | 0.16\% |
|  |  | $-1.2426$ | 0.1663 | -0.9877 | 0.6055 | -0.3136 | -0.9131 | -1.1186 | -0.9545 | 0.3261 | -0.0194 | 0.8814 | 0.1985 | 0.1838 | 0.7891 | 0.4395 | 0.5398 |
| IRELAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.97\% | 0.92\% | 0.65\% | 0.58\% | 1.14\% | 0.79\% | 0.61\% | 0.52\% | 0.95\% | 0.67\% | 0.47\% | 0.37\% | 1.00\% | 0.70\% | 0.49\% | 0.33\% |
|  |  | 2.4609 | 2.6897 | 1.9923 | 2.0021 | 2.4943 | 1.8968 | 1.5916 | 1.4708 | 2.0064 | 1.4920 | 1.1189 | 0.9254 | 2.0713 | 1.4710 | 1.0729 | 0.7615 |
| CAR (1) |  | 1.18\% | 0.90\% | 0.63\% | 0.51\% | 0.97\% | 0.64\% | 0.50\% | 0.43\% | 0.74\% | 0.49\% | 0.35\% | 0.26\% | 0.91\% | 0.55\% | 0.37\% | 0.21\% |
|  |  | 3.1021 | 2.6318 | 2.0079 | 1.8085 | 2.1995 | 1.5436 | 1.3192 | 1.2331 | 1.6035 | 1.1136 | 0.8510 | 0.6754 | 1.8544 | 1.1892 | 0.8306 | 0.4960 |
| BHAR (0) |  | 0.72\% | 0.39\% | -0.37\% | $\mathbf{0 . 7 1 \%}$ | 1.05\% | 1.13\% | -0.22\% | 0.83\% | 0.69\% | 0.50\% | 1.14\% | 0.90\% | 1.27\% | 0.88\% | 0.23\% | 0.87\% |
|  |  | 1.5070 | 0.7825 | -0.8860 | 1.4577 | 2.0341 | 2.1913 | -0.5084 | 1.6869 | 1.2841 | 0.9590 | 2.1324 | 1.7790 | 2.4066 | 1.5853 | 0.4383 | 1.4418 |
| BHAR (1) |  | 1.14\% | 0.67\% | -0.19\% | $\mathbf{0 . 8 2 \%}$ | 1.12\% | 1.04\% | -0.22\% | 0.68\% | 0.51\% | 0.41\% | 1.07\% | 0.59\% | 0.79\% | 0.90\% | -0.05\% | 0.82\% |
|  |  | 2.4506 | 1.3455 | -0.4694 | 1.7181 | 2.0772 | 1.9684 | -0.5156 | 1.3969 | 0.9705 | 0.8132 | 2.0432 | 1.2016 | 1.4797 | 1.6151 | -0.1024 | 1.3609 |
| ISRAEL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.64\% | 0.49\% | 0.47\% | 0.32\% | 0.64\% | 0.60\% | 0.40\% | 0.24\% | 0.61\% | 0.54\% | 0.39\% | 0.27\% | 0.69\% | 0.47\% | 0.34\% | 0.24\% |
|  |  | 1.7852 | 1.8673 | 2.1285 | 1.5277 | 1.7393 | 1.9995 | 1.3733 | 0.8320 | 1.7504 | 1.6010 | 1.1376 | 0.7938 | 1.9253 | 1.3095 | 0.9576 | 0.6941 |
| CAR (1) |  | 0.48\% | 0.45\% | 0.42\% | $\mathbf{0 . 2 1 \%}$ | 0.60\% | 0.51\% | 0.31\% | 0.16\% | 0.87\% | 0.58\% | 0.37\% | 0.26\% | 0.52\% | 0.36\% | 0.26\% | 0.15\% |
|  |  | 1.3271 | 1.6936 | 1.8196 | 0.9499 | 1.7477 | 1.6134 | 1.0008 | 0.5268 | 2.2726 | 1.5519 | 1.0036 | 0.7425 | 1.4659 | 0.9970 | 0.7163 | 0.4201 |
| BHAR (0) |  | 0.26\% | 0.14\% | 0.74\% | 0.82\% | 0.33\% | 0.70\% | -0.17\% | 0.55\% | 0.15\% | 0.06\% | 0.28\% | 0.03\% | 0.80\% | 0.53\% | 0.49\% | 0.37\% |
|  |  | 0.5829 | 0.3096 | 1.7328 | 2.1002 | 0.7498 | 1.8088 | -0.3729 | 1.4322 | 0.3400 | 0.1311 | 0.7015 | 0.0662 | 1.7851 | 1.3931 | 1.2555 | 0.9450 |
| BHAR (1) |  | 0.53\% | 0.70\% | 0.76\% | 0.74\% | 0.87\% | 0.51\% | 0.18\% | 0.40\% | 0.84\% | 0.57\% | 0.38\% | 0.65\% | 0.72\% | 0.43\% | 0.36\% | 0.35\% |
|  |  | 1.3029 | 1.8642 | 1.7625 | 1.8887 | 2.3225 | 1.3164 | 0.4628 | 1.0146 | 2.1867 | 1.4637 | 1.0186 | 1.6885 | 1.8792 | 1.0924 | 0.8968 | 0.8451 |




| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.35\% | 0.18\% | 0.06\% | 0.06\% | 0.36\% | 0.14\% | 0.10\% | 0.06\% | 0.39\% | 0.19\% | 0.08\% | -0.02\% | 0.18\% | 0.03\% | -0.05\% | -0.10\% |
|  |  | 1.2714 | 0.8486 | 0.3083 | 0.3466 | 1.1640 | 0.4961 | 0.3825 | 0.2487 | 1.1528 | 0.6091 | 0.2799 | -0.0708 | 0.5320 | 0.0955 | -0.1452 | -0.3149 |
| CAR (1) |  | 0.19\% | 0.12\% | 0.03\% | $\mathbf{0 . 0 1 \%}$ | 0.27\% | 0.10\% | 0.07\% | -0.02\% | 0.21\% | 0.11\% | 0.00\% | -0.08\% | 0.04\% | -0.07\% | -0.14\% | -0.17\% |
|  |  | 0.7190 | 0.5357 | 0.1474 | 0.0445 | 0.8878 | 0.3868 | 0.3042 | -0.0641 | 0.6586 | 0.3620 | 0.0123 | -0.2619 | 0.1112 | -0.2063 | -0.4481 | -0.5541 |
| BHAR (0) |  | 0.47\% | 0.31\% | -0.02\% | -0.41\% | 0.46\% | -0.03\% | -0.03\% | -0.29\% | 0.40\% | 0.00\% | 0.21\% | -0.18\% | 0.10\% | 0.04\% | 0.03\% | -0.09\% |
|  |  | 1.4785 | 1.0214 | -0.0694 | -1.1809 | 1.4521 | -0.0796 | -0.0748 | -0.8368 | 1.1308 | 0.0104 | 0.5984 | -0.5503 | 0.2906 | 0.0937 | 0.0716 | -0.2481 |
| BHAR (1) |  | 0.32\% | 0.18\% | -0.08\% | -0.43\% | 0.51\% | -0.03\% | 0.23\% | -0.29\% | 0.35\% | 0.18\% | 0.13\% | -0.12\% | 0.01\% | -0.13\% | -0.10\% | -0.09\% |
|  |  | 0.9866 | 0.5917 | -0.2499 | -1.2811 | 1.5428 | -0.0880 | 0.6656 | -0.8458 | 0.9792 | 0.5244 | 0.3759 | -0.3350 | 0.0320 | -0.3481 | -0.2736 | -0.2442 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.12\% | 0.00\% | 0.07\% | 0.14\% | -0.17\% | 0.05\% | 0.23\% | 0.20\% | 0.09\% | 0.25\% | 0.28\% | 0.25\% | 0.22\% | 0.29\% | 0.26\% | 0.24\% |
|  |  | -0.6710 | 0.0037 | 0.5635 | 1.2412 | -0.7677 | 0.2631 | 1.2881 | 1.2612 | 0.3854 | 1.2083 | 1.4276 | 1.3864 | 0.9265 | 1.2917 | 1.2256 | 1.1921 |
| CAR (1) |  | 0.00\% | 0.08\% | 0.17\% | 0.14\% | -0.01\% | 0.22\% | 0.30\% | 0.22\% | 0.26\% | 0.34\% | 0.33\% | 0.23\% | 0.27\% | 0.29\% | 0.27\% | 0.20\% |
|  |  | -0.0286 | 0.5596 | 1.3777 | 1.2812 | -0.0561 | 1.1430 | 1.7256 | 1.3796 | 1.1565 | 1.6081 | 1.7122 | 1.3024 | 1.1607 | 1.2922 | 1.3155 | 1.0462 |
| BHAR (0) |  | -0.02\% | -0.12\% | -0.32\% | 0.06\% | -0.19\% | 0.01\% | 0.11\% | 0.42\% | 0.02\% | 0.15\% | 0.20\% | 0.15\% | 0.25\% | 0.22\% | 0.14\% | 0.18\% |
|  |  | -0.0790 | -0.5302 | -1.3940 | 0.2777 | -0.7740 | 0.0543 | 0.4724 | 1.8515 | 0.0811 | 0.5877 | 0.8816 | 0.6597 | 0.9860 | 0.8552 | 0.5632 | 0.7331 |
| BHAR (1) |  | 0.07\% | 0.01\% | -0.18\% | 0.10\% | 0.03\% | 0.27\% | 0.16\% | $\mathbf{0 . 4 2 \%}$ | $0.31 \%$ | 0.29\% | $0.14 \%$ | 0.05\% | $0.24 \%$ | $0.22 \%$ | $0.14 \%$ | $0.21 \%$ |
|  |  | 0.3803 | 0.0538 | -0.7932 | 0.4405 | 0.1198 | 1.1764 | 0.6942 | 1.8908 | $1.2192$ | $1.1531$ | $0.5959$ | 0.2311 | $0.9741$ | $0.8726$ | $0.5767$ | $0.9057$ |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.12\% | 0.03\% | 0.07\% | 0.20\% | 0.05\% | 0.12\% | 0.25\% | 0.26\% | 0.20\% | 0.32\% | 0.32\% | 0.21\% | 0.33\% | 0.36\% | 0.22\% | 0.14\% |
|  |  | -0.6460 | 0.1905 | 0.5217 | 1.5834 | 0.2100 | 0.5460 | 1.2725 | 1.5403 | 0.7985 | 1.3331 | 1.4793 | 1.0410 | 1.3073 | 1.4659 | 0.9589 | 0.6518 |
| CAR (1) |  | -0.09\% | 0.06\% | 0.13\% | 0.20\% | 0.10\% | 0.19\% | 0.29\% | 0.23\% | 0.27\% | 0.37\% | 0.30\% | 0.15\% | 0.36\% | 0.33\% | 0.16\% | 0.09\% |
|  |  | -0.4659 | 0.3806 | 0.9140 | 1.6045 | 0.4139 | 0.8896 | 1.5662 | 1.3854 | 1.0492 | 1.6078 | 1.4153 | 0.7676 | 1.3968 | 1.3777 | 0.7413 | 0.4373 |
| BHAR (0) |  | -0.28\% | -0.12\% | 0.04\% | -0.04\% | $-0.09 \%$ | 0.04\% | $0.09 \%$ | $0.37 \%$ | 0.12\% | $0.26 \%$ | 0.30\% | 0.32\% | 0.30\% | 0.46\% | 0.18\% | $0.14 \%$ |
|  |  | -1.2700 | $-0.5578$ | 0.1796 | -0.1779 | -0.3657 | 0.1527 | 0.3347 | 2.0648 | 0.4456 | 0.9677 | 1.3168 | 1.3712 | 1.1257 | 1.7796 | 0.7148 | $0.5273$ |
| BHAR (1) |  | -0.05\% | -0.11\% | 0.10\% | 0.13\% | -0.01\% | 0.11\% | 0.21\% | 0.26\% | 0.19\% | 0.28\% | 0.20\% | 0.19\% | 0.28\% | 0.33\% | 0.00\% | 0.01\% |
|  |  | -0.2244 | -0.5567 | 0.4281 | 0.6524 | -0.0325 | 0.4531 | 0.9031 | 1.4279 | 0.7092 | 1.1243 | 0.8814 | 0.8243 | 1.0896 | 1.2755 | 0.0184 | 0.0467 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.23\% | -0.07\% | 0.06\% | 0.08\% | -0.14\% | 0.05\% | 0.13\% | 0.10\% | 0.11\% | 0.17\% | 0.17\% | 0.10\% | 0.17\% | 0.16\% | 0.13\% | 0.08\% |
|  |  | -1.3499 | -0.4988 | 0.4753 | 0.7372 | -0.6833 | 0.3060 | 0.8210 | 0.7278 | 0.5069 | 0.9191 | 0.9526 | 0.6352 | 0.8224 | 0.8462 | 0.7313 | 0.4800 |
| CAR (1) |  | -0.17\% | 0.01\% | 0.12\% | 0.08\% | 0.00\% | 0.16\% | 0.16\% | 0.10\% | 0.23\% | 0.22\% | 0.17\% | 0.09\% | 0.17\% | 0.16\% | 0.11\% | 0.07\% |
|  |  | -1.0143 | 0.1005 | 0.9771 | 0.8388 | 0.0064 | 0.9461 | 1.0885 | 0.7415 | 1.1587 | 1.2040 | 1.0230 | 0.5986 | 0.8466 | 0.8539 | 0.6383 | 0.3873 |
| BHAR (0) |  | -0.32\% | 0.00\% | -0.19\% | 0.17\% | -0.15\% | 0.05\% | -0.14\% | 0.29\% | 0.14\% | 0.11\% | 0.26\% | 0.08\% | 0.17\% | 0.20\% | 0.14\% | 0.13\% |
|  |  | -1.5984 | -0.0176 | -0.9910 | 0.8478 | -0.6919 | 0.2473 | -0.6493 | 1.8714 | 0.6510 | 0.5320 | 1.4051 | 0.4593 | 0.7732 | 0.9550 | 0.6591 | 0.6190 |
| BHAR (1) |  | -0.15\% | -0.11\% | -0.11\% | 0.16\% | -0.04\% | 0.15\% | -0.12\% | 0.21\% | 0.24\% | 0.03\% | 0.16\% | -0.06\% | 0.06\% | 0.11\% | 0.00\% | 0.00\% |
|  |  | -0.7286 | -0.5783 | -0.6236 | 0.8413 | -0.1984 | 0.7603 | -0.5639 | 1.4323 | 1.0804 | 0.1540 | 0.8543 | -0.3340 | 0.2781 | 0.5361 | -0.0121 | 0.0026 |

Panel C. The time-series momentum strategy using inversed volatility-weighted return


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.64\% | 0.61\% | 0.55\% | 0.53\% | 0.84\% | 0.73\% | 0.70\% | 0.61\% | 0.88\% | 0.82\% | 0.70\% | 0.59\% | 0.91\% | 0.78\% | 0.63\% | 0.52\% |
|  |  | 6.1776 | 6.1170 | 6.1255 | 6.7072 | 6.7108 | 5.9724 | 6.2299 | 5.9738 | 6.8667 | 6.4832 | 5.8605 | 5.3178 | 6.7778 | 5.8652 | 5.0548 | 4.4260 |
| CAR (1) |  | 0.59\% | 0.56\% | 0.52\% | $\mathbf{0 . 4 7 \%}$ | 0.79\% | 0.72\% | 0.64\% | $\mathbf{0 . 5 3 \%}$ | 0.85\% | 0.73\% | 0.62\% | $\mathbf{0 . 5 0 \%}$ | 0.80\% | 0.68\% | 0.53\% | 0.43\% |
|  |  | 5.6943 | 5.8302 | 6.0590 | 6.0587 | 6.2522 | 5.7921 | 5.7742 | 5.2927 | 6.5983 | 5.8669 | 5.2423 | 4.5884 | 6.1169 | 5.2661 | 4.3506 | 3.6982 |
| BHAR (0) |  | 0.74\% | 0.69\% | 0.51\% | 0.53\% | 0.80\% | 0.65\% | 0.62\% | 0.79\% | 0.85\% | 0.86\% | 0.79\% | $\mathbf{0 . 7 2 \%}$ | 0.90\% | 0.83\% | 0.66\% | 0.60\% |
|  |  | 5.8912 | 5.1592 | 3.7288 | 4.2669 | 5.6841 | 4.0034 | 4.3522 | 5.9019 | 6.0544 | 5.6761 | 5.5357 | 4.7769 | 6.1962 | 5.5198 | 4.3487 | 3.7591 |
| BHAR (1) |  | 0.51\% | 0.64\% | 0.56\% | 0.55\% | 0.71\% | 0.68\% | 0.49\% | $\mathbf{0 . 7 1 \%}$ | 0.89\% | 0.74\% | 0.73\% | 0.54\% | 0.81\% | 0.70\% | 0.63\% | 0.41\% |
|  |  | 3.7159 | 4.9181 | 3.7108 | 4.4387 | 5.2900 | 4.2768 | 3.7286 | 5.8432 | 6.2732 | 5.0364 | 5.2477 | 3.6917 | 5.7526 | 4.7601 | 4.1795 | 2.6723 |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.41\% | 0.38\% | 0.37\% | 0.33\% | 0.48\% | 0.47\% | 0.43\% | 0.36\% | 0.60\% | 0.49\% | 0.37\% | 0.27\% | 0.59\% | 0.40\% | 0.30\% | 0.22\% |
|  |  | 2.9058 | 3.0134 | 3.3989 | 3.3791 | 2.9181 | 3.2751 | 3.2354 | 2.8790 | 3.3217 | 3.0035 | 2.3903 | 1.8688 | 2.9984 | 2.2136 | 1.7726 | 1.3879 |
| CAR (1) |  | 0.35\% | 0.33\% | 0.34\% | 0.30\% | 0.49\% | 0.47\% | 0.43\% | 0.31\% | 0.63\% | 0.46\% | 0.31\% | 0.21\% | 0.48\% | 0.31\% | 0.22\% | 0.17\% |
|  |  | 2.4682 | 3.0755 | 3.4042 | 3.1955 | 3.2102 | 3.3702 | 3.2135 | 2.5566 | 3.5437 | 2.7950 | 2.0136 | 1.5059 | 2.5374 | 1.7326 | 1.3119 | 1.0866 |
| BHAR (0) |  | 0.34\% | 0.31\% | 0.21\% | 0.11\% | 0.35\% | 0.52\% | 0.48\% | 0.56\% | 0.58\% | 0.24\% | 0.28\% | 0.20\% | 0.54\% | 0.56\% | 0.16\% | 0.33\% |
|  |  | 1.5850 | 1.3027 | 1.2657 | 0.4420 | 1.9221 | 3.2767 | 2.8273 | 3.3053 | 2.8880 | 1.1214 | 1.5245 | 1.0662 | 2.5879 | 2.7846 | 0.8157 | 1.7092 |
| BHAR (1) |  | 0.54\% | 0.23\% | 0.25\% | 0.14\% | 0.55\% | 0.59\% | 0.49\% | 0.49\% | 0.58\% | 0.21\% | 0.21\% | 0.16\% | 0.48\% | 0.45\% | -0.02\% | 0.29\% |
|  |  | 3.2823 | 1.3951 | 1.6161 | 0.7427 | 3.1821 | 3.6619 | 2.9400 | 2.9397 | 2.9947 | 1.0039 | 1.1686 | 0.8831 | 2.3681 | 2.2814 | -0.0917 | 1.5078 |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.06\% | -0.04\% | 0.08\% | 0.33\% | 0.13\% | -0.12\% | 0.16\% | 0.27\% | 0.25\% | 0.22\% | 0.23\% | 0.07\% | 0.42\% | 0.30\% | 0.01\% | -0.03\% |
|  |  | -0.3343 | -0.1833 | 0.4584 | 2.1643 | 0.6179 | -0.4775 | 0.7445 | 1.4594 | 1.2557 | 0.8778 | 1.0670 | 0.3971 | 2.0656 | 1.4343 | 0.0694 | -0.1519 |
| CAR (1) |  | 0.14\% | -0.03\% | 0.12\% | 0.27\% | 0.17\% | 0.03\% | 0.25\% | 0.22\% | 0.35\% | 0.40\% | 0.23\% | $\mathbf{0 . 0 1 \%}$ | 0.50\% | 0.22\% | -0.09\% | -0.07\% |
|  |  | 0.7331 | -0.1442 | 0.7549 | 1.8263 | 0.8307 | 0.1259 | 1.1859 | 1.2345 | 1.7418 | 1.6832 | 1.1269 | 0.0775 | 2.5608 | 0.9688 | -0.4004 | -0.3646 |
| BHAR (0) |  | 0.30\% | -0.42\% | 0.53\% | 0.00\% | 0.16\% | -0.59\% | 0.52\% | 0.57\% | 0.37\% | 0.79\% | -0.11\% | 1.08\% | 0.53\% | 0.40\% | 0.16\% | 0.03\% |
|  |  | 1.0835 | -1.1024 | 1.3076 | 0.0085 | 0.7240 | -1.5145 | 1.5656 | 1.3851 | 1.9921 | 2.8258 | -0.2722 | 3.0985 | 2.5327 | 1.1527 | 0.4494 | $0.0893$ |
| BHAR (1) |  | 0.17\% | -0.78\% | 0.63\% | 0.05\% | 0.05\% | -0.47\% | 0.21\% | 0.86\% | 0.09\% | 0.63\% | -0.58\% | 0.29\% | 0.45\% | 0.04\% | $\mathbf{- 0 . 1 1 \%}$ | -0.11\% |
|  |  | 0.6348 | -1.9491 | 1.2708 | 0.1083 | 0.1633 | -1.2398 | 0.5506 | 2.1752 | 0.3313 | 1.5843 | -1.3545 | 0.6167 | 1.5434 | 0.0963 | -0.3208 | -0.2749 |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.72\% | 0.48\% | 0.46\% | 0.38\% | 0.75\% | 0.69\% | 0.58\% | 0.48\% | 0.75\% | 0.66\% | 0.54\% | 0.47\% | 0.82\% | 0.65\% | 0.56\% | 0.42\% |
|  |  | 4.5238 | 3.1731 | 3.3895 | 3.2671 | 4.3144 | 4.1134 | 3.5241 | 2.9428 | 3.6000 | 3.0792 | 2.4786 | 2.7493 | 4.1174 | 2.9634 | 3.2127 | 2.6141 |
| CAR (1) |  | 0.67\% | 0.53\% | 0.57\% | 0.43\% | 0.75\% | 0.68\% | 0.55\% | 0.46\% | 0.76\% | 0.60\% | 0.53\% | 0.44\% | 0.77\% | 0.64\% | 0.48\% | 0.34\% |
|  |  | 4.3873 | 3.5699 | 4.3123 | 3.4239 | 4.4439 | 3.8775 | 3.1609 | 2.8573 | 3.8309 | 2.9119 | 2.7808 | 2.8291 | 3.9598 | 3.3683 | 2.8676 | 2.2016 |
| BHAR (0) |  | 0.54\% | 0.15\% | 0.42\% | -0.28\% | 0.65\% | 0.67\% | 0.60\% | 0.55\% | 0.81\% | 0.63\% | 0.62\% | 0.34\% | $\mathbf{0 . 8 1 \%}$ | 0.83\% | 0.54\% | 0.27\% |
|  |  | 2.5944 | 0.5717 | 1.7653 | -0.8782 | 3.2704 | 3.4980 | 2.9506 | 2.3517 | 3.9163 | 2.4141 | 2.4566 | 1.2952 | 4.1297 | 4.1538 | 2.0529 | 1.5399 |
| BHAR (1) |  | 0.67\% | 0.62\% | 0.70\% | 0.03\% | 0.58\% | 0.89\% | 0.53\% | 0.54\% | 0.79\% | 0.43\% | 0.41\% | 0.15\% | 0.71\% | 0.75\% | 0.40\% | 0.28\% |
|  |  | 3.5355 | 2.9582 | 3.1404 | 0.0870 | 3.0788 | 3.8485 | 2.6016 | 2.0614 | 3.9631 | 1.6969 | 1.5729 | 0.5592 | 3.7133 | 3.8541 | 1.5307 | 1.6895 |



| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.34\% | 0.37\% | 0.38\% | 0.33\% | 0.52\% | 0.50\% | 0.46\% | 0.37\% | 0.55\% | 0.53\% | 0.47\% | 0.37\% | 0.57\% | 0.50\% | 0.44\% | 0.34\% |
|  |  | 2.0914 | 2.7577 | 3.4106 | 3.2742 | 2.8851 | 3.2082 | 3.2430 | 2.7408 | 3.2053 | 3.3519 | 3.1969 | 2.7124 | 3.2228 | 3.0290 | 2.8601 | 2.3722 |
| CAR (1) |  | 0.35\% | 0.36\% | 0.34\% | 0.27\% | 0.55\% | 0.52\% | 0.42\% | 0.33\% | 0.60\% | 0.52\% | 0.44\% | 0.32\% | 0.56\% | 0.48\% | 0.37\% | 0.30\% |
|  |  | 2.2756 | 2.8991 | 3.1592 | 2.7564 | 3.3455 | 3.5648 | 3.1489 | 2.5945 | 3.7697 | 3.4467 | 3.0913 | 2.4317 | 3.2816 | 2.9945 | 2.5053 | 2.1212 |
| BHAR (0) |  | 0.24\% | 0.34\% | 0.31\% | 0.34\% | 0.48\% | 0.41\% | 0.29\% | 0.31\% | 0.50\% | 0.48\% | 0.58\% | 0.19\% | 0.55\% | 0.48\% | 0.55\% | 0.32\% |
|  |  | 1.2718 | 1.6700 | 1.9154 | 2.2662 | 2.4766 | 2.3603 | 1.3444 | 1.7861 | 2.8211 | 2.6699 | 3.4135 | 1.0335 | 3.0772 | 2.8399 | 3.3860 | 2.0227 |
| BHAR (1) |  | 0.28\% | 0.33\% | 0.38\% | 0.37\% | 0.49\% | 0.42\% | 0.48\% | 0.24\% | 0.54\% | 0.51\% | 0.57\% | 0.17\% | 0.56\% | 0.51\% | 0.47\% | 0.34\% |
|  |  | 1.5181 | 1.6829 | 2.2299 | 2.6113 | 2.6150 | 2.4032 | 2.6695 | 1.4518 | 3.1478 | 3.0799 | 3.4432 | 1.0061 | 3.1949 | 3.0116 | 2.8508 | 2.1287 |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.05\% | -0.13\% | -0.08\% | -0.01\% | -0.25\% | -0.20\% | -0.08\% | -0.08\% | -0.19\% | -0.10\% | -0.10\% | -0.13\% | -0.07\% | -0.13\% | -0.15\% | -0.17\% |
|  |  | -0.3239 | -1.0137 | -0.8026 | -0.1155 | -1.4946 | -1.3703 | -0.6413 | -0.6847 | -1.1391 | -0.6530 | -0.6922 | -0.9918 | -0.4037 | -0.7969 | -1.0238 | -1.2884 |
| CAR (1) |  | -0.03\% | -0.10\% | -0.03\% | -0.01\% | -0.18\% | -0.10\% | -0.03\% | -0.08\% | -0.03\% | -0.03\% | -0.07\% | -0.13\% | -0.02\% | -0.13\% | -0.15\% | -0.18\% |
|  |  | $-0.2023$ | -0.8588 | -0.2605 | -0.1080 | -1.1321 | -0.7231 | -0.2242 | -0.7369 | -0.2109 | -0.1955 | -0.4897 | -1.0437 | -0.1448 | -0.8067 | -1.0748 | -1.3572 |
| BHAR (0) |  | -0.13\% | 0.07\% | -0.10\% | 0.09\% | -0.20\% | -0.18\% | -0.11\% | 0.09\% | -0.13\% | -0.07\% | 0.02\% | -0.01\% | -0.08\% | -0.10\% | -0.15\% | -0.13\% |
|  |  | -0.8090 | 0.4290 | -0.6250 | 0.6492 | -1.1760 | -1.0604 | -0.6702 | 0.6702 | -0.7844 | -0.4424 | 0.1753 | -0.0438 | -0.4688 | -0.5823 | -0.9478 | -0.8644 |
| BHAR (1) |  | $-\mathbf{0 . 1 0 \%}$ | $0.08 \%$ | -0.12\% | 0.11\% | -0.22\% | -0.30\% | -0.09\% | 0.02\% | -0.08\% | 0.00\% | -0.04\% | -0.06\% | -0.08\% | -0.21\% | -0.26\% | -0.19\% |
|  |  | $-0.6493$ | $0.5201$ | $-0.7291$ | 0.8310 | $-1.2944$ | $-1.7930$ | $-0.5389$ | 0.1731 | $-0.5081$ | 0.0244 | -0.2705 | -0.4002 | -0.4538 | -1.2876 | -1.6694 | -1.2315 |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.45\% | 0.30\% | 0.32\% | 0.36\% | 0.50\% | 0.44\% | 0.49\% | 0.44\% | 0.65\% | 0.63\% | 0.57\% | 0.49\% | 0.69\% | 0.61\% | 0.52\% | 0.47\% |
|  |  | 3.3956 | 2.7705 | 3.3867 | 4.1630 | 3.6696 | 3.4465 | 4.1442 | 4.1568 | 4.1354 | 4.3020 | 4.1416 | 3.8053 | 4.3526 | 3.9166 | 3.4712 | 3.3157 |
| CAR (1) |  | 0.31\% | 0.28\% | 0.32\% | 0.30\% | 0.47\% | 0.46\% | 0.49\% | 0.41\% | 0.65\% | 0.62\% | 0.53\% | 0.45\% | 0.65\% | 0.57\% | 0.48\% | 0.44\% |
|  |  | 2.5929 | 2.6766 | 3.3754 | 3.5859 | 3.5127 | 3.6533 | 4.1613 | 3.8700 | 4.2368 | 4.2281 | 3.8955 | 3.5861 | 4.0708 | 3.7400 | 3.2340 | 3.1315 |
| BHAR (0) |  | 0.44\% | 0.26\% | 0.20\% | 0.19\% | 0.57\% | 0.39\% | 0.43\% | 0.59\% | 0.64\% | 0.55\% | 0.56\% | 0.54\% | 0.64\% | 0.59\% | 0.54\% | 0.42\% |
|  |  | 2.7765 | 1.5834 | 1.5007 | 1.2850 | 3.7182 | 2.6142 | 2.8076 | 4.9384 | 3.9157 | 3.2670 | 3.4311 | 3.3669 | 3.9372 | 3.6999 | 3.4310 | 2.4513 |
| BHAR (1) |  | 0.21\% | 0.08\% | 0.24\% | 0.12\% | 0.43\% | 0.42\% | 0.45\% | 0.51\% | 0.59\% | 0.52\% | 0.49\% | 0.43\% | 0.62\% | 0.60\% | 0.52\% | 0.41\% |
|  |  | 1.3672 | 0.5217 | 1.7833 | 0.7327 | 2.8506 | 2.8002 | 2.9841 | 4.3864 | 3.5395 | 3.1308 | 3.0170 | 2.6808 | 3.8650 | 3.6808 | 3.5206 | 2.4496 |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.15\% | 0.93\% | 0.62\% | 0.53\% | 0.90\% | 0.74\% | 0.55\% | 0.35\% | 0.81\% | 0.69\% | 0.48\% | 0.24\% | 0.85\% | 0.64\% | 0.39\% | 0.16\% |
|  |  | 3.6967 | 4.5889 | 4.1148 | 4.6702 | 6.8400 | 6.0499 | 4.6961 | 2.7525 | 5.7368 | 5.5430 | 3.7293 | 1.7337 | 6.1491 | 4.9395 | 2.9489 | 1.1140 |
| CAR (1) |  | 1.13\% | 0.83\% | 0.57\% | 0.47\% | 0.82\% | 0.64\% | 0.47\% | 0.25\% | 0.74\% | 0.60\% | 0.39\% | 0.15\% | 0.77\% | 0.54\% | 0.30\% | 0.07\% |
|  |  | 3.7527 | 4.2988 | 3.9446 | 4.3129 | 6.1551 | 5.3395 | 3.9634 | 2.0144 | 5.4620 | 4.9583 | 3.0811 | 1.0961 | 5.7378 | 4.2631 | 2.2498 | 0.5134 |
| BHAR (0) |  | 1.25\% | 0.70\% | 0.79\% | 0.29\% | 0.90\% | 0.88\% | 0.57\% | 0.26\% | 0.83\% | 0.59\% | 0.59\% | -0.05\% | 0.82\% | 0.79\% | 0.30\% | 0.42\% |
|  |  | 3.2633 | 4.2125 | 1.8994 | 1.7543 | 6.1602 | 6.0775 | 3.6788 | 1.1707 | 5.1339 | 3.5745 | 4.1491 | -0.1922 | 5.6387 | 5.8160 | 1.5510 | 3.1040 |
| BHAR (1) |  | 1.19\% | 0.60\% | 0.47\% | 0.18\% | 0.96\% | 0.75\% | 0.53\% | 0.07\% | 0.78\% | 0.50\% | 0.41\% | -0.15\% | 0.82\% | 0.68\% | 0.11\% | 0.40\% |
|  |  | 3.6461 | 3.7717 | 1.3067 | 1.0114 | 6.1287 | 4.6821 | 3.5351 | 0.2550 | 4.9874 | 2.8767 | 2.1877 | -0.6290 | 5.4783 | 4.9753 | 0.5205 | 2.9317 |


| IVOL $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| NORWAY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.30\% | 0.28\% | 0.29\% | 0.26\% | 0.42\% | 0.39\% | 0.40\% | 0.29\% | 0.51\% | 0.47\% | 0.40\% | 0.25\% | 0.57\% | 0.39\% | 0.30\% | 0.16\% |
|  | 1.7632 | 2.1676 | 2.4203 | 2.4323 | 2.4646 | 2.4926 | 2.7018 | 2.1674 | 2.7474 | 2.6661 | 2.3690 | 1.5958 | 2.9611 | 2.1056 | 1.7194 | 0.9626 |
| CAR (1) | 0.27\% | 0.28\% | 0.30\% | 0.22\% | 0.43\% | 0.43\% | 0.39\% | 0.23\% | 0.53\% | 0.46\% | 0.35\% | 0.17\% | 0.51\% | 0.33\% | 0.21\% | 0.09\% |
|  | 1.7645 | 2.1275 | 2.3973 | 2.0607 | 2.5499 | 2.7073 | 2.6126 | 1.7223 | 2.8762 | 2.5569 | 2.1395 | 1.1300 | 2.5390 | 1.7929 | 1.2534 | 0.5404 |
| BHAR (0) | 0.44\% | 0.35\% | 0.43\% | 0.45\% | 0.37\% | 0.24\% | 0.20\% | 0.51\% | 0.59\% | 0.46\% | 0.45\% | $\mathbf{0 . 2 1 \%}$ | 0.63\% | 0.37\% | 0.25\% | 0.11\% |
|  | 2.0258 | 1.3598 | 2.0063 | 2.6364 | 1.9615 | 1.2373 | 1.0238 | 2.9622 | 2.9555 | 2.2115 | 2.0758 | 0.9556 | 2.9810 | 1.7670 | 1.2430 | 0.4965 |
| BHAR (1) | 0.28\% | 0.26\% | 0.26\% | 0.36\% | 0.36\% | 0.31\% | 0.18\% | 0.35\% | 0.51\% | 0.41\% | 0.46\% | $\mathbf{0 . 1 0 \%}$ | 0.53\% | 0.39\% | 0.19\% | 0.12\% |
|  | 1.7050 | 1.5700 | 1.7267 | 2.2120 | 1.9618 | 1.5620 | 0.9610 | 1.9912 | 2.7392 | 2.1680 | 2.1999 | 0.5167 | 2.6006 | 1.9307 | 1.0159 | 0.5889 |
| PORTUGAL |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.52\% | 0.48\% | 0.42\% | 0.23\% | 0.89\% | 0.53\% | 0.42\% | 0.26\% | 0.34\% | 0.21\% | 0.11\% | -0.06\% | 0.42\% | 0.23\% | -0.03\% | -0.17\% |
|  | 1.6760 | 1.6002 | 1.6055 | 0.8642 | 2.9200 | 1.5357 | 1.3116 | 0.9024 | 1.1005 | 0.6603 | 0.3728 | -0.2274 | 1.4073 | 0.6895 | -0.0803 | -0.5153 |
| CAR (1) | 0.31\% | 0.51\% | 0.33\% | 0.22\% | 0.80\% | 0.55\% | 0.48\% | 0.27\% | 0.48\% | 0.22\% | 0.08\% | -0.11\% | 0.34\% | 0.15\% | -0.11\% | -0.22\% |
|  | 0.9788 | 1.6858 | 1.2089 | 0.8424 | 2.6036 | 1.6154 | 1.4714 | 0.9524 | 1.4597 | 0.6797 | 0.2684 | -0.3772 | 1.1099 | 0.4684 | -0.3215 | -0.6812 |
| BHAR (0) | 0.42\% | 0.55\% | 0.37\% | 0.52\% | 1.01\% | 0.66\% | 0.34\% | 0.36\% | 0.36\% | 0.16\% | 0.68\% | 0.50\% | 0.43\% | 0.22\% | 0.01\% | -0.11\% |
|  | 0.8710 | 1.1503 | 0.6435 | 1.1155 | 2.9007 | 1.6505 | 0.5257 | 0.8579 | 1.1906 | 0.3968 | 1.4959 | 1.0983 | 1.3235 | 0.5480 | 0.0338 | -0.2069 |
| BHAR (1) | 0.09\% | 0.69\% | 0.84\% | 0.08\% | 0.67\% | 0.82\% | 0.31\% | 0.24\% | 0.41\% | 0.18\% | 0.48\% | 0.08\% | 0.05\% | 0.25\% | -0.20\% | -0.24\% |
|  | 0.1967 | 1.4131 | 1.6158 | 0.1733 | 1.4326 | 1.8023 | 0.5174 | 0.5659 | 0.8561 | 0.3944 | 0.8735 | 0.1645 | 0.1354 | 0.5929 | -0.4348 | -0.4589 |
| SINGAPORE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.38\% | 0.40\% | 0.29\% | 0.14\% | 0.41\% | 0.35\% | 0.22\% | 0.11\% | 0.39\% | 0.24\% | 0.11\% | 0.00\% | 0.29\% | 0.18\% | 0.05\% | -0.03\% |
|  | 1.6740 | 2.2887 | 1.8205 | 0.9002 | 1.9190 | 1.7699 | 1.1843 | 0.6073 | 1.6666 | 1.1175 | 0.5334 | -0.0140 | 1.2799 | 0.8488 | 0.2470 | -0.1511 |
| CAR (1) | 0.28\% | 0.31\% | 0.19\% | 0.06\% | 0.40\% | 0.31\% | 0.15\% | 0.05\% | 0.32\% | 0.18\% | 0.03\% | -0.06\% | 0.28\% | 0.12\% | -0.02\% | -0.07\% |
|  | 1.2275 | 1.8050 | 1.1494 | 0.3680 | 1.9149 | 1.5425 | 0.8007 | 0.2581 | 1.3740 | 0.8623 | 0.1626 | -0.3315 | 1.2792 | 0.5703 | -0.0821 | -0.3556 |
| BHAR (0) | 0.37\% | 0.25\% | 0.12\% | 0.23\% | 0.41\% | 0.38\% | 0.09\% | 0.16\% | 0.35\% | 0.24\% | 0.13\% | -0.01\% | 0.31\% | 0.20\% | 0.07\% | -0.09\% |
|  | 1.3466 | 0.9086 | 0.5347 | 0.9397 | 1.5396 | 1.5504 | 0.3390 | 0.6925 | 1.4305 | 1.0361 | 0.6058 | -0.0587 | 1.2454 | 0.8476 | 0.2982 | -0.4351 |
| BHAR (1) | 0.13\% | -0.06\% | -0.05\% | 0.06\% | 0.46\% | 0.50\% | 0.03\% | 0.34\% | 0.42\% | 0.15\% | 0.15\% | 0.02\% | 0.27\% | 0.26\% | -0.09\% | 0.05\% |
|  | 0.4983 | -0.2642 | -0.2090 | 0.3795 | 2.0566 | 2.3275 | 0.1227 | 1.9124 | 1.7304 | 0.7175 | 0.7386 | 0.0708 | 1.1979 | 1.1274 | -0.4190 | 0.2093 |
| SPAIN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) | 0.55\% | 0.40\% | 0.53\% | 0.47\% | 0.59\% | 0.59\% | 0.54\% | 0.42\% | 0.73\% | 0.59\% | 0.50\% | 0.42\% | 0.64\% | 0.58\% | 0.52\% | 0.45\% |
|  | 3.0678 | 2.3795 | 3.8530 | 3.5900 | 3.1015 | 3.4294 | 3.1603 | 2.7708 | 3.5983 | 2.8170 | 2.6140 | 2.4631 | 3.1451 | 3.0092 | 2.8453 | 2.6625 |
| CAR (1) | 0.41\% | 0.35\% | 0.46\% | 0.38\% | 0.53\% | 0.59\% | 0.52\% | 0.38\% | 0.70\% | 0.53\% | 0.43\% | 0.36\% | 0.61\% | 0.56\% | 0.49\% | 0.41\% |
|  | 2.5041 | 2.4368 | 3.5556 | 3.1871 | 2.9171 | 3.3895 | 3.1537 | 2.6089 | 3.5276 | 2.6494 | 2.3675 | 2.1936 | 3.1625 | 2.9836 | 2.7323 | 2.4798 |
| BHAR (0) | 0.37\% | 0.22\% | 0.40\% | 0.31\% | 0.50\% | 0.46\% | 0.42\% | 0.40\% | 0.66\% | 0.62\% | 0.60\% | 0.38\% | 0.54\% | 0.49\% | 0.62\% | 0.27\% |
|  | 1.5147 | 0.8854 | 1.4733 | 1.2475 | 2.0448 | 1.9121 | 1.5363 | 1.7436 | 2.7327 | 2.5079 | 2.9144 | 1.7200 | 2.2161 | 2.0888 | 3.0942 | 1.1843 |
| BHAR (1) | 0.28\% | 0.02\% | 0.26\% | 0.03\% | 0.41\% | 0.48\% | 0.24\% | 0.29\% | 0.68\% | 0.39\% | 0.55\% | 0.16\% | 0.55\% | 0.47\% | 0.61\% | 0.26\% |
|  | 1.3861 | 0.0823 | 1.0566 | 0.1289 | 1.9946 | 2.3339 | 1.1372 | 1.3053 | 3.3176 | 1.6307 | 2.7628 | 0.7339 | 2.6779 | 2.4312 | 3.1193 | 1.3157 |


| IVOL | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=3$ |  | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.67\% | 0.45\% | 0.41\% | 0.42\% | 0.60\% | 0.47\% | 0.45\% | 0.35\% | 0.65\% | 0.52\% | 0.37\% | 0.28\% | 0.65\% | 0.39\% | 0.29\% | 0.27\% |
|  |  | 3.1368 | 2.4347 | 2.5313 | 2.8102 | 2.4689 | 1.8897 | 1.8715 | 1.4754 | 2.6047 | 2.0780 | 1.4522 | 1.1221 | 2.6659 | 1.5076 | 1.1125 | 1.2207 |
| CAR (1) |  | 0.53\% | 0.39\% | 0.43\% | 0.39\% | 0.58\% | 0.45\% | 0.40\% | 0.26\% | 0.64\% | 0.45\% | 0.28\% | 0.24\% | 0.53\% | 0.28\% | 0.23\% | 0.22\% |
|  |  | 2.7307 | 1.8738 | 2.5065 | 2.3855 | 2.4890 | 1.8660 | 1.7046 | 1.1536 | 2.7410 | 1.8516 | 1.1571 | 1.0531 | 2.2442 | 1.1186 | 1.0057 | 1.0733 |
| BHAR (0) |  | 0.79\% | 0.20\% | 0.69\% | -0.12\% | 0.51\% | 0.46\% | 0.35\% | $\mathbf{0 . 3 1 \%}$ | 0.58\% | 0.30\% | 0.47\% | 0.14\% | 0.66\% | 0.63\% | 0.43\% | 0.30\% |
|  |  | 2.6040 | 0.6718 | 1.9887 | -0.4413 | 1.7326 | 1.5288 | 1.0703 | 1.0638 | 1.8820 | 0.9942 | 1.4033 | 0.4231 | 2.1523 | 2.0319 | 1.3971 | 0.9188 |
| BHAR (1) |  | 0.56\% | 0.41\% | 0.94\% | 0.17\% | 0.65\% | 0.48\% | 0.35\% | 0.15\% | 0.71\% | 0.35\% | 0.50\% | 0.07\% | 0.71\% | 0.65\% | 0.29\% | 0.31\% |
|  |  | 2.3562 | 1.2989 | 3.0971 | 0.5822 | 2.7931 | 2.1002 | 1.0647 | 0.5218 | 3.0067 | 1.1847 | 2.0535 | 0.2117 | 3.0898 | 2.9018 | 0.9671 | 1.7338 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.50\% | 0.37\% | 0.31\% | 0.33\% | 0.54\% | 0.44\% | 0.43\% | 0.40\% | 0.52\% | 0.52\% | 0.48\% | 0.38\% | 0.64\% | 0.52\% | 0.42\% | 0.33\% |
|  |  | 3.6661 | 3.0739 | 2.8642 | 3.5400 | 3.4243 | 2.9524 | 3.1952 | 3.2788 | 3.1154 | 3.1989 | 3.2457 | 2.7885 | 3.8266 | 3.2045 | 2.7050 | 2.1908 |
| CAR (1) |  | 0.38\% | 0.31\% | 0.30\% | 0.30\% | 0.48\% | 0.42\% | 0.39\% | 0.33\% | 0.52\% | 0.48\% | 0.43\% | 0.31\% | 0.59\% | 0.45\% | 0.36\% | 0.26\% |
|  |  | 2.9920 | 2.6666 | 3.0153 | 3.4213 | 3.0095 | 2.8275 | 2.9361 | 2.7810 | 3.1070 | 3.0387 | 2.9913 | 2.2707 | 3.5250 | 2.8193 | 2.3135 | 1.7515 |
| BHAR (0) |  | 0.44\% | 0.33\% | 0.35\% | 0.33\% | 0.52\% | 0.45\% | 0.33\% | 0.59\% | 0.55\% | 0.45\% | 0.47\% | 0.49\% | 0.65\% | 0.57\% | 0.44\% | 0.28\% |
|  |  | 2.6278 | 1.8208 | 2.1884 | 2.1858 | 3.1827 | 2.7743 | 2.2145 | 4.2283 | 3.1205 | 2.3330 | 3.0576 | 2.8334 | 3.7680 | 3.3288 | 2.6097 | 1.6231 |
| BHAR (1) |  | 0.37\% | 0.19\% | 0.40\% | 0.31\% | 0.43\% | 0.34\% | 0.22\% | 0.52\% | 0.43\% | 0.38\% | 0.39\% | 0.30\% | 0.51\% | 0.48\% | 0.36\% | 0.26\% |
|  |  | 2.4232 | 1.1206 | 2.5052 | 1.9873 | 2.5813 | 1.8731 | 1.5300 | 3.6555 | 2.2999 | 1.9924 | 2.5001 | 1.6706 | 3.0189 | 2.8137 | 2.2034 | 1.5005 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.59\% | 0.57\% | 0.45\% | 0.47\% | 0.83\% | 0.66\% | 0.61\% | 0.55\% | 0.87\% | 0.70\% | 0.53\% | 0.50\% | 0.83\% | 0.60\% | 0.51\% | 0.47\% |
|  |  | 5.3461 | 6.3437 | 5.4353 | 6.0152 | 6.3891 | 5.4808 | 5.4577 | 4.9853 | 6.1402 | 5.0820 | 3.8417 | 4.2456 | 5.7361 | 3.7856 | 3.8598 | 3.9431 |
| CAR (1) |  | 0.43\% | 0.43\% | 0.43\% | 0.43\% | 0.70\% | 0.59\% | 0.58\% | 0.49\% | 0.71\% | 0.59\% | 0.47\% | 0.42\% | 0.66\% | 0.46\% | 0.44\% | 0.40\% |
|  |  | 3.7305 | 4.6321 | 5.0775 | 5.6208 | 5.7041 | 4.7255 | 5.0980 | 4.4614 | 4.9656 | 4.1249 | 3.3990 | 3.4271 | 4.5624 | 2.8491 | 3.3042 | 3.4333 |
| BHAR (0) |  | 0.42\% | 0.67\% | 0.48\% | 0.43\% | 0.70\% | 0.53\% | 0.48\% | 0.85\% | 0.78\% | 0.71\% | 0.71\% | 0.54\% | 0.80\% | 0.53\% | 0.60\% | 0.51\% |
|  |  | 2.8626 | 4.2963 | 2.5271 | 2.8148 | 4.9423 | 3.2268 | 2.7787 | 5.7498 | 5.2028 | 4.1029 | 3.5917 | 3.1822 | 5.7943 | 2.1942 | 4.4915 | 2.7754 |
| BHAR (1) |  | 0.56\% | 0.37\% | 0.63\% | 0.28\% | 0.65\% | 0.57\% | 0.46\% | 0.74\% | 0.75\% | 0.41\% | 0.68\% | 0.40\% | 0.47\% | 0.47\% | 0.55\% | 0.40\% |
|  |  | 3.0621 | 2.4730 | 3.2188 | 1.9119 | 4.0118 | 3.2590 | 2.7420 | 6.0500 | 3.9651 | 1.5770 | 3.3857 | 2.3701 | 1.9880 | 1.9329 | 3.5451 | 2.2218 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.24\% | 0.37\% | 0.33\% | 0.29\% | 0.42\% | 0.34\% | 0.32\% | 0.24\% | 0.37\% | 0.30\% | 0.20\% | 0.08\% | 0.17\% | 0.04\% | -0.04\% | -0.17\% |
|  |  | 0.9223 | 1.6309 | 1.5950 | 1.5986 | 1.3819 | 1.2063 | 1.2892 | 1.0623 | 1.2050 | 1.0567 | 0.7968 | 0.3462 | 0.5976 | 0.1668 | -0.1805 | -0.8557 |
| CAR (1) |  | 0.39\% | 0.36\% | 0.34\% | 0.27\% | 0.34\% | 0.28\% | 0.25\% | 0.15\% | 0.39\% | 0.22\% | 0.13\% | -0.03\% | 0.10\% | -0.01\% | -0.14\% | -0.23\% |
|  |  | 1.5083 | 1.6748 | 1.7519 | 1.5905 | 1.0498 | 1.0146 | 1.0154 | 0.6688 | 1.3004 | 0.8105 | 0.5511 | -0.1240 | 0.3749 | -0.0511 | -0.6489 | -1.1903 |
| BHAR (0) |  | 0.00\% | 0.61\% | -0.01\% | 0.24\% | 0.37\% | 0.41\% | 0.04\% | 0.26\% | 0.37\% | 0.24\% | 0.02\% | -0.13\% | 0.27\% | 0.38\% | 0.05\% | 0.01\% |
|  |  | -0.0164 | 1.9462 | -0.0429 | 0.8428 | 1.0191 | 1.1088 | 0.0973 | 1.0751 | 1.0554 | 0.7656 | 0.0512 | -0.4071 | 0.8341 | 1.2391 | 0.1613 | 0.0303 |
| BHAR (1) |  | -0.07\% | 0.42\% | -0.18\% | 0.24\% | 0.43\% | 0.39\% | -0.13\% | -0.02\% | 0.15\% | 0.05\% | -0.06\% | -0.33\% | -0.10\% | 0.07\% | -0.17\% | -0.26\% |
|  |  | -0.2400 | 1.3154 | -0.6143 | 0.9502 | 1.2869 | 1.2479 | -0.4797 | -0.0694 | 0.4660 | 0.1624 | -0.2114 | -1.0485 | -0.3196 | 0.2407 | -0.5388 | -0.8098 |

## Appendix 11. Time-series momentum strategy-"Out of sample"







| EW | $\mathrm{J}=$ |  | 3 |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=3$ |  | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.98\% | 1.21\% | 0.94\% | 0.91\% | 1.47\% | 1.37\% | 1.14\% | 0.94\% | 1.58\% | 1.47\% | 1.10\% | 0.83\% | 1.57\% | 1.25\% | 0.94\% | 0.70\% |
|  |  | 2.2784 | 3.3574 | 3.0951 | 3.5109 | 3.0451 | 3.3349 | 3.1695 | 2.9485 | 3.3763 | 3.5007 | 2.7815 | 2.3353 | 3.2326 | 2.7576 | 2.2383 | 1.7888 |
| CAR (1) |  | 1.53\% | 1.31\% | 1.06\% | 0.90\% | 1.69\% | 1.41\% | 1.09\% | 0.85\% | 1.75\% | 1.37\% | 0.98\% | $\mathbf{0 . 7 1 \%}$ | 1.40\% | 1.05\% | 0.77\% | 0.58\% |
|  |  | 3.7184 | 4.0144 | 3.8754 | 3.7053 | 3.7623 | 3.6436 | 3.1954 | 2.7565 | 3.9880 | 3.3865 | 2.5206 | 2.0300 | 3.0048 | 2.3890 | 1.8774 | 1.5303 |
| BHAR (0) |  | 1.11\% | 0.99\% | 0.89\% | 0.65\% | 1.63\% | 1.67\% | 1.09\% | 0.90\% | 1.65\% | 1.38\% | 1.13\% | 0.58\% | 1.49\% | 1.32\% | 0.95\% | 0.85\% |
|  |  | 2.5215 | 2.5242 | 2.3414 | 1.4799 | 3.1522 | 3.9086 | 2.1589 | 2.2630 | 3.4641 | 2.8242 | 2.4328 | 1.2679 | 2.9771 | 2.9737 | 2.1677 | 2.2805 |
| BHAR (1) |  | 1.49\% | 1.11\% | 0.95\% | 0.70\% | 1.84\% | 1.64\% | 1.04\% | 0.87\% | 1.71\% | 1.36\% | 1.15\% | 0.43\% | 1.41\% | 1.29\% | 0.75\% | 0.86\% |
|  |  | 3.4800 | 2.9314 | 2.8240 | 1.6683 | 3.8411 | 4.3166 | 2.1596 | 2.2762 | 3.7948 | 3.0116 | 2.5615 | 0.9349 | 2.9113 | 2.9848 | 1.6988 | 2.1581 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.99\% | 0.96\% | 0.85\% | 0.84\% | 1.37\% | 1.24\% | 1.15\% | 0.97\% | 1.35\% | 1.27\% | 1.06\% | 0.82\% | 1.44\% | 1.16\% | 0.89\% | 0.67\% |
|  |  | 4.1098 | 4.3937 | 4.0072 | 4.4884 | 4.7463 | 4.2777 | 4.2984 | 4.1141 | 4.0941 | 4.0044 | 3.5895 | 3.1135 | 4.2248 | 3.5870 | 2.9580 | 2.4318 |
| CAR (1) |  | 1.05\% | 0.96\% | 0.85\% | 0.79\% | 1.40\% | 1.21\% | 1.09\% | 0.85\% | 1.33\% | 1.18\% | 0.94\% | 0.68\% | 1.34\% | 1.02\% | 0.74\% | 0.53\% |
|  |  | 4.5476 | 4.3346 | 4.0831 | 4.3898 | 4.7299 | 4.1222 | 4.1612 | 3.7437 | 4.0061 | 3.7509 | 3.2470 | 2.6512 | 4.0676 | 3.1951 | 2.5071 | 1.9700 |
| BHAR (0) |  | 0.83\% | 0.84\% | 0.78\% | 0.84\% | 1.51\% | 1.48\% | 1.08\% | 1.36\% | 1.32\% | 1.08\% | 1.25\% | 0.93\% | 1.45\% | 1.44\% | 0.95\% | 0.86\% |
|  |  | 2.9153 | 2.6614 | 2.5384 | 2.3404 | 4.6960 | 4.4165 | 3.0824 | 4.3986 | 3.7573 | 2.8540 | 4.0460 | 2.9679 | 4.1561 | 4.2664 | 2.6916 | 2.7155 |
| BHAR (1) |  | 0.94\% | 0.71\% | 0.78\% | 0.78\% | 1.39\% | 1.37\% | 0.99\% | 1.20\% | 1.18\% | 0.94\% | 1.06\% | 0.73\% | 1.26\% | 1.26\% | 0.69\% | 0.75\% |
|  |  | 3.5281 | 2.3336 | 2.5705 | 2.2508 | 4.1387 | 3.9683 | 2.9905 | 4.0397 | 3.4362 | 2.6167 | 3.4758 | 2.1703 | 3.8405 | 3.8904 | 2.1231 | 2.4248 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.33\% | 1.26\% | 1.07\% | 1.05\% | 1.75\% | 1.49\% | 1.37\% | 1.16\% | 1.72\% | 1.57\% | 1.31\% | 1.02\% | 1.85\% | 1.50\% | 1.15\% | 0.85\% |
|  |  | 4.6483 | 5.0210 | 5.1210 | 5.8403 | 5.1364 | 5.0239 | 5.4367 | 5.1503 | 5.0110 | 5.1743 | 4.6640 | 3.9375 | 5.3343 | 4.5643 | 3.7512 | 2.9773 |
| CAR (1) |  | 1.42\% | 1.23\% | 1.07\% | 0.98\% | 1.63\% | 1.39\% | 1.24\% | 1.01\% | 1.63\% | 1.42\% | 1.13\% | 0.83\% | 1.61\% | 1.27\% | 0.92\% | 0.67\% |
|  |  | 5.1101 | 5.1959 | 5.5134 | 5.6885 | 5.0635 | 5.0902 | 5.2226 | 4.6174 | 5.0552 | 4.8336 | 4.0965 | 3.2426 | 4.8351 | 3.9581 | 3.0878 | 2.3817 |
| BHAR (0) |  | 1.17\% | 1.08\% | 1.04\% | 0.77\% | 1.75\% | 1.50\% | 1.05\% | 1.44\% | 1.70\% | 1.49\% | 1.30\% | 1.02\% | 1.72\% | 1.53\% | 1.16\% | 0.75\% |
|  |  | 3.4454 | 3.4370 | 3.3904 | 2.3690 | 4.9345 | 4.5759 | 3.1648 | 6.0324 | 4.6373 | 4.3012 | 4.6246 | 3.2989 | 4.7615 | 4.5150 | 3.3073 | 2.3485 |
| BHAR (1) |  | 1.36\% | 1.03\% | 0.89\% | 0.69\% | 1.60\% | 1.36\% | 1.00\% | 1.21\% | 1.63\% | 1.29\% | 1.07\% | $\mathbf{0 . 8 0 \%}$ | 1.54\% | 1.22\% | 0.80\% | 0.45\% |
|  |  | 4.4256 | 3.5156 | 3.2200 | 2.1432 | 5.0927 | 4.7365 | 3.2545 | 5.3880 | 4.8663 | 4.0004 | 3.8057 | 2.5910 | 4.5212 | 3.9083 | 2.3441 | 1.4942 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.03\% | 0.16\% | 0.16\% | 0.09\% | 0.26\% | 0.30\% | 0.21\% | -0.01\% | 0.37\% | 0.27\% | 0.05\% | -0.18\% | 0.18\% | -0.01\% | -0.23\% | -0.41\% |
|  |  | 0.1129 | 0.6793 | 0.8264 | 0.4960 | 0.8007 | 1.0532 | 0.8094 | -0.0313 | 1.0775 | 0.8574 | 0.1583 | -0.6436 | 0.5071 | -0.0364 | -0.6972 | -1.3862 |
| CAR (1) |  | 0.18\% | 0.27\% | 0.23\% | 0.04\% | 0.41\% | 0.38\% | 0.17\% | -0.09\% | 0.44\% | 0.21\% | -0.05\% | -0.30\% | 0.08\% | -0.12\% | -0.35\% | -0.51\% |
|  |  | 0.7391 | 1.2368 | 1.2383 | 0.2216 | 1.3735 | 1.4194 | 0.6752 | -0.4100 | 1.3514 | 0.6848 | -0.1562 | -1.1101 | 0.2405 | -0.3703 | -1.1267 | -1.7940 |
| BHAR (0) |  | -0.08\% | 0.23\% | 0.07\% | 0.13\% | 0.23\% | 0.37\% | -0.23\% | 0.34\% | 0.42\% | 0.19\% | 0.23\% | -0.13\% | 0.21\% | 0.16\% | -0.16\% | -0.32\% |
|  |  | -0.2776 | 0.8969 | 0.2295 | 0.4590 | 0.6256 | 1.1064 | -0.6234 | 1.4146 | 1.1192 | 0.5325 | 0.8498 | -0.4349 | 0.5555 | 0.4451 | -0.4551 | -0.9350 |
| BHAR (1) |  | 0.22\% | 0.18\% | 0.05\% | 0.02\% | 0.34\% | 0.36\% | -0.30\% | 0.02\% | 0.40\% | 0.02\% | -0.04\% | -0.34\% | -0.02\% | -0.13\% | -0.39\% | -0.50\% |
|  |  | 0.8764 | 0.6423 | 0.1605 | 0.0563 | 1.0987 | 1.2731 | -0.8472 | 0.0795 | 1.1686 | 0.0471 | -0.1229 | -1.1168 | -0.0584 | -0.3667 | -1.1593 | -1.4484 |

Panel B. The time-series momentum strategy using market-weighted return




| MW | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| ITALY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.49\% | 0.83\% | 0.66\% | 0.75\% | 1.10\% | 1.09\% | 1.06\% | 1.05\% | 1.05\% | 1.31\% | 1.25\% | 1.18\% | 1.54\% | 1.52\% | 1.35\% | 1.19\% |
|  |  | 1.1959 | 2.1951 | 2.2621 | 2.9020 | 2.1067 | 2.4546 | 2.7422 | 2.9135 | 2.0553 | 2.7418 | 2.8967 | 2.9058 | 2.9074 | 3.0182 | 2.9069 | 2.7442 |
| CAR (1) |  | 0.99\% | 1.03\% | 0.81\% | 0.84\% | 1.20\% | 1.11\% | 1.05\% | 1.02\% | 1.41\% | 1.37\% | 1.24\% | 1.15\% | 1.58\% | 1.46\% | 1.27\% | 1.13\% |
|  |  | 2.3638 | 3.0324 | 2.8625 | 3.4176 | 2.4913 | 2.6306 | 2.7851 | 2.9033 | 2.8136 | 2.9938 | 2.9063 | 2.8938 | 2.9969 | 2.9533 | 2.7770 | 2.6888 |
| BHAR (0) |  | 0.89\% | 0.41\% | 1.21\% | 0.77\% | 1.13\% | 1.08\% | 0.76\% | 1.14\% | 1.07\% | 0.66\% | 1.22\% | 0.46\% | 1.64\% | 1.73\% | 1.58\% | 1.46\% |
|  |  | 1.6704 | 0.7687 | 2.0956 | 1.3541 | 1.9824 | 2.0512 | 1.3816 | 2.1588 | 1.9286 | 1.0747 | 2.4482 | 0.8935 | 3.0030 | 3.3705 | 3.0036 | 3.1095 |
| BHAR (1) |  | 1.04\% | 0.85\% | 1.59\% | 1.08\% | 0.92\% | 0.93\% | 0.66\% | 1.24\% | 0.98\% | 0.84\% | 0.88\% | 0.36\% | 1.66\% | 1.64\% | 1.47\% | 1.35\% |
|  |  | 1.9544 | 1.6617 | 2.8267 | 2.0059 | 1.6352 | 1.7723 | 1.2667 | 2.3308 | 1.6662 | 1.4480 | 1.7859 | 0.7023 | 2.9708 | 3.3264 | 2.6851 | 2.9011 |
| JAPAN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.12\% | -0.17\% | 0.02\% | 0.06\% | -0.28\% | -0.17\% | 0.04\% | -0.01\% | -0.15\% | 0.06\% | 0.05\% | 0.00\% | 0.00\% | -0.11\% | -0.09\% | -0.11\% |
|  |  | -0.3187 | -0.4701 | 0.0542 | 0.2229 | -0.6086 | -0.4048 | 0.1080 | -0.0315 | -0.3054 | 0.1416 | 0.1283 | -0.0034 | -0.0051 | -0.2512 | -0.2215 | -0.3216 |
| CAR (1) |  | 0.02\% | -0.04\% | 0.12\% | 0.07\% | -0.11\% | 0.05\% | 0.15\% | $\mathbf{- 0 . 0 2 \%}$ | 0.19\% | 0.22\% | 0.12\% | 0.02\% | 0.05\% | -0.11\% | -0.06\% | -0.11\% |
|  |  | 0.0528 | -0.1157 | 0.4206 | 0.2992 | -0.2441 | 0.1228 | 0.4480 | -0.0545 | 0.4191 | 0.5156 | 0.3186 | 0.0558 | 0.1117 | -0.2502 | -0.1527 | -0.3212 |
| BHAR (0) |  | -0.03\% | 0.14\% | -0.04\% | 0.34\% | -0.01\% | -0.12\% | 0.04\% | 0.57\% | -0.03\% | 0.14\% | 0.27\% | $\mathbf{0 . 1 9 \%}$ | 0.19\% | 0.19\% | -0.23\% | 0.01\% |
|  |  | -0.0700 | 0.3314 | -0.0949 | 0.8490 | -0.0186 | -0.2482 | 0.0821 | 1.3898 | -0.0536 | 0.3088 | 0.6979 | 0.4775 | 0.3721 | 0.3940 | -0.5263 | 0.0240 |
| BHAR (1) |  |  | $-0.28 \%$ | -0.48\% | 0.27\% | -0.18\% | -0.19\% | 0.02\% | 0.49\% | $-0.09 \%$ | $0.11 \%$ | 0.15\% | -0.08\% | -0.05\% | -0.15\% | $-\mathbf{0 . 4 0 \%}$ | $-0.24 \%$ |
|  |  | $0.0234$ | $-0.6592$ | $-1.0700$ | 0.6849 | $-0.3779$ | $-0.4332$ | $0.0515$ | 1.2418 | $-0.2107$ | $0.2849$ | 0.4013 | -0.2116 | $-0.1113$ | $-0.3233$ | $-0.9747$ | $-0.5657$ |
| NETHERLANDS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.69\% | 0.35\% | 0.54\% | 0.54\% | 0.43\% | 0.46\% | 0.54\% | 0.46\% | 0.47\% | 0.42\% | 0.37\% | 0.24\% | 0.45\% | 0.34\% | 0.38\% | 0.29\% |
|  |  | 1.5687 | 0.9936 | 1.8482 | 2.0691 | 0.8650 | 1.0976 | 1.3719 | 1.2798 | 0.8821 | 0.8272 | 0.7806 | 0.5572 | 0.8129 | 0.6375 | 0.7740 | 0.6490 |
| CAR (1) |  | 0.50\% | 0.30\% | 0.55\% | 0.39\% | 0.37\% | 0.50\% | 0.49\% | 0.34\% | 0.55\% | 0.40\% | 0.33\% | 0.15\% | 0.33\% | 0.25\% | 0.29\% | 0.26\% |
|  |  | 1.1737 | 0.8902 | 1.8881 | 1.5928 | 0.7581 | 1.1531 | 1.2316 | 0.9446 | 0.9967 | 0.7737 | 0.6964 | 0.3513 | 0.5919 | 0.4836 | 0.5900 | 0.6123 |
| BHAR (0) |  | 1.01\% | 0.10\% | 0.20\% | 0.59\% | 0.20\% | 0.25\% | 0.26\% | 1.28\% | 0.32\% | 0.38\% | 0.56\% | 0.36\% | 0.80\% | 0.77\% | 0.59\% | 0.57\% |
|  |  | 1.9635 | 0.2084 | 0.3502 | 1.1563 | 0.3349 | 0.4630 | 0.4159 | 2.4139 | 0.5330 | 0.6467 | 1.0131 | 0.6551 | 1.2371 | 1.1818 | 0.9455 | 0.9337 |
| BHAR (1) |  | 0.77\% | -0.11\% | -0.03\% | 0.71\% | -0.02\% | 0.02\% | 0.26\% | 0.89\% | 0.41\% | 0.28\% | 0.34\% | -0.05\% | 0.36\% | 0.28\% | 0.46\% | 0.27\% |
|  |  | 1.4212 | -0.2101 | -0.0490 | 1.3826 | -0.0268 | 0.0299 | 0.3987 | 1.6992 | 0.6926 | 0.4941 | 0.6289 | -0.0910 | 0.5695 | 0.4439 | 0.7605 | 0.4486 |
| NEWZEALAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 2.19\% | 1.88\% | 1.49\% | 1.31\% | 1.99\% | 1.63\% | 1.36\% | 1.10\% | 1.54\% | 1.47\% | 1.12\% | 0.99\% | 1.70\% | 1.42\% | 1.27\% | 1.07\% |
|  |  | 3.2112 | 3.7748 | 3.8732 | 4.1239 | 3.3567 | 3.4528 | 3.3608 | 3.1075 | 2.7729 | 2.9390 | 2.5670 | 2.5381 | 2.8716 | 2.7355 | 2.8078 | 2.6120 |
| CAR (1) |  | 1.82\% | 1.52\% | 1.30\% | 1.07\% | 1.54\% | 1.39\% | 1.14\% | 0.86\% | 1.40\% | 1.30\% | 1.01\% | 0.86\% | 1.40\% | 1.23\% | 1.11\% | 0.91\% |
|  |  | 3.1546 | 3.4899 | 3.8821 | 3.7202 | 2.7334 | 3.0313 | 2.9445 | 2.5076 | 2.5971 | 2.7004 | 2.4538 | 2.2983 | 2.4218 | 2.4838 | 2.5901 | 2.2602 |
| BHAR (0) |  | 2.00\% | 2.05\% | 0.82\% | 0.95\% | 1.61\% | 1.65\% | 0.73\% | 1.07\% | 1.43\% | 1.23\% | 1.60\% | 0.61\% | 1.91\% | 1.95\% | 1.67\% | 1.64\% |
|  |  | 2.6314 | 3.9517 | 1.0659 | 1.8612 | 2.3883 | 2.6012 | 1.3132 | 1.8800 | 2.4971 | 1.9112 | 3.0094 | 1.2365 | 3.0532 | 3.3195 | 2.9563 | 2.9747 |
| BHAR (1) |  | 1.64\% | 1.21\% | 0.04\% | 0.59\% | 1.19\% | 1.02\% | 0.60\% | 0.52\% | 1.52\% | 1.09\% | 1.26\% | 0.39\% | 1.64\% | 1.42\% | 1.18\% | 1.47\% |
|  |  | 2.4878 | 2.4029 | 0.0665 | 1.1676 | 1.9013 | 1.7200 | 1.1615 | 1.0069 | 2.4649 | 1.6995 | 2.3292 | 0.7805 | 2.5563 | 2.3643 | 2.2018 | 2.6295 |



| MW | $\mathrm{J}=$ |  | 3 |  | 6 |  |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{H}=$ | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.59\% | 1.10\% | 0.85\% | 0.77\% | 1.37\% | 1.03\% | 0.70\% | 0.62\% | 0.83\% | 0.54\% | 0.38\% | 0.16\% | 0.66\% | 0.37\% | 0.13\% | -0.03\% |
|  |  | 3.0956 | 2.4879 | 2.0923 | 2.0994 | 2.3911 | 1.9016 | 1.3031 | 1.2125 | 1.3719 | 0.8575 | 0.6026 | 0.2739 | 0.8799 | 0.4984 | 0.1890 | -0.0406 |
| CAR (1) |  | 1.27\% | 0.91\% | 0.75\% | 0.56\% | 1.20\% | 0.83\% | 0.61\% | 0.47\% | 0.91\% | 0.44\% | 0.26\% | 0.03\% | 0.36\% | 0.25\% | -0.03\% | -0.09\% |
|  |  | 2.5451 | 2.1313 | 1.9524 | 1.5433 | 2.2257 | 1.4829 | 1.1197 | 0.9213 | 1.3943 | 0.6715 | 0.4180 | 0.0463 | 0.4851 | 0.3550 | -0.0386 | -0.1363 |
| BHAR (0) |  | 1.52\% | 0.36\% | 0.95\% | 0.00\% | 1.27\% | 1.41\% | 0.66\% | 0.33\% | 1.05\% | 0.09\% | 0.26\% | -0.73\% | 0.42\% | 0.40\% | -0.35\% | 0.37\% |
|  |  | 2.4410 | 0.6618 | 1.5635 | 0.0050 | 2.0191 | 2.2935 | 0.8548 | 0.4906 | 1.5344 | 0.1256 | 0.3771 | -1.0506 | 0.5361 | 0.5394 | -0.4605 | 0.5022 |
| BHAR (1) |  | 1.32\% | 0.21\% | 0.88\% | -0.10\% | 1.17\% | 1.23\% | 0.65\% | 0.17\% | 0.92\% | 0.16\% | 0.01\% | -0.79\% | 0.33\% | 0.11\% | -0.50\% | 0.41\% |
|  |  | 2.4439 | 0.3949 | 1.5878 | -0.1823 | 1.9155 | 1.9727 | 0.8568 | 0.2393 | 1.3116 | 0.2298 | 0.0204 | -1.1308 | 0.4618 | 0.1433 | -0.6691 | 0.5509 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.14\% | 0.48\% | 0.49\% | 0.59\% | 0.69\% | 0.70\% | 0.72\% | 0.62\% | 0.65\% | 0.86\% | 0.76\% | 0.56\% | 0.97\% | 0.85\% | 0.65\% | 0.50\% |
|  |  | 0.4688 | 2.0017 | 2.1501 | 2.9597 | 1.9570 | 2.0961 | 2.3447 | 2.2576 | 1.7231 | 2.3900 | 2.2506 | 1.7625 | 2.3753 | 2.1600 | 1.7636 | 1.4708 |
| CAR (1) |  | 0.47\% | 0.55\% | 0.62\% | $\mathbf{0 . 6 1 \%}$ | 0.88\% | 0.82\% | 0.74\% | 0.56\% | 1.03\% | 0.93\% | 0.75\% | 0.49\% | 0.94\% | 0.75\% | 0.53\% | 0.41\% |
|  |  | 1.7277 | 2.2088 | 2.5975 | 3.1388 | 2.4396 | 2.4510 | 2.4682 | 2.0662 | 2.6052 | 2.4924 | 2.1681 | 1.5675 | 2.3312 | 1.8901 | 1.4639 | 1.2019 |
| BHAR (0) |  | -0.10\% | 0.28\% | 0.12\% | 0.30\% | 0.72\% | 0.73\% | 0.45\% | 0.93\% | 0.49\% | 0.30\% | 0.83\% | 0.68\% | 0.83\% | 1.20\% | 0.59\% | 0.70\% |
|  |  | -0.2738 | 0.8329 | 0.3322 | 0.7708 | 1.8260 | 1.9081 | 1.0363 | 2.3935 | 1.1628 | 0.6495 | 2.1744 | 1.8328 | 1.9417 | 2.5955 | 1.2230 | 1.6330 |
| BHAR (1) |  | 0.14\% | 0.07\% | 0.20\% | 0.33\% | 0.96\% | 0.90\% | 0.27\% | 0.88\% | $0.66 \%$ | $0.32 \%$ | 0.63\% | 0.39\% | $0.74 \%$ | 0.88\% | $0.51 \%$ | 0.41\% |
|  |  | 0.4023 | 0.1910 | 0.5514 | 0.8265 | 2.3716 | 2.2690 | 0.6207 | 2.2557 | $1.5421$ | $0.6856$ | 1.5824 | 0.9460 | $1.9041$ | 2.0117 |  | $0.9773$ |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.44\% | 0.59\% | 0.57\% | 0.75\% | 0.45\% | 0.61\% | 0.82\% | 0.73\% | 0.84\% | 1.03\% | 1.00\% | 0.70\% | 0.67\% | 0.87\% | 0.74\% | 0.51\% |
|  |  | 1.0170 | 1.5373 | 1.6426 | 2.5189 | 0.8385 | 1.2603 | 1.9294 | 1.9096 | 1.4783 | 1.9423 | 2.0340 | 1.5476 | 1.1248 | 1.5623 | 1.4390 | 1.0433 |
| CAR (1) |  | 0.50\% | 0.65\% | 0.68\% | 0.75\% | 0.71\% | 0.87\% | 0.93\% | 0.71\% | 0.95\% | 1.10\% | 0.92\% | 0.57\% | 0.86\% | 0.90\% | 0.68\% | 0.42\% |
|  |  | 1.1143 | 1.6737 | 1.9965 | 2.6145 | 1.4056 | 1.8426 | 2.2746 | 1.9060 | 1.6269 | 2.0966 | 1.9054 | 1.2820 | 1.5447 | 1.6787 | 1.3643 | 0.8881 |
| BHAR (0) |  | 0.17\% | 0.56\% | 0.15\% | 0.59\% | 0.50\% | 0.65\% | 0.57\% | 1.17\% | 0.99\% | 1.20\% | 1.11\% | 1.04\% | 0.52\% | 0.82\% | 0.88\% | 0.59\% |
|  |  | 0.3150 | 1.0648 | 0.2906 | 1.1973 | 0.8749 | 1.1620 | 1.0689 | 2.8415 | 1.5418 | 1.9596 | 2.0083 | 1.9937 | 0.7922 | 1.3250 | 1.4942 | 0.9807 |
| BHAR (1) |  | 0.24\% | 0.37\% | 0.13\% | 0.74\% | 0.77\% | 0.78\% | 0.69\% | 0.97\% | 1.10\% | 1.38\% | 1.09\% | 0.84\% | 0.99\% | 0.63\% | 0.47\% | 0.34\% |
|  |  | 0.4329 | 0.6845 | 0.2469 | 1.5548 | 1.4886 | 1.5202 | 1.4093 | 2.3286 | 1.8107 | 2.4236 | 1.9869 | 1.6294 | 1.6661 | 1.0370 | 0.7775 | 0.5549 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.05\% | 0.19\% | 0.31\% | 0.32\% | 0.26\% | 0.46\% | 0.55\% | 0.40\% | 0.51\% | 0.66\% | 0.50\% | 0.32\% | 0.45\% | 0.43\% | 0.28\% | 0.19\% |
|  |  | 0.1526 | 0.6480 | 1.2388 | 1.3251 | 0.6197 | 1.2280 | 1.5969 | 1.2556 | 1.1230 | 1.5844 | 1.3054 | 0.8821 | 0.9473 | 0.9745 | 0.6659 | 0.4829 |
| CAR (1) |  | 0.15\% | 0.31\% | 0.41\% | 0.27\% | 0.52\% | 0.68\% | 0.59\% | 0.38\% | 0.83\% | 0.75\% | 0.52\% | 0.27\% | 0.43\% | 0.38\% | 0.22\% | 0.14\% |
|  |  | 0.4391 | 1.0773 | 1.6211 | 1.1533 | 1.2572 | 1.8405 | 1.7310 | 1.1986 | 1.8392 | 1.8776 | 1.3537 | 0.7425 | 0.9233 | 0.8759 | 0.5417 | 0.3521 |
| BHAR (0) |  | -0.22\% | 0.41\% | -0.16\% | 0.38\% | 0.28\% | 0.35\% | 0.06\% | 0.85\% | 0.51\% | 0.60\% | 0.67\% | 0.30\% | 0.58\% | 0.63\% | 0.32\% | 0.33\% |
|  |  | -0.5328 | 1.0358 | -0.3480 | 0.9300 | 0.6114 | 0.8024 | 0.1318 | 2.7369 | 1.0407 | 1.3092 | 1.6350 | 0.7134 | 1.1676 | 1.3918 | 0.6586 | 0.6803 |
| BHAR (1) |  | 0.21\% | 0.12\% | -0.17\% | 0.24\% | 0.31\% | 0.48\% | 0.11\% | 0.54\% | 0.67\% | 0.57\% | 0.50\% | 0.14\% | 0.27\% | 0.32\% | 0.16\% | 0.14\% |
|  |  | 0.5773 | 0.2463 | -0.3849 | 0.5498 | 0.7200 | 1.2451 | 0.2410 | 1.6076 | 1.3744 | 1.1742 | 1.1140 | 0.3181 | 0.5199 | 0.7489 | 0.3406 | 0.2835 |

Panel C. The time-series momentum strategy using inversed volatility-weighted return


| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| DENMARK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.25\% | 1.28\% | 1.15\% | 1.16\% | 1.75\% | 1.62\% | 1.56\% | 1.34\% | 1.84\% | 1.80\% | 1.55\% | 1.28\% | 2.13\% | 1.84\% | 1.49\% | 1.19\% |
|  |  | 5.8134 | 6.2314 | 6.0789 | 6.8097 | 6.3196 | 6.0467 | 6.3363 | 5.8989 | 5.8000 | 5.8444 | 5.2925 | 4.7602 | 6.9385 | 6.0290 | 4.9482 | 4.2088 |
| CAR (1) |  | 1.32\% | 1.28\% | 1.19\% | 1.12\% | 1.74\% | 1.57\% | 1.46\% | 1.19\% | 1.88\% | 1.72\% | 1.39\% | $\mathbf{1 . 1 0 \%}$ | 1.96\% | 1.63\% | 1.29\% | 0.99\% |
|  |  | 6.0679 | 6.2555 | 6.2250 | 6.4873 | 6.1551 | 5.8179 | 6.0229 | 5.2562 | 6.0606 | 5.5968 | 4.8376 | 4.1664 | 6.3509 | 5.2506 | 4.3063 | 3.5543 |
| BHAR (0) |  | 1.17\% | 1.08\% | 0.78\% | 0.96\% | 1.64\% | 1.62\% | 1.28\% | 1.76\% | 1.75\% | 1.54\% | 1.61\% | 1.28\% | 2.04\% | 1.92\% | 1.52\% | 0.92\% |
|  |  | 4.9298 | 4.0402 | 2.6881 | 3.5459 | 5.3470 | 5.0991 | 4.0671 | 6.1447 | 5.1728 | 4.6725 | 4.9055 | 4.3272 | 6.0197 | 5.8468 | 4.6484 | 2.8357 |
| BHAR (1) |  | 1.23\% | 1.05\% | 0.85\% | 1.02\% | 1.69\% | 1.50\% | 1.18\% | 1.47\% | 1.88\% | 1.66\% | 1.51\% | 1.07\% | 1.92\% | 1.61\% | 1.37\% | 0.65\% |
|  |  | 4.9602 | 4.1324 | 2.9839 | 3.9695 | 5.6964 | 4.7530 | 3.9287 | 5.1917 | 5.9770 | 4.9807 | 4.7936 | 3.5113 | 6.0302 | 4.8921 | 4.0945 | 2.0207 |
| FINLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.88\% | 0.92\% | 0.95\% | 0.83\% | 1.25\% | 1.16\% | 1.12\% | 0.91\% | 1.41\% | 1.24\% | 1.02\% | 0.73\% | 1.23\% | 0.97\% | 0.77\% | 0.54\% |
|  |  | 2.6266 | 3.3181 | 3.9694 | 3.6960 | 3.5205 | 3.5804 | 3.7354 | 3.0411 | 3.6217 | 3.3120 | 2.6604 | 1.9559 | 2.7216 | 2.1963 | 1.7791 | 1.2858 |
| CAR (1) |  | 1.15\% | 1.02\% | 0.98\% | 0.83\% | 1.28\% | 1.19\% | 1.03\% | 0.76\% | 1.41\% | 1.10\% | 0.88\% | 0.55\% | 1.15\% | 0.84\% | 0.64\% | 0.44\% |
|  |  | 3.5095 | 3.8956 | 4.2813 | 3.6625 | 3.7797 | 3.8428 | 3.3597 | 2.4998 | 3.6362 | 2.8707 | 2.1987 | 1.4483 | 2.4667 | 1.8662 | 1.4501 | 1.0453 |
| BHAR (0) |  | 0.38\% | 0.56\% | 0.86\% | 0.69\% | 1.21\% | 1.10\% | 1.00\% | 1.21\% | 1.31\% | 1.06\% | 0.88\% | 0.40\% | 1.22\% | 1.27\% | 0.92\% | 0.91\% |
|  |  | 0.7737 | 1.1917 | 2.0924 | 1.3257 | 3.0021 | 2.6830 | 2.6562 | 2.9639 | 3.0196 | 2.2913 | 2.1443 | 0.8963 | 2.6499 | 2.9352 | 1.8640 | 2.1560 |
| BHAR (1) |  | 1.20\% | 0.61\% | 1.13\% | 0.55\% | 1.49\% | 1.30\% | 0.97\% | 0.98\% | 1.55\% | 0.93\% | 0.74\% | 0.38\% | 1.11\% | 1.00\% | 0.64\% | 0.69\% |
|  |  | 3.0665 | 1.4719 | 3.0328 | 1.0963 | 4.3950 | 3.4542 | 2.5999 | 2.5216 | 3.6942 | 1.9896 | 1.7501 | 0.8452 | 2.4494 | 2.3760 | 1.2852 | 1.7088 |
| FRANCE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.02\% | 0.41\% | 0.38\% | 0.54\% | 0.73\% | 0.78\% | 0.81\% | 0.70\% | 1.06\% | 1.09\% | 0.99\% | 0.78\% | 1.10\% | 1.04\% | 0.82\% | 0.67\% |
|  |  | -0.0507 | 1.7342 | 1.8217 | 3.0257 | 2.1321 | 2.4902 | 2.9121 | 2.7530 | 2.9404 | 3.3235 | 3.1879 | 2.7808 | 3.0217 | 3.0623 | 2.5779 | 2.2243 |
| CAR (1) |  | 0.52\% | 0.55\% | 0.46\% | 0.53\% | 0.94\% | 0.83\% | 0.82\% | 0.62\% | 1.33\% | 1.12\% | 0.92\% | 0.68\% | 1.21\% | 0.99\% | 0.75\% | 0.61\% |
|  |  | 1.6930 | 2.4037 | 2.2874 | 2.9823 | 2.7812 | 2.7473 | 3.0479 | 2.5269 | 3.8239 | 3.4486 | 3.0168 | 2.4815 | 3.5437 | 2.9939 | 2.4079 | 2.0634 |
| BHAR (0) |  | 0.28\% | 0.18\% | 0.69\% | -0.18\% | 0.68\% | 0.46\% | 0.49\% | 0.05\% | 0.92\% | 0.93\% | 1.17\% | $\mathbf{0 . 8 1 \%}$ | 1.08\% | 1.05\% | 1.10\% | 0.64\% |
|  |  | 0.7568 | 0.4897 | 1.6919 | -0.4457 | 1.9230 | 1.1072 | 1.2194 | 0.0960 | 2.5119 | 2.6223 | 3.7757 | 2.4131 | 2.9033 | 2.8269 | 3.0752 | 1.8188 |
| BHAR (1) |  | 0.30\% | 0.32\% | 0.66\% | 0.19\% | 0.85\% | 0.75\% | 0.64\% | 0.48\% | 1.15\% | 0.97\% | 1.09\% | 0.50\% | 1.19\% | 0.93\% | 0.92\% | 0.55\% |
|  |  | 0.8227 | 0.8815 | 1.3447 | 0.4247 | 2.3283 | 1.9917 | 1.6542 | 1.5261 | 3.0191 | 2.5151 | 3.2187 | 1.3583 | 3.2794 | 2.5258 | 2.6472 | 1.4782 |
| GERMANY |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.14\% | 0.99\% | 0.89\% | 0.87\% | 1.47\% | 1.35\% | 1.33\% | 1.09\% | 1.63\% | 1.51\% | 1.27\% | 1.01\% | 1.70\% | 1.39\% | 1.12\% | 0.95\% |
|  |  | 3.8995 | 3.8930 | 3.8206 | 4.0801 | 4.4146 | 4.5112 | 4.7760 | 4.0483 | 4.7251 | 4.5622 | 3.8462 | 3.3266 | 4.7740 | 3.9001 | 3.3170 | 3.0079 |
| CAR (1) |  | 1.49\% | 1.07\% | 0.96\% | 0.86\% | 1.54\% | 1.34\% | 1.25\% | 0.95\% | 1.68\% | 1.42\% | 1.13\% | 0.88\% | 1.66\% | 1.23\% | 0.98\% | 0.83\% |
|  |  | 4.8750 | 4.1482 | 4.1339 | 3.9089 | 4.8797 | 4.5308 | 4.4316 | 3.5977 | 4.8443 | 4.1857 | 3.3762 | 2.8825 | 4.7361 | 3.4790 | 2.9771 | 2.6825 |
| BHAR (0) |  | 1.05\% | 0.55\% | 0.82\% | -0.53\% | 1.48\% | 1.45\% | 1.38\% | 1.10\% | 1.59\% | 1.50\% | 1.08\% | 1.04\% | 1.70\% | 1.38\% | 1.04\% | 0.91\% |
|  |  | 3.1383 | 1.5536 | 2.3175 | -1.0366 | 3.9790 | 4.3093 | 3.4014 | 2.9602 | 4.3320 | 3.7469 | 3.1813 | 2.5313 | 4.7551 | 3.8456 | 2.8083 | 2.6495 |
| BHAR (1) |  | 1.54\% | 0.81\% | 1.39\% | 0.19\% | 1.46\% | 1.41\% | 1.26\% | 0.91\% | 1.63\% | 1.35\% | 0.90\% | 0.84\% | 1.60\% | 1.29\% | 0.85\% | 0.87\% |
|  |  | 4.9111 | 2.4459 | 4.7192 | 0.4497 | 4.3897 | 4.1953 | 3.2445 | 2.4577 | 4.6246 | 3.2901 | 2.6246 | 2.0046 | 4.4816 | 3.7878 | 2.4547 | 2.5521 |





| IVOL | $\mathrm{J}=$ | 3 |  |  |  | 6 |  |  |  | 9 |  |  |  | 12 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}=$ |  | 36 |  | 9 | 12 | 6 |  | 9 | 12 | 3 | 6 | 9 | 12 | 3 | 6 | 9 | 12 |
| SWEDEN |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.24\% | 1.19\% | 1.02\% | 0.97\% | 1.59\% | 1.37\% | 1.18\% | 0.99\% | 1.76\% | 1.58\% | 1.21\% | 0.92\% | 1.66\% | 1.32\% | 1.00\% | 0.76\% |
|  |  | 3.0211 | 3.1461 | 3.2228 | 3.6517 | 3.4277 | 3.1311 | 3.0720 | 2.8884 | 3.7608 | 3.6718 | 2.9573 | 2.4692 | 3.3382 | 2.8260 | 2.2807 | 1.8743 |
| CAR (1) |  | 1.29\% | 1.15\% | 0.99\% | 0.87\% | 1.60\% | 1.35\% | 1.08\% | 0.83\% | 1.85\% | 1.46\% | 1.06\% | 0.77\% | 1.48\% | 1.14\% | 0.82\% | 0.64\% |
|  |  | 3.0734 | 3.3190 | 3.3104 | 3.3027 | 3.3981 | 3.2095 | 2.8890 | 2.4714 | 4.2086 | 3.4875 | 2.6297 | 2.1105 | 3.1139 | 2.4945 | 1.9280 | 1.6309 |
| BHAR (0) |  | 1.40\% | 1.16\% | 1.10\% | 0.63\% | 1.80\% | 1.74\% | 1.18\% | 1.14\% | 1.81\% | 1.43\% | 1.15\% | $\mathbf{0 . 7 0 \%}$ | 1.52\% | 1.42\% | 1.00\% | 0.96\% |
|  |  | 3.3476 | 2.7710 | 2.7929 | 1.4190 | 3.7441 | 3.9008 | 2.2654 | 2.6710 | 3.8306 | 2.8591 | 2.4686 | 1.4850 | 2.9590 | 3.0683 | 2.1492 | 2.4659 |
| BHAR (1) |  | 1.46\% | 1.05\% | 0.86\% | 0.90\% | 1.88\% | 1.65\% | 1.24\% | 0.95\% | 1.88\% | 1.50\% | 1.17\% | 0.59\% | 1.38\% | 1.32\% | 0.78\% | 0.93\% |
|  |  | 3.5409 | 2.5888 | 2.3259 | 1.8080 | 3.9833 | 3.9772 | 2.4850 | 2.3348 | 4.1052 | 3.2302 | 2.5426 | 1.2377 | 2.7339 | 2.9145 | 1.6905 | 2.2688 |
| SWITZERLAND |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 0.83\% | 0.82\% | 0.75\% | 0.79\% | 1.20\% | 1.13\% | 1.10\% | 0.95\% | 1.28\% | 1.26\% | 1.08\% | 0.85\% | 1.43\% | 1.18\% | 0.92\% | 0.71\% |
|  |  | 3.4963 | 3.7568 | 3.5938 | 4.2696 | 4.1345 | 3.8146 | 4.0348 | 3.8942 | 3.8330 | 3.9037 | 3.5745 | 3.0771 | 4.1175 | 3.5527 | 2.9352 | 2.4345 |
| CAR (1) |  | 0.76\% | 0.74\% | 0.74\% | 0.70\% | 1.16\% | 1.09\% | 1.02\% | $\mathbf{0 . 8 1 \%}$ | 1.29\% | 1.20\% | 0.97\% | 0.72\% | 1.33\% | 1.05\% | 0.78\% | 0.58\% |
|  |  | 3.3896 | 3.3061 | 3.5116 | 3.8521 | 3.8720 | 3.6095 | 3.8269 | 3.4186 | 3.8041 | 3.7231 | 3.2495 | 2.6303 | 3.9409 | 3.1846 | 2.4941 | 1.9924 |
| BHAR (0) |  | 0.64\% | 0.68\% | 0.61\% | 0.74\% | 1.31\% | 1.36\% | 1.12\% | 1.36\% | 1.25\% | 1.13\% | 1.28\% | 1.00\% | 1.43\% | 1.42\% | 0.99\% | 0.84\% |
|  |  | 2.3308 | 2.0910 | 1.8474 | 2.0330 | 4.0149 | 3.8339 | 3.0657 | 4.2162 | 3.5731 | 2.9672 | 3.9815 | 3.1185 | 4.1287 | 4.1532 | 2.7080 | 2.6317 |
| BHAR (1) |  | 0.57\% | 0.40\% | 0.47\% | 0.58\% | 1.17\% | 1.25\% | 0.93\% | 1.19\% | 1.15\% | 0.98\% | 1.06\% | 0.73\% | 1.23\% | 1.25\% | 0.75\% | 0.76\% |
|  |  | 2.2245 | 1.2570 | 1.5251 | 1.6366 | 3.3352 | 3.4443 | 2.7053 | 3.7541 | 3.2633 | 2.6419 | 3.3279 | 2.1259 | 3.6913 | 3.7438 | 2.1151 | 2.4299 |
| UK |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | 1.42\% | 1.33\% | 1.14\% | 1.16\% | 1.89\% | 1.59\% | 1.50\% | 1.27\% | 1.92\% | 1.75\% | 1.43\% | 1.10\% | 2.03\% | 1.64\% | 1.25\% | 0.93\% |
|  |  | 5.9823 | 5.8583 | 5.8075 | 6.6552 | 6.0727 | 5.6814 | 6.0583 | 5.5382 | 5.9340 | 5.7988 | 5.0318 | 4.0967 | 6.1374 | 5.0898 | 4.1228 | 3.2788 |
| CAR (1) |  | 1.42\% | 1.26\% | 1.10\% | 1.05\% | 1.71\% | 1.47\% | 1.35\% | 1.09\% | 1.82\% | 1.60\% | 1.26\% | 0.91\% | 1.80\% | 1.42\% | 1.01\% | 0.74\% |
|  |  | 5.8960 | 5.7563 | 5.9267 | 6.2229 | 5.6619 | 5.5137 | 5.6087 | 4.8523 | 5.9015 | 5.4345 | 4.4649 | 3.4409 | 5.6149 | 4.4798 | 3.4280 | 2.6792 |
| BHAR (0) |  | 1.34\% | 1.14\% | 1.27\% | 1.01\% | 1.78\% | 1.52\% | 1.12\% | 1.47\% | 1.86\% | 1.56\% | 1.41\% | 1.06\% | 1.92\% | 1.73\% | 1.35\% | 0.86\% |
|  |  | 4.9154 | 3.9328 | 4.3281 | 3.1539 | 5.3651 | 4.6498 | 3.2977 | 6.0962 | 5.3268 | 4.4548 | 5.0820 | 3.4462 | 5.5622 | 5.2051 | 3.9261 | 2.5809 |
| BHAR (1) |  | 1.56\% | 0.90\% | 1.19\% | 0.90\% | 1.72\% | 1.47\% | 1.11\% | 1.33\% | 1.85\% | 1.44\% | 1.32\% | 0.87\% | 1.75\% | 1.42\% | 1.02\% | 0.61\% |
|  |  | 5.2344 | 2.7474 | 4.0763 | 3.0803 | 5.6407 | 5.2524 | 3.5328 | 6.3135 | 5.6330 | 4.1726 | 4.3842 | 2.7805 | 5.3660 | 4.7165 | 3.1079 | 2.0245 |
| US |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAR (0) |  | -0.21\% | -0.02\% | 0.07\% | 0.04\% | 0.05\% | 0.26\% | 0.24\% | 0.05\% | 0.27\% | 0.30\% | 0.13\% | -0.07\% | 0.12\% | 0.03\% | -0.11\% | -0.27\% |
|  |  | -0.8012 | -0.0942 | 0.3758 | 0.2486 | 0.1640 | 0.9191 | 0.9586 | 0.2048 | 0.7852 | 0.9150 | 0.4369 | -0.2481 | 0.3224 | 0.0905 | -0.3287 | -0.8893 |
| CAR (1) |  | 0.03\% | 0.18\% | 0.20\% | 0.05\% | 0.32\% | 0.40\% | 0.23\% | 0.01\% | 0.43\% | 0.29\% | 0.07\% | -0.16\% | 0.10\% | -0.01\% | -0.19\% | -0.32\% |
|  |  | 0.1380 | 0.8400 | 1.0896 | 0.3074 | 1.0667 | 1.4812 | 0.9298 | 0.0445 | 1.3041 | 0.9062 | 0.2426 | -0.5881 | 0.2954 | -0.0299 | -0.6140 | $-1.1411$ |
| BHAR (0) |  | -0.33\% | 0.02\% | -0.07\% | 0.08\% | 0.08\% | 0.32\% | -0.19\% | $\mathbf{0 . 4 1 \%}$ | 0.34\% | 0.20\% | 0.31\% | 0.00\% | 0.19\% | 0.26\% | 0.02\% | -0.20\% |
|  |  | -1.0579 | 0.0712 | -0.1874 | 0.2611 | 0.2214 | 0.9830 | -0.5076 | 1.7390 | 0.9093 | 0.5357 | 1.0932 | 0.0105 | 0.5060 | 0.7097 | 0.0480 | -0.5646 |
| BHAR (1) |  | 0.02\% | 0.02\% | -0.09\% | $\mathbf{0 . 0 2 \%}$ | 0.25\% | 0.35\% | -0.21\% | 0.14\% | 0.35\% | 0.07\% | 0.06\% | -0.22\% | 0.01\% | 0.01\% | -0.19\% | -0.35\% |
|  |  | 0.0609 | 0.0657 | -0.2866 | 0.0789 | 0.8020 | 1.2081 | -0.6017 | 0.5960 | 0.9964 | 0.1878 | 0.1982 | -0.6965 | 0.0292 | 0.0297 | -0.5742 | -1.0004 |


[^0]:    ${ }^{1}$ Momentum anomaly indicates that the excess returns from the momentum investment strategies are difficult to be explained by standard risk factors. The momentum strategy has been documented in US stock market (Jegadeesh \& Titman, 1993), European stock markets (Bird \& Casavecchia, 2006; Rouwenhorst, 1998), emerging stock markets (Hameed \& Kusnadi, 2002), international stock markets (Gupta, Locke, \& Scrimgeour, 2010), industries (Moskowitz \& Grinblatt, 1999), currencies (Menkhoff, Sarno, Schmeling, \& Schrimpf, 2012) and futures markets (Asness, Moskowitz, \& Pedersen, 2013).

[^1]:    ${ }^{2}$ The cross-sectional stock selection criteria based on recent returns has been investigated broadly across international stock markets (Gupta, Locke, \& Scrimgeour, 2013; Rouwenhorst, 1998), industry markets (Moskowitz \& Grinblatt, 1999), currency and futures markets (Asness et al., 2013; Moskowitz et al., 2012) as well as the selection criteria on the basis of 52 high stock prices (George \& Hwang, 2004).
    ${ }^{3}$ Jegadeesh and Titman (1993) provide motivation for the investigation of momentum strategies with the observation that "the majority of the mutual funds examined by Grinblatt and Titman $(1989,1993)$ a tendency to buy stocks that have increased in price over the previous quarter."
    ${ }^{4}$ Jegadeesh and Titman (1993) find that momentum strategy is profitable after accounting for the transaction cost, whereas Lesmond, Ogden, and Trzcinka (2004) claim that momentum strategy is non-profitable when the transaction costs are taken into account.

[^2]:    ${ }^{5}$ The weak form of the EMH claims that prices already reflect all past publicly available information. The semistrong form of the EMH claims that prices reflect all publicly available information and new public information. The strong form of the EMH claims that prices instantly reflect even hidden or insider information.

[^3]:    ${ }^{6}$ The four-factor model (Carhart, 1997) is an extension of the Fama-French three-factor model (market, size and value factors) with the additional factor of momentum return.

[^4]:    ${ }^{7}$ The differences between the two momentum strategies will be explained in Section 1.3.

[^5]:    ${ }^{8}$ Goyenko et al. (2009) examine twelve measures of estimating transaction costs. Nine measures employed in the following studies: Roll (1984)(Roll model), Holden (2009)(Effective tick model and Holden model), Hasbrouck (2009) (Gibbs model), Lesmond et al. (1999) (LOT model, Zero model and Zero2 model), Amihud (2002)(Amihud model) and Pastor and Stambaugh (2001)(Pastor and Stambaugh model). Three new/extended methods are included: Effective Tick2 model, LOT Y-Split model and Amivest Liquidity ratio model.

[^6]:    ${ }^{9}$ For markets with a small number of stocks, it may seem that stocks are not eligible to be selected into the winner (or loser) portfolio in some months as historical returns do not exceed the upper/lower levels. In such cases, the study assumes that the winner (or loser) portfolio returns are zero instead of missing for that time period for two reasons. First, the missing value will be initially set up as zero when calculating the momentum returns, which are the winners minus losers. Second, it is difficult to compare time-series and cross-sectional momentum returns over time if one data set is discrete due to the missing value and the other is continuous.

[^7]:    ${ }^{10}$ The style momentum strategy suggests that investors tend to classify stocks as being small and large, value and growth stocks, and invest on this basis. This is referred to as style investing (Bernstein \& organizacija kompozitora Jugoslavije, 1995).
    ${ }^{11}$ Contrarian strategy is the other side of coin of momentum investment strategy. Momentum strategy bets that stocks performing better (worse) in the past will cautiously outperform (underperform) the market in the near future, whereas, contrarian strategy assume that stocks performing better (worse) in the past will underperform (outperform) the market in the future.

[^8]:    ${ }^{12}$ Noise trader is an investor who makes buy and sell decisions without the use of fundamental data.

[^9]:    ${ }^{13}$ As identified by Bem (1965), self-attribution bias refers to the tendency for human to attribute success to their own abilities or to place too much significance on signals that confirm their beliefs, whereas they tend to attribute failure to external factors, such as bad luck.

[^10]:    ${ }^{14}$ The approaches of calculating three weighting schemes will be explained in Section 4.3.2.

[^11]:    ${ }^{15}$ The details of determining upper and lower cut-offs for each market in practices are discussed in Appendix 1.

[^12]:    ${ }^{16}$ If the formation return over the whole sample period is not normal distributed, we then set upper (lower) level at $\mathrm{x} \%$ standard deviation above (below) the mean in order that the total number of stocks in the time-series momentum strategy matches (or closes to) the total number of stocks selected in the cross-sectional momentum strategy.

[^13]:    ${ }^{17}$ BHAR is buy-and-hold portfolio construction; CAR is monthly-rebalancing portfolio construction. ' 0 ' indicates no gaps between formation and holding periods. ' 1 ' indicates one-month gap between the formation and holding periods. Technical examples regarding implementing the momentum strategies are shown in the Appendix 2.

[^14]:    ${ }^{18}$ The Bid-ask spread is the difference between the prices quoted for sale (bid price) and purchase (ask price). The effective spread is the actual difference between bid and ask price incorporating the direction of price movements. The realized spread is the difference between average bid and ask price over a period of time. Price impact refers to the correlation between an incoming order (to sale or to purchase) and the subsequent price changes.
    ${ }^{19}$ For the time-series momentum strategy, the study uses four types of formation, and five types of cut-off selection: single cut-off point ( $0 \%$ and market index), double cut-off points (in-sample - selecting cut-offs for investing approx. $32 \%$ or $60 \%$ of sample) and double cut-off (out-of-sample), four types of portfolio

[^15]:    constructions, three types of weighting schemes and four types of holding periods. For the cross-sectional momentum strategy, the study applies four types of formation, three types of cut-off selection: winner/loser portfolio contains top/bottom $16 \%, 30 \%$ and $50 \%$ stocks in the entire market, four types of portfolio constructions, three types of weighting schemes and four types of holding periods.
    ${ }^{20}$ For in-sample upper and lower cut-off points, we first estimate the returns for each stock over the formation period, and then calculate the mean and standard deviation of these returns over the whole sample period. We set the cut-off points at plus and minus one standard deviation from the mean. It will result in the $32 \%$ of stocks being allocated to either winner or loser portfolios across the whole sample period.
    For out-of-sample upper and lower cut-off points, we set the cut-off points at each time period using plus and minus one standard deviation from the mean based on the sample where the returns for each stock over the formation periods.
    ${ }^{21}$ To be consistent with Fama (1998), BHAR indicates momentum return has been calculated by buy-and hold construction and CAR indicates momentum return has been calculated by monthly rebalancing construction. BHAR (0)/BARH (1) present BHAR with zero-/one- month gap between formation and holding periods.

[^16]:    ${ }_{22}^{22}$ Newey-West t-statistics were calculated in order to determine the significance of the average monthly returns.
    ${ }^{23}$ The average time-series monthly (in-sample) returns using the cut-offs at the $30 \%, 50 \%$ levels and the timeseries (out-of-sample) monthly returns using the cut-offs at the $16 \%$ level were also calculated. As one would expect these cut-offs produced inferior results to the situation where a $16 \%$ cut-off was used. Hence, in the interests of space the results with cut-offs $30 \%$ and $50 \%$ are reported in the Appendix 6, 8 and 9 .

[^17]:    ${ }^{24}$ This is an effective "in-sample" means of calculating the cut-offs as they are based on the mean and standard deviations of the returns of the stocks in our universe over the entire sample period. We also determine and apply cut-offs determined "out-of-sample" by setting new cut-offs for each calendar year based on the history of stock returns realised in the past period. When applying these "out-of-sample" cut-offs, we obtain results almost identical to those reported in this paper. The results of "out-of-sample" time-series momentum are reported in the appendix 11.
    ${ }^{25}$ The "in-sample" cut-offs of time-series momentum strategy across 24 markets are attached in Appendix 4 when investing $32 \%$ stocks and showed in Appendix 5 when investing $60 \%$ stocks .

[^18]:    ${ }^{26}$ Although the implementations chosen do represent a slight compromise on that which is optimum for one or other of the two momentum strategies, the difference in returns are no more than a few basis points and so a comparison between the optimum implementations for each strategy does not lead to change to any of the conclusions in this study.

[^19]:    ${ }^{27}$ The results of cross-sectional momentum strategies with investing $60 \%$ stocks are shown in Appendix 7 and the results with investing all of the stocks in the stock universe are presented in Appendix 10. The results of

[^20]:    time-series momentum strategies with investing $60 \%$ stocks are shown in Appendix 6 and the results with investing all of the stocks using $0 \%$ (market index) cut-off are shown in Appendix 8 (9).

[^21]:    ${ }^{28}$ As explained in the previous paragraph, the limitation of this regression analysis is that it only reports equal weighted portfolios, and therefore the results of the regression focus on optimal implementation approaches which exclude portfolio weight.

[^22]:    ${ }^{29}$ The study also used the previous three- and six- month past performances of the relevant indexes to define up and down markets. One thing this did achieve was to increase the number of down months but the major findings remained unchanged to those reported here.

[^23]:    ${ }^{30}$ Annualised returns in charts are based on continuously compounded return which is calculated by $\sum_{1}^{12} L N\left(1+\right.$ simple return of momentum $\left.{ }_{t}\right)$.

[^24]:    ${ }^{31}$ According to Lesmond et al. (1999), the estimated transaction costs from the LOT model have an $85 \%$ correlation coefficient with the most commonly used estimate of transaction costs, the bid-ask spread plus commissions. Regressions for the spread plus commissions on the estimated costs have an aggregated $\mathrm{R}^{2}$ of $88 \%$.

[^25]:    ${ }^{32}$ Since the intercept term in the risk model normally captures the misspecification in the market index and not the transaction costs, Lesmond et al. (1999) use the risk model without the intercept term.

[^26]:    ${ }^{33}$ Round-trip transaction costs are estimated as a percentage of the price for each stock in each calendar year. As in Liu et al. (2011), stocks have at least $30 \%$ nonzero returns in a calendar year are included in the model. The starting values for the estimated parameters $\alpha_{1 j}, \alpha_{2 j}, \beta_{j}$ and $\sigma_{j}$ are $0.01,0.01,1$, and 0.1 , respectively. If the procedure fails to converge, the starting values change to $0.1,0.1,1$, and 0.1 , and re-estimate.

[^27]:    ${ }^{34}$ The percentage of monthly transaction cost for each stock is estimated by the LOT-Y model (Goyenko et al., 2009).

[^28]:    ${ }^{35}$ It was deemed in appropriate to use the Carhart (1997) four-factor model which includes momentum as the fourth factor given that we are trying to ascertain the performance of momentum investment strategies.

[^29]:    ${ }^{36}$ Wald test are reported for each component in the regression based on the hypothesis, H 0 sum of the coefficients equals to zero. $\mathrm{H} 0: \beta 1+\beta 0=0, \mathrm{H} 0: \beta 3+\beta 2=0, \mathrm{H} 0: \beta 5+\beta 4=0, \mathrm{H} 0: \beta 7+\beta 6=0$

