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Determinants of Corporate Leverage Adjustments:

A Cross-Country Analysis

A thesis

submitted in fulfilment

of the requirements for the degree

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by

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Abstract

Capital structure literature suggests that firms are very likely to consider target leverage ratios when they issue new capital (Graham & Harvey, 2001). Albeit the dynamic trade-off theory predicts that firms have incentives to move toward achieving target debt ratios by reducing any deviation from those targets (Frank & Goyal, 2009), due to substantial financing frictions, that is issuance costs or intermediation costs, firms may decide to temporarily deviate from their target levels. A recent strand of research has investigated significant factors that affect such adjustment costs or firms' leverage SOA. This thesis consists of three essays that investigate crucial determinants of corporate leverage adjustments: equity liquidity, corporate sustainability performance (CSP), and employment protection laws (EPLs).

Chapter 2 examines the impact of liquidity on the speed of adjustment (SOA) of corporate leverage at the individual company level. Using a sample of UK firms and data from 35 countries, respectively, over the period from 1996 to 2016, the chapter finds that high-liquidity firms have a significantly faster SOA than less liquid firms. This result survives a series of robustness checks and holds after addressing the endogeneity concern using exogenous shocks and additional control variables. Further analyses imply that the positive effect of liquidity on the SOA exists only for over-levered firms, and this impact is moderated in countries with bankruptcy codes. In the cross section, the chapter suggests that the positive relationship between liquidity and SOA is more pronounced for firms whose current position is relatively close to its target leverage ratio and whose target ratio is relatively stable. The chapter further shows that the positive equity liquidity-SOA association is less (more) pronounced for firms in strong (weak) institutional environments. The results provide new insights into the role of liquidity in firms' capital structure decisions and the determinants of capital structure dynamics.

Chapter 3 investigates the impact of corporate sustainability performance (CSP) on the speed at which firms adjust their leverage to the target ratios. Using a large sample of 31 countries from 2002 to 2018 with two proxies of CSP, the chapter suggests that firms that invest more in CSP move faster toward their target leverage. In exploring the potential underlying economic mechanisms through which CSP affects leverage adjustments, the chapter shows that superior CSP plays an important role in easing information asymmetry, enhancing stakeholder engagements, pushing up stock prices in the stock market, and improving competitive advantages in the product market of firms. In further analyses, the positive association between CSP and leverage SOA is shown to be less pronounced in countries with high-quality institutions. The results remain statistically and quantitatively unchanged from numerous robustness tests and IV estimates. Overall, this chapter enlightens the crucial role of CSP in shaping the firm's decisions on dynamic capital structure and provides implications for strategic planning of firms on the optimal choices of CSP investments.

Finally, chapter 4 highlights the impact of employment protection laws (EPLs) on the speed of corporate leverage adjustments. By exploiting within-country changes in EPLs across 19 OECD countries, the chapter suggests that firms operating in countries with more stringent EPLs have significantly low leverage adjustment speeds. This association is consistent with the view that stringent EPLs raise firms' costs of adjustment on target leverage. The result survives several tests addressing the endogeneity concern by instrument variable approach, Rajan and Zingales (1998)'s method, and additional control variables and is robust to a battery of robustness checks. The chapter further demonstrates that the response of leverage adjustment to changes in EPLs is more pronounced in countries with effective legal enforcement. Generally, results of the chapter are consistent with the dynamic trade-off theory of capital structure.

Keywords: dynamic capital structure, leverage adjustment, leverage SOA, leverage deviation, equity liquidity, corporate sustainability performance, ESG, employment protection laws, UK, international context, institutional environments.

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Declaration

I, Ly Thi Hai Ho, declare that the content of this thesis is the result of work that has been carried out by me in the University of Waikato. I further certify that except where explicit reference is made to the contribution of others, and where prior works referred to are duly acknowledged, this thesis is originally written by me. The work has not been submitted previously, in whole or in part, to qualify for any other academic award anywhere.

Thesis-related research outcomes

REFEREED PUBLICATION

1. **Ho, L.**, Lu, Y., & Bai, M. (2021). Liquidity and speed of leverage adjustment. *Australian Journal of Management*, 46(1), 76-109. [SSCI and ABDC ranking = A].
2. **Ho, L.**, Bai, M., Lu, Y., & Qin, Y. (2021) The effect of corporate sustainability performance on leverage adjustments. *The British Accounting Review*, forthcoming, doi: 10.1016/j.bar.2021.100989 [SSCI and ABDC ranking = A*].

SUBMITTED AND COMPLETED PAPERS

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2. **Ho, L.**, Bai, M., & Lu, Y. (2020) OECD Labour Protection and Dynamic Leverage Adjustments. *Management Science*, under review [SSCI and ABDC ranking = A*].

CONFERENCE PAPERS

1. **Ho, L.**, Lu, Y., & Bai, M. (2019). Equity liquidity, speed of leverage adjustments and the role of institutional environments, *23rd New Zealand Finance Colloquium*, University of Lincoln, Christchurch, New Zealand
2. **Ho, L.** & Lu, Y. (2019). Equity Liquidity, Speed of Leverage Adjustment, and the Role of Institutional Environments, *7th Spring Conference of the Multinational Finance Society*, Greece.
3. **Ho, L.**, Lu, Y., & Bird, R. (2018). Liquidity, leverage deviation, target change and the speed of leverage adjustment, *The 5th Vietnam International Conference In Finance (VICIF)*, Ho Chi Minh City, Vietnam.
4. **Ho, L.**, Lu, Y., & Bird, R. (2018). Liquidity, Leverage Deviation, Target Change and the Speed of Leverage Adjustment, *25th Annual Conference of the Multinational Finance Society*, Budapest, Hungary.
5. **Ho, L.**, Lu, Y., & Bird, R. (2018). Liquidity, Leverage Deviation, Target Change and the Speed of Leverage Adjustment, *Paris Financial Management Conference*, Paris, France.

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List of Abbreviations

SOA	Speed of adjustment
UK	United Kingdom
US	United States
USA	United States of American
IMF	International Monetary Fund
NYSE	The New York Stock Exchange
NASDAQ	National Association of Securities Dealers Automated Quotations exchange
OLS	Ordinary Least Squares
GMM	System Generalize Method of Moments
R&D	Research and development
Ln	Natural logarithm
OECD	The Organization for Economic Cooperation and Development
WDI	World Development Indicators
MiFID	The Directive on Markets in Financial Instruments
CSP	Corporate sustainability performance
IV	Instrument variable
CSR	Corporate social responsibility
ESG	Environment, social, and governance
ESGC	Environment, social, and governance controversies
SEC	The US Securities and Exchange Commission
EDGAR	The Electronic Data Gathering, Analysis, and Retrieval system
MD&A	Management Discussion and Analysis
EPLs	Employment protection laws
QWI	Quarterly Workforce Indicator
SIC	Standard Industrial Classification
NAICS	North American Industry Classification System

Chapter 1

Introduction

1.1. Background of the thesis

This thesis investigates three crucial determinants of corporate leverage adjustments¹: a firm-level financial factor, i.e., equity liquidity; a firm-level non-financial factor, i.e., corporate sustainability performance (hereafter, CSP); and a country-level factor, i.e., employment protection laws (hereafter, EPL).

Capital structure, which relates to decisions as to how the firm is financed, is one of the most debatable substantial topics of modern finance theory. This not only reflects this subject has received formal attention in recent years but also recognition it has continuously attracted for more than five decades. The traditional trade-off theory of capital structure argues that a firm's value can be maximized if the firm operates at the target leverage ratio in which the benefits and the costs of capital are balanced (Fischer, Heinkel, & Zechner, 1989; Flannery & Rangan, 2006; Harris & Raviv, 1991; Hovakimian & Li, 2011). Subsequently, dynamic trade-off models predict that firms have an incentive to move toward their optimal capital structure by reducing any deviations between their actual debt/equity ratios and those optimal points. However, while converging on the targets, a firm may suffer significant costs of adjustment that reduce the leverage speed of adjustment (hereafter, SOA). As suggested by Myers (1984), if firms face high costs of leverage adjustment, they may deviate far from the optimal point. Hence, it is important to pay more attention to identifying the costs of converging, and the time taken for any adjustment to occur, rather than just concentrating on refining static trade-off theories.

¹ In this thesis, the terms *leverage adjustment*, *leverage dynamic*, *capital structure dynamic*, and *capital structure adjustment* are used interchangeably as each represents the situation in which firms converge on their target leverage ratios.

Consequently, a new strand of the literature has developed that studies the sources of leverage adjustment costs and determinants of SOA.

Recent studies have explored several determinants of firm's leverage adjustment speed. At the firm level, firm's leverage SOA is associated with the deviation from that target and the firm's financing needs (Byoun, 2008), equity mispricing (Warr, Elliott, Koëter-Kant, & Öztekin, 2012), cash flow features (Faulkender, Flannery, Hankins, & Smith, 2012), corporate governance (Chang, Chou, & Huang, 2014), crash risk exposure (An, Li, & Yu, 2015), debt covenants (Devos, Rahman, & Tsang, 2017), and news media coverage (Dang, Dang, Moshirian, Nguyen, & Zhang, 2019). At the country level, the speed of leverage adjustments depends on the state of the economy (Cook & Tang, 2010), default risks (Elsas & Florysiak, 2011), institutional environment (Öztekin, 2015; Öztekin & Flannery, 2012), business cycle (Halling, Yu, & Zechner, 2016), and political uncertainty (Çolak, Gungoraydinoglu, & Öztekin, 2018). Adding to this strand of research, we propose liquidity, CSP, and EPL as the new and crucial determinants of leverage SOA.

We include three essays in this thesis as firm-level and country-level determinants of the speed that firms adjust to their target leverage ratios. The novelty of this thesis is that the thesis introduces new evidence of the impacts of equity liquidity and CSP as firm-level determinants of leverage adjustments. The thesis further investigates the distinct impacts of liquidity on the leverage SOA for over- and under-levered firms. The potential underlying economic mechanisms through which CSP affects leverage adjustments are also explored. By using an international sample, the thesis examine how country-level environments impact the sensitivity of leverage SOA to liquidity and CSP, hence contributing to the extant literature on the impacts of macro-level institutional environments on corporate capital structure decisions and aggregate financial markets. This thesis also examines one important country-level determinant of

leverage adjustments, that is EPLs. In countries with effective legal enforcement, this association is even more pronounced.

The following sections (1.2 to 1.4) provide an overview of the three essays that are included in this thesis.

1.2. Liquidity and corporate leverage adjustments

The first essay focuses on the association between equity liquidity and corporate leverage adjustments, drawn from two research papers. The first paper, as a pilot study, examines the impact of equity liquidity on leverage SOA using the UK data. The second paper studies the liquidity-leverage SOA association employing data from 35 countries and further investigates the role of institutional environments in shaping this relationship.

Liquidity plays a crucial role in capital structure decisions. The static trade-off model suggests that more liquid firms have lower floatation costs for equity issuance that makes equity financing more attractive than debt financing. Consequently, firms with high liquidity are likely to have lower leverage ratio. Based on US, Thailand, and Australia markets, respectively, Lipson and Mortal (2009), Udomsirikul, Jumreornvong, and Jiraporn (2011) and Nadarajah, Ali, Liu, and Haung (2018) investigate the negative effects of liquidity on firm's capital structure. Using data from 39 countries, Gao and Zhu (2015) show that high-liquidity firms are expected to have lower debt financing in their capital structure and that this relationship is more pronounced in countries with weak institutional environments. These studies, however, focus on the static trade-off view of capital structure. It is, therefore, interesting to know how liquidity affects the dynamic nature of capital structure, specifically the speed at which firms converge their leverage toward the target ratio. Our argument is that greater liquidity is typically associated with lower transaction costs (Amihud & Mendelson, 1986; Butler, Grullon, & Weston, 2005; Hennessy & Whited, 2005; Stoll & Whaley, 1983), lower levels of information

asymmetry (Friewald, Hennessy, & Jankowitsch, 2015; Fulghieri & Lakin, 2001), stronger corporate governance (Edmans, Fang, & Zur, 2013; Maug, 1998; Noe, 2002), lower costs of issuing both debt and equity financing (Cheung, Im, Noe, & Zhang, 2019; Lipson & Mortal, 2009), and, ultimately, lower costs of adjustment to the target leverage. Despite the evidence that equity liquidity and the speed at which firms adjust toward their target leverage are related, and despite the theoretical prediction among them, how liquidity determines firms' leverage SOA is largely unknown to us. The essay fills this knowledge gap. This research further highlights the distinct impact of liquidity on leverage SOA for over- and under-levered firms, and the joint relationship among equity liquidity, leverage deviation, target stability and leverage SOA.

This essay also contributes to the empirical literature on the relation between equity liquidity and capital structure decisions in the UK market. Numerous studies have examined the debt/equity choices of UK firms (Bennett & Donnelly, 1993; Bevan & Danbolt, 2002, 2004; Dang, 2013), though they do not explore the dynamic capital structure adjustments. In addition, whereas several studies investigate leverage adjustments in the US (Devos et al., 2017; Faulkender et al., 2012; Warr et al., 2012), it is unclear whether US findings in dynamic capital structure research are sample-specific and driven by institutional arrangements peculiar to the US market. Therefore, it is important to address whether US results could carry over to other markets.

By using an international sample, the second paper in this essay examines how institutional environments affect the association between liquidity and leverage SOA, thus contributing to the extant literature on the impacts of country-level environments on firm's capital structure decisions and aggregate financial markets. For example, Öztekin and Flannery (2012) suggest that corporations that operate in countries with better institutional settings have lower external financing costs and higher speed of leverage adjustments. Çolak et al. (2018) investigate

whether high-quality institutions attenuate the adverse effects of uncertainty on leverage SOA. Shleifer and Wolfenzon (2002) and La Porta, Lopez-de-Silanes, Shleifer, and Vishny (2002) show that liability enforcement and strict legal disclosure requirements benefit financial market developments, establishing the links between institutional environments and the aggregate financial markets.

1.3. Corporate Sustainability Performance and corporate leverage adjustments

The second essay examines the impact of CSP on corporate leverage adjustments, the potential underlying economic mechanisms through which CSP affects leverage adjustments, and how this association is affected by the country's institutional quality.

Corporate sustainability as a firm's non-financial performance feature has attracted significant attention among companies and their stakeholders in recent decades. CSP presents the extent to which a company simultaneously integrates economic growth, environmental protection, social efficiency, and governance factors into its operations, and ultimately, the influence these elements exert on the firm and society (Artiach, Lee, Nelson, & Walker, 2010). Prior literature recommends that firms with strong CSP potentially have more voluntary disclosure which improves information transparency and reduces agency costs (Dhaliwal, Heitzman, & Li, 2006). Investors are also more patient in receiving negative news and are less responsive to mispricing signals of such firms (Cao, Titman, Zhan, & Zhang, 2020; Starks, Venkat, & Zhu, 2017). This, in turn, makes the firms overvalued, which reduces the cost of equity issuance (Warr et al., 2012). Flammer (2015a), Flammer (2015b) and Cao, Liang, and Zhan (2019) show that CSP is considered as a competitive advantage that helps firms to improve their positions in the product market and increase the expected future cash flow realization. It results in a low marginal capital transaction cost of firms (Faulkender et al., 2012). Stakeholder theory further suggests that with superior CSP, firms are more likely to build long-term relationships with suppliers, customers,

and creditors, thus, improving firms' revenue and profit and enabling them to capitalise on their performance advantages (Bae, El Ghouli, Guedhami, Kwok, & Zheng, 2019; Choi & Wang, 2009; Lins, Servaes, & Tamayo, 2017). Such firms are awarded high ratings by credit rating agencies (Attig, El Ghouli, Guedhami, & Suh, 2013; Stellner, Klein, & Zwergel, 2015). Overall, by reducing the information asymmetry, pushing up the stock prices, improving competitive advantages, and enhancing stakeholder engagements of firms, superior CSP reduces firms' agency costs, transaction costs (Cheng, Ioannou, & Serafeim, 2014), costs of equity capital (Breuer, Müller, Rosenbach, & Salzmänn, 2018; Dhaliwal, Li, Tsang, & Yang, 2011; El Ghouli, Guedhami, Kim, & Park, 2018; El Ghouli, Guedhami, Kwok, & Mishra, 2011), and to some extent, costs of bank loans (Goss & Roberts, 2011). These reduced costs, in turn, could effectively lower the cost of leverage adjustments. This essay contributes to the literature by introducing a new non-financial essential element, CSP, which explains the cross-sectional variation of leverage SOA. The research further investigates the potential underlying economic channels and identifies four mechanisms that explain the link between CSP and speed of leverage adjustments.

By using a broad range of institutional elements, this essay investigates the important role of institutional contexts on capital structure. Institutional environments are generally considered as external mechanisms to reduce agency conflicts (An et al., 2015; Çolak et al., 2018; Öztekin, 2015; Öztekin & Flannery, 2012). They could not only attenuate information asymmetry and distress costs, but also enhance financial flexibility and the accessibility to capital markets. Institutional settings are not controlled by firms and are a less costly means for firms to manage asymmetric information and improve stakeholder engagements. Consequently, strong institutional settings can substitute the role of CSP in increasing the leverage SOA, making the positive association between CSP and leverage SOA less pronounced.

This essay also contributes to the literature on CSP. Previous literature (Cheng et al., 2014; El Ghoul et al., 2018; El Ghoul et al., 2011; Lee & Faff, 2009; Sassen, Hinze, & Hardeck, 2016) emphasize the role of CSP on financial performance, firm risks, costs of external financing, and financial constraints but not on the capital structure. This research sheds light on the important effect of CSP on the dynamic nature of capital structure. Furthermore, to the extent that CSP investments bring firms both benefits and costs (Bae et al., 2019; Cheng et al., 2014; Luo, Meier, & Oberholzer-Gee, 2011), this essay has significant implications for corporate strategic planning on the privately optimal choices of CSP investment.

1.4. Employment Protection Laws and corporate leverage adjustments

The third essay focuses on the impact of EPLs and dynamic leverage adjustments, and how a country's legal enforcement affects this association. Since labour is a key factor of production that impacts corporate performance and the ability to adopt labour regulations is crucial for many features of firms' operation such as innovation (Acharya, Baghai, & Subramanian, 2013, 2014), costs of financing (Alimov, 2015; Chen, Kacperczyk, & Ortiz-Molina, 2011), capital structure (Simintzi, Vig, & Volpin, 2015), and cash holdings (Cui, John, Pang, & Wu, 2018; Karpuz, Kim, & Ozkan, 2020), an investigation of firms' dynamic capital structure in conjunction with EPLs is an important gap to fill in the literature.

The impact of EPLs on leverage SOA is theoretically debatable. On one hand, the stringency of labour regulations limits the flexibility to adjust the workforce, enhances labour adjustment costs and decreases operating flexibility of firms. As a result, rigid labour laws may distort investment and production decisions, negatively impact corporate performance and growth (Autor, Kerr, & Kugler, 2007; Hirsch, 1991), increase distress risks and costs of external capital (Alimov, 2015; Chen et al., 2011; Cui et al., 2018). In addition, previous literature suggests that firms are likely to reserve the information asymmetry when their employees have more

protection (Belkhir, Ben-Nasr, & Boubaker, 2016; Hilary, 2006; Scott, 1994). This, in turn, increases firms' agency costs, costs of leverage adjustment, and reduces leverage SOA. On the other hand, one can debate that the strong labour regulation may protect creditors' wealth by deterring firms from taking high risk investments and corporate takeovers (Pagano & Volpin, 2005; Warga & Welch, 1993) and improve firms' productivity and innovation through worker training, selection, hiring, and retention (Acharya et al., 2013, 2014; Belot, Boone, & Van Ours, 2007; Poschke, 2009). Countries with stringent EPLs, additionally, usually have more friendly political environments for workers that may help large firms in events of financial distress. This, in turn, lowers firms' financial risks, lowers the cost of external financing, and enables firms to adjust more quickly toward their target leverage.

This essay contributes to a growing literature that explores the impacts of labour market mechanisms on various corporate decisions, such as investment activities (Acharya et al., 2013, 2014; Dessaint, Golubov, & Volpin, 2017), governance (Atanassov & Kim, 2009), financing (Agrawal & Matsa, 2013; Chen et al., 2011; Devos & Rahman, 2018; Matsa, 2010; Simintzi et al., 2015), and liquidity management (Cui et al., 2018; Karpuz et al., 2020). The study provides new cross-country empirical evidence on the negative and significant role played by a country's labour protection in determining firms' optimal capital structure decisions. Given the important influences of a country's policies related to workforce on economic agents, our empirical study provides valuable insights on policy implications for the corporate sector. This essay also adds to the dynamic capital structure literature especially the country-level determinants of leverage SOA in conjunction with macroeconomic conditions (Cook & Tang, 2010), institutional features (Öztekin & Flannery, 2012), and political uncertainty (Çolak et al., 2018).

1.5. Structure of the thesis

The remainder of the thesis is organized in five chapters. A brief overview of each chapter is given below. The thesis covers four peer-reviewed papers being categorized in three essays. These papers have been either published or submitted in academic journals at the time of submission. Specifically, Chapter 1 provides an overview of the thesis. Chapter 2 consists of two research papers: “Liquidity and dynamic leverage adjustments: Evidence from the UK” and “Liquidity and speed of leverage adjustment”. Chapter 3 consists of the paper, “The effect of corporate sustainability performance on leverage adjustments”. Chapter 4 consists of the paper entitled, “OECD labour protection and dynamic leverage adjustments”. Chapters 2 to 4 are structured with an abstract, introduction, literature review and hypothesis development, data and variable construction, methodology, empirical results, conclusion, references, and appendix. Chapter 5 concludes with a summary of the thesis’s findings, contributions, limitations and suggestions for future research directions.

Chapter 2

Liquidity and corporate leverage adjustments

Chapter 2 consists of two research papers that investigate the impact of liquidity on corporate leverage adjustments. The first paper, as a pilot study, is entitled, “Liquidity and dynamic leverage adjustments: Evidence from the UK”. This paper has been revised and resubmitted in *Meditari Accountancy Research* (SSCI and ABDC - rank A) in year 2020. The paper examines the relationship between liquidity and leverage SOA using a sample of UK firms over the period of 1996-2016. The results show that firm’s equity liquidity has a positive impact on the speed that firms adjust back to their target ratios. Further analyses imply that highly liquid firms that are over-levered are likely to move more quickly to their targets while the leverage SOA of under-levered firms are not affected by equity liquidity. The paper also documents that the positive relationship between liquidity and SOA is more pronounced for firms whose current position is relatively close to its target leverage ratio and whose target ratio is relatively stable. The second paper entitled “Liquidity and speed of leverage adjustment,” has been published online by *Australian Journal of Management* (SSCI and ABDC –rank A) in year 2020. Using panel analysis of data from 35 countries between 1996 and 2016, the paper shows that high-liquidity firms have a significantly faster SOA than less liquid firms. This result survives a series of robustness checks and holds after addressing the endogeneity concern using exogenous shocks and additional control variables. The paper also provides the evidence that the positive effect of liquidity on the SOA exists only for over-levered firms, and this impact is moderated in countries with bankruptcy codes. The paper further finds that the positive liquidity-SOA relationship is less (more) pronounced for firms in strong (weak) institutional environments.

Liquidity and dynamic leverage adjustments: Evidence from the UK

Abstract

This paper investigates the impact of equity liquidity, leverage deviation and target instability on a firm's dynamic leverage adjustments using a sample of UK firms over the period from 1996 to 2016. Our analyses yield three new findings. First, we find evidence that the firm's equity liquidity has a positive impact on the speed of adjustment (SOA) of its leverage ratio back to the target ratio. Second, further analyses imply that highly liquid firms that are over-levered are likely to move more quickly to their targets while the leverage SOA of under-levered firms are not affected by equity liquidity. Third, we document that the positive relationship between liquidity and SOA is more pronounced for firms whose current position is relatively close to its target leverage ratio and whose target ratio is relatively stable. The results, which are robust to a battery of robustness checks, provide a new insight into the determinants of the SOA.

Key Words: Equity liquidity; leverage adjustment; dynamic trade-off theory; leverage deviation; target leverage instability

JEL classification: C23, C51, G32, G33

1. Introduction

The managerial decision on corporate capital structure is one of the most debated topics by modern finance scholars and practitioners around the world. While the static trade-off theory of capital structure suggests that the value of a firm can be maximized by targeting a leverage ratio that minimizes its cost of capital (Fischer, Heinkel, & Zechner, 1989; Harris & Raviv, 1991), more recently, dynamic trade-off models argue that firms have incentives to adjust their actual debt/equity ratio towards the optimal (target) ratio (Flannery & Rangan, 2006; Hovakimian & Li, 2011). However, if the adjustment is costly, then the speed of adjustment (hereafter SOA) tends to be slowed. Myers (1984) points out that where the costs of leverage adjustment are high, one might expect to see firms to deviate from their target debt-equity ratios by large amounts for extended periods. Hence, an essential task is to explain the cross-sectional differences in the dynamics of corporate capital structure decisions, rather than only concentrating on purifying the traditional static trade-off models (Graham and Leary, 2011). In this paper, we investigate the impact of equity liquidity on leverage SOA in the UK equity market.

Recent research has examined various determinants of dynamic leverage adjustments. At the firm level, the speed that a firm adjusts toward its target leverage depends on the deviation from that target and the firm's financing needs (Byoun, 2008), equity mispricing (Warr, Elliott, Koëter-Kant, & Öztekin, 2012), cash flow features (Faulkender, Flannery, Hankins, & Smith, 2012), corporate governance (Chang, Chou, & Huang, 2014), crash risk exposure (An, Li, & Yu, 2015), debt covenants (Devos, Rahman, & Tsang, 2017), and news media coverage (Dang, Dang, Moshirian, Nguyen, & Zhang, 2019). At the macro and country level, the speed of leverage adjustment is affected by the state of economy (Cook & Tang, 2010), institutional environment (Öztekin & Flannery, 2012), business cycle (Halling, Yu, & Zechner, 2016), and political uncertainty (Çolak, Gungoraydinoglu, & Öztekin, 2018).

Adding to this strand of research, we propose liquidity as a new and important determinant of leverage SOA.

Liquidity plays an important role in firms' financial decisions. Using data of the US market, Lipson and Mortal (2009) and Frieder and Martell (2006) show that firms with high equity liquidity are significantly less leveraged. Based on Thailand and Australian markets, Udomsirikul, Jumreornvong, and Jiraporn (2011) and Nadarajah, Ali, Liu, and Haung (2018) also document the negative relation between liquidity and firms' leverage. However, these studies focus on the static trade-off view of capital structure. Our paper focuses on the impact of equity liquidity on the dynamic capital structure. Our argument is that greater liquidity is typically associated with lower transaction costs, lower levels of information asymmetry, stronger corporate governance, lower costs of issuing both debt and equity financing, and, ultimately, lower costs of adjustment to the target leverage (Amihud & Mendelson, 1986; Berkman & Nguyen, 2010; Dang, Moshirian, Wee, & Zhang, 2015; Lipson & Mortal, 2009). Specifically, Stoll and Whaley (1983) first suggest that illiquid firms have higher stock transaction costs, and thus higher required rate of return from investors. Amihud and Mendelson (1986) argue that transaction costs, like a tax, increase required rate of return for small and illiquid stocks. Looking just at issuance costs, Butler, Grullon, and Weston (2005) show that investment banking fees are lower for more liquid firms. These issuance costs must be acknowledged when raising equity through external financing and are an implicit cost of external equity. Using a theoretical model, Hennessey and Whited (2005) confirm that firms with high liquidity are more likely to have lower transaction costs, and thus lower cost of equity. Cheung, Im, Noe, and Zhang (2019) indicate that firms with high liquidity not only have easier access to the equity market, but also have lower costs of debt financing. Hence, one might expect that equity liquidity would reduce the cost of leverage adjustment, resulting in a faster SOA.

The vast majority of existing studies which address leverage adjustment issues have been based on the US-data (Devos et al., 2017; Faulkender et al., 2012; Liao, Mukherjee, & Wang, 2015; Zhou, Tan, Faff, & Zhu, 2016), with there being sparse evidence of empirical studies on SOA and its determinants in other markets. According to Dimson, Nagel, and Quigley (2003), it is not obvious and dangerous for investors to extend the results from US experience to other countries where capital markets are less developed and corporate ownership much more concentrated. In this study, we take a step in this direction by basing our analysis on the UK market. On one hand, UK is considered a major worldwide economic market. It is large and has grown rapidly in recent years (IMF, 2011). The London Stock Exchange has a huge daily volume of transactions, competing with the major US stock exchanges, such as NYSE and NASDAQ (Charitou, Neophytou, & Charalambous, 2004). Therefore, the UK provides a financial environment “ideal” for the examination of issues on equity liquidity and corporate capital structure decision-making. On the other hand, there are differences between the US and UK in terms of corporate ownership structure, institutional ownership concentration, and the constitution and operation of corporate boards (Short & Keasey, 1999). The UK results can thus add unique insights into the existing literature on corporate capital structure dynamics.

The potential impact of equity liquidity on leverage SOA, furthermore, may be conditional on the position of a firm’s actual leverage relative to its target ratio. Particularly, an over-levered firm should have different strategies from an under-levered firm for adjusting its leverage ratio. A liquid over-levered firm is in an advantageous position to issue more equity and so move toward its target leverage ratio. However, a liquid under-levered firm has a much lower need to issue new equity capital and so benefit from the advantages that stem from the higher equity liquidity. Further, firms deviating too far from targets and/or changing target ratios very frequently have higher financial risks and thus higher cost of equity or

lower equity liquidity (Zhou et al., 2016). These firms, moreover, will be wary of attempting fully adjusting back to their target ratio (Dang, Kim, & Shin, 2014). The reason is that adjustment costs are an increasing function of the target leverage deviation, i.e., there is a proportional cost function (Leary & Roberts, 2005). The firm's managers may also concern that the target leverage ratio might move during the adjustment phase, making it highly unlikely that they will ever achieve their target ratio. In this circumstance, the management feels most comfortable in moving towards the target ratio in small steps and by doing so reducing the impact that equity liquidity will have on the SOA. Hence, we expect that the association between equity liquidity and corporate leverage SOA will be conditional on both the extent of its deviation from and the instability of the target level through time.

Our findings show that firms with higher liquidity reveal a higher leverage SOA to their target level. Further analyses provide evidence that equity liquidity only has a positive impact on the SOA of over-levered firms but no significant impact on that of under-levered firms. In addition, we remark an interactive association among equity liquidity, leverage deviation, target instability, and SOA: the positive association between a firm's equity liquidity and SOA is more pronounced for firms with smaller leverage deviation and/or higher target stability.

The findings of our study contribute to three strands of corporate finance literature. First, while prior studies have well documented the impact of equity liquidity on firms' static capital structure (e.g., Lipson and Mortal, 2009), there has been no prior research that examines the important impact of liquidity on corporate dynamic leverage adjustments. Previous studies show that a highly liquid firm has lower financial transaction costs, which is the main part of leverage adjustment costs (Amihud & Mendelson, 1986). Moreover, high liquidity helps firms to reduce issuing costs of both equity and debt financing (Butler et al.,

2005; Cheung et al., 2019; Hennessy & Whited, 2005). Despite the evidence that equity liquidity and the speed at which firms adjust toward their target leverage are related, and despite the theoretical prediction among them, how liquidity determines firms' leverage SOA is largely unknown to us. Our study fills this knowledge gap.

Second, our study contributes to the empirical literature on the association between equity liquidity and firms' capital structure decisions in the UK market. Although several studies have examined the capital structure choices of UK firms (Bennett & Donnelly, 1993; Bevan & Danbolt, 2002, 2004; Dang, 2013a), they do not investigate the dynamic leverage adjustments. Our study thus fills this important gap in the literature by examining dynamic leverage adjustments in the UK. Specifically, we use a comprehensive sample of UK firms over the period 1996 – 2016 to test our hypotheses. Whereas there are some studies examining leverage adjustments in the US (Devos et al., 2017; Faulkender et al., 2012; Warr et al., 2012), it is unclear whether US findings in dynamic capital structure research are sample-specific and driven by institutional arrangements peculiar to the US market. Therefore, it is important to address whether US results could carry over to other markets.

Third, our study contributes to the empirical literature on the joint relationship among equity liquidity, leverage deviation, target stability and leverage SOA. Prior literature suggests that firms with greater leverage deviation or target instability confront higher financial risks, pay even higher costs of equity and have low equity liquidity (Ippolito, Steri, & Tebaldi, 2012; Zhou et al., 2016) while equity liquidity has been documented to have impacts on leverage adjustments. Given that there is evidence that equity liquidity, leverage deviation, target stability and leverage adjustments are associated, how the first three factors jointly influence leverage adjustments is still unexplored. Our study unveils this gap.

The paper proceeds as follow. Section 2 provides the literature and hypotheses development. Section 3 describes the sample, data collection and variable construction. The empirical methods are reported in section 4 and the results are presented in section 5. The study is concluded in section 6.

2. Literature review and hypotheses development

2.1. Related literature on capital structure and leverage adjustments

The irrelevance framework of Modigliani and Miller (1958), Modigliani and Miller (1963) suggests a logically consistent proof that, with the assumption of “a perfect market” such as unfettered arbitrage opportunities, no possibility of firms’ bankruptcy, and no corporate taxes, the amount of firms’ debt issues does not affect its total market value. Consistent with this theory, numerous studies have found the same results under different and more general assumptions (Hirshleifer, 1966; Stiglitz, 1969, 1972, 1973). However, when relaxing the assumption of no corporate taxes and given that firms’ interest payments are deductible from taxable income, the total market value of the firm may be influenced by changes in its level of debts, and this has resulted in the development of a number of capital structure theories.

The trade-off theory predicts that firms will maintain an optimal capital structure that maximizes firm value by balancing the benefits (e.g., interest tax shield) and costs (e.g., financial distress costs) of debts (DeAngelo & Masulis, 1980; Kim, 1978; Kraus & Litzenberger, 1973; Robichek & Myers, 1965). A large number of studies support the targeting behaviour of firms, such as Leary and Roberts (2005), Flannery and Rangan (2006), and Lemmon, Roberts, and Zender (2008) for US firms, and Ozkan (2001), Bunn and Young (2004), Beattie, Goodacre, and Thomson (2006), Antoniou, Guney, and Paudyal (2006) for UK firms. Firms may take different paths to their optimal capital structure at potentially heterogeneous rates (Fischer et al., 1989; Flannery & Rangan, 2006; Lemmon et al., 2008;

Ramjee & Gwatidzo, 2012). The source of this asymmetry is the differences in the costs of adjustment that firms face. Fischer et al. (1989) develop a dynamic trade-off model and show that firms may have a range of optimal ratios. Bunn and Young (2004) and Flannery and Rangan (2006) confirm that UK and US firms, respectively, do not identify a strict target leverage, but rather a range over which their target ratios are allowed to vary.

Contrast with the trade-off theory, Myers and Majluf (1984) endorse the pecking order theory. Accordingly, there is a capital hierarchy in financing firms' investments: internally generated funds are the first resort for financing, then debt, and equity issues is the last (Shyam-Sunder & Myers, 1999). This pecking order to financing could arise due to the asymmetry in the tax code (Stiglitz, 1973) or asymmetric information and adverse selection (Heaton, 2002; Myers, 2003; Shyam-Sunder & Myers, 1999). Implicitly, the pecking order theory suggests that firms would have neither strong preference about their debt-equity ratios nor strong inclination to reserve capital structure changes caused by financing needs or profitability growth.

Overall, whereas the trade-off theory predicts the existence of target leverage and firms' adjustment towards such targets, the pecking order theory does not (Barclay, Smith, & Morellec, 2006). Nevertheless, several previous studies suggest that an integrated context that combines the arguments of both trade-off and pecking order models should be built (Fama & French, 2002). Beattie et al. (2006) indicate the essential need for a model combining factors of the trade-off and pecking order theories and suggest that when examining the target leverage, we can reconcile such two competing theories. Hovakimian, Opler, and Titman (2001) and Kayhan and Titman (2007) show that though firms have optimal leverage, they still prefer internal funds to external financing. Barclay and Smith (2005) comment that along with many other different types of costs and benefits, adverse

selection cost can affect firms' financing decision-making. Thereby, with the existence of information costs, although firms have target leverage ratios, they still prefer internal financing (Leary & Roberts, 2005; Strebulaev, 2007). Supporting this stream of argument, Frank and Goyal (2003) explain that "the pecking order theory implies that the financing deficit ought to wipe out the effects of other variables. If the financing deficit is simply one factor among many that firms trade-off, then what is left is a generalized version of the trade-off theory". By doing a survey with 392 CFOs in the US about the cost of capital, capital budget and capital structure, Graham and Harvey (2001) ask directly whether firms have an optimal or target leverage. The results show that 10% of firms have strict target leverage, 34% have a somewhat tight target or range, and 37% have a flexible target. For others who do not have tight or somewhat strict targets, they still seem to set and try to move back to the targets, even they do not recognize that operation. Similarly, Correia and Cramer (2008) do a survey in South Africa and find that only 21% of the firms did not follow a target debt-equity ratio. For others who follow a target, 34% of companies had a somewhat tight target debt-equity ratio. Dissanaik, Lambrecht, and Seabra (2001) conclude that there are about 60% of UK firms which pursue a target leverage ratio. In sum, while the evidence is far from conclusive, on balance it seems that some form of target or target range is employed by firms, consistent with the logic of the trade-off theory (Beattie et al., 2006).

At which speed that we expect firms to adjust toward the target leverage? Previous literature suggests that firms facing different levels of adjustment cost have different speeds of converging to the target ratios. In particular, Leary and Roberts (2005) provide evidence that the cost of leverage adjustment significantly affects firms' behavior regarding leverage rebalancing. Furthermore, Strebulaev (2007) and Goldstein, Ju, and Leland (2001) find that firms adjust their capital structure more frequently when the transaction costs are relatively low. Dang et al. (2014) address both cross-sectional and time-varying heterogeneity in the

speed of capital structure dynamics. This has motivated a line of research into what the sources of these adjustment costs are and how they can explain cross-sectional variations in the SOA. Lööf (2004) argues that firms which diverge further away from their optimal leverage have relatively slower leverage SOA. Warr et al. (2012) find that the mispricing of equity affects firms' SOA, and this association depends on whether the firm is under- or over-levered. Chang et al. (2014) and Liao et al. (2015) suggest an association between corporate governance and dynamic leverage adjustments, indicating that better governed firms face lower costs of adjustment and so will adjust more quickly towards their targets. An et al. (2015) show a negative link between the crash-risk exposures of firms and leverage SOA although this link is attenuated in countries with transparent information environments. Zhou et al. (2016) and Devos et al. (2017) study the effects on the leverage SOA of a firm's cost of equity capital and debt covenants, respectively. Most recently, Dang et al. (2019) show that greater news coverage and more positive news sentiment increase the leverage SOA significantly. The effects of macroeconomic conditions, political uncertainty, business cycles and institutional factors on the SOA have also been investigated (Çolak et al., 2018; Cook & Tang, 2010; Drobetz & Wanzenried, 2006; Öztekin & Flannery, 2012). In brief, though this strand of research has investigated several significant factors that affect a firm's leverage SOA, the question of whether equity liquidity has an impact on the leverage SOA, which is the focus of our study, remains silent.

Our study also relates to the capital structure literature in the UK market. Marsh (1982) finds that market conditions and the history of security prices are important determinants of firms in choosing between debt and equity. He also suggests that firms appear to make their choice of financing sources as if they have target levels of debt in mind. Ozkan (2001) indicates that UK firms do have target leverage ratios and converge to such targets relatively quickly (above 50%). Antoniou et al. (2006) highlight that firms in three European countries

(including the UK) adjust their leverage at different speeds to reach target structures and provide evidence that environmental factors and traditions are important determinants of leverage SOA. On the other hand, Watson and Wilson (2002) examine the UK market and highlight that the pecking order model provides a more empirically plausible explanation of the changes in financing than the static trade-off model, mainly for small and medium-sized firms. Examining a sample of 218 UK firms from 1964 to 1990 using an error correction model, Dissanaik et al. (2001) find that one financing approach is not likely to be descriptive for all firms. Employing the same method but larger sample size and more recent study period (including 1340 UK firms over the period 1980-2007), Dang (2013b) suggests that UK, French and German firms adjust towards target leverage quickly in both the partial adjustment and error correction models, which is consistent with the trade-off theory. They further highlight that the trade-off theory explains these firms' capital structure decisions better than the pecking order theory in the models nesting the two theories and pecking order considerations are of minor importance to UK, German and French firms. In sum, there is a growing literature examining UK firms. However, these studies have only examined either the determinants of capital structure, or one of the trade-off and pecking order theories. We are the first study to examine the determinant of speed of leverage adjustment in this important market.

2.2. Hypothesis development

There has been a stream of literature that documents the role of equity liquidity on firms' capital structure decisions. Stoll and Whaley (1983) suggest that it is desirable to consider the transaction costs when evaluating the investments on stocks and claim that investors require higher rates of return on small and illiquid firms. Brennan and Subrahmanyam (1996) and Brennan, Chordia, and Subrahmanyam (1998) provide other important evidence of the

negative relationship between equity liquidity and the cost of capital, that is, higher equity liquidity means lower cost of capital. Cheung et al. (2019) further highlight that more liquid firms are more likely to access debt financing and have lower costs of debt compared to their counterparties. In sum, firms with higher liquidity have lower costs of capital and are easier to access external financing sources.

Liquidity can also influence the transaction costs associated with raising new external equity capital. First, an illiquid firm has to offer a discount on the current share price to attract the capital that it requires. This discount is reflected by the magnitude of the bid-ask spread and price impact of issuing new equity (Bundgaard & Ahm, 2012; Silber, 1991). This view is supported by Amihud and Mendelson (1986) who find that the illiquidity of a firm's equity is valued in the market. Thereby, illiquid stocks tend to be traded at a discount. Second, when a firm raises new equity capital, it incurs the issuance fees that an issuer will have to pay institutions who assist it in the fund-raising process. Butler et al. (2005) find that institutions charge higher issuance fees for less liquid firms as they are faced with greater risks. The bottom line is that firms with higher equity liquidity will have lower transaction costs associated with issuing new equity and so have greater incentives to rapidly correct any deviation of its actual leverage level from its target.

In addition, information is likely to be another important channel between equity liquidity and leverage SOA. This argument suggests that greater liquidity facilitates more informed trading and produces more information about the firm (Friedwald, Hennessy, & Jankowitsch, 2015; Fulghieri & Lukin, 2001). Consequently, stock liquidity helps to reduce adverse selection and equity mispricing, thus lowering the agency costs, and thereby, reduce leverage adjustment costs and increase the speed of leverage adjustment (Öztekın, 2015; Öztekın & Flannery, 2012).

In our analysis, we address the previous discussion by studying the association between the firm's equity liquidity and the speed at which it adjusts the leverage ratio to the target. We propose the first hypothesis as follows:

H1: Equity liquidity has a positive impact on leverage SOA.

As previously discussed, it is likely that higher equity liquidity translates into lower costs associated with raising additional equity capital, and therefore, higher leverage SOA. However, this impact may depend on whether the firm is over-levered or under-levered. Specifically, an over-levered firm can adjust by either issuing more equities, repurchasing debts or some combination of the two. The actual course that an over-levered firm will pursue is very much dependent on its funding needs. As the assets of the firms in our sample are growing on average by slightly more than 5% p.a., an over-levered firm will have to both expand its funding and correct its over-levered position, which suggests that it is more likely for such firms to issue new equity capital (Brennan et al., 1998; Brennan & Subrahmanyam, 1996). Hence, one would think that higher equity liquidity would be of direct benefit to these over-levered firms. An under-levered firm adjusting back to its target can issue more debt, repurchase equity, or combine these two approaches. Again, as the firms in our sample are on average expanding, this increases the likelihood that firms will have to largely relying on issuing debt to correct their capital structure imbalance and so the liquidity of their equity will be far less important than it is for over-levered firms.

From the above discussion, we propose the next hypothesis:

H2: The impact of equity liquidity on the SOA is stronger for over-levered and under-levered firms.

Finally, we consider how the deviation from target ratios and instability in these ratios affect the association between equity liquidity and leverage SOA. We have already raised the possibility that highly liquid firms are positively associated with fast leverage SOA, which is a result of the lower cost of leverage adjustment. However, because of the far deviation from or high instability of its target leverage ratio, it is possible that a firm should pay a penalty in the form of higher cost of equity capital. Specifically, a firm with higher deviation from or higher instability in its target level will confront higher financial risks, which influence the required rate of return on corporate equity capital, and hence, leave greater costs of equity capital and lower equity liquidity for the firm. Consistent with this argument, Zhou et al. (2016) derive a theoretical link between leverage deviation and costs of equity and confirm that the firm's cost of equity positively relates to the deviation from its target level of leverage. Ippolito et al. (2012) also suggest the significantly positive association between the deviation from target and the expected equity return (then, cost of equity capital). Specifically, investors require a higher expected equity return for firms that deviate further from the target leverage. These firms, consequently, confront greater cost of equity that leads to lower equity liquidity. Accordingly, the question that we raise here is whether the magnitude of the positive relationship between equity liquidity and leverage SOA will be impacted by the extent of the deviation between the actual and the target ratios and/or the stability of target ratios of firms.

Building on the above discussion, we investigate the following hypotheses:

H3: The positive impact of equity liquidity on leverage SOA is less pronounced for firms that deviate further from target ratios.

H4: The positive impact of equity liquidity on leverage SOA is less pronounced for firms that have higher instability in target ratios.

3. Data and variable construction

3.1. Data

The annual firm-level and industry-level accounting data are retrieved from Worldscope via the Datastream database. To estimate liquidity measures, we collect daily data (e.g., bid/ask price, trading volume and stock return) from this database. Only data for firms with common securities are collected whereas those with distinct characters, for instance warrants, trusts, funds, and non-equity stocks, are excluded. Financial and utility corporations are also eliminated from the sample since these corporations are subject to special regulations on financing policies. Following conventional practices (Halling et al., 2016), the subsequent screens are applied to our sample. Firm-year observations in cases where the book value of total assets or market capitalization is zero are dropped. Firm-year observations with negative net sales or a net leverage ratio of less than -1 are also removed. Additionally, we remove firm-years with book leverage ratios or market leverage ratios missing or greater than one. To avoid outliers, very small firms that have average book values of total assets less than 10 million US dollars are excluded. By applying all the above screens, the final sample contains 20,090 firm-year observations for the UK market during the period from 1996 to 2016. Finally, to reduce the possible impacts of extreme values, we winsorize both the dependent and independent variables at the 1st and 99th percentiles.

3.2. Variable construction

3.2.1. Leverage measurements

Based on existing studies (An et al., 2015; Chang et al., 2014; Halling et al., 2016), we use both the book ratio (*BLEV*) and the market ratio (*MLEV*) of leverage as dependent variables. Specifically, we define the book leverage ratio as:

$$BLEV_{i,t} = \frac{D_{i,t}}{TA_{i,t}} \quad (1)$$

where $D_{i,t}$ is the book value of firm i 's interest-bearing debt (i.e., the sum of short-term and long-term book value of interest-bearing debt) at time t , and $TA_{i,t}$ is the book value of firm i 's total assets at time t .

We define the market leverage ratio as follows:

$$MLEV_{i,t} = \frac{D_{i,t}}{D_{i,t} + S_{i,t}P_{i,t}} \quad (2)$$

where $D_{i,t}$ is the book value of firm i 's interest-bearing debt (the sum of short-term and long-term book value of interest-bearing debt) at time t , $S_{i,t}$ is the number of common shares outstanding and $P_{i,t}$ is the stock price per share at time t .

3.2.2. Equity liquidity

We have four proxies for equity liquidity: Amihud illiquidity (Amihud, 2002), zero-return proportion (Lesmond, Ogden, & Trzcinka, 1999), daily percentage quoted spread (Chung & Zhang, 2014; Fong, Holden, & Trzcinka, 2017), and turnover (Berkman & Nguyen, 2010; Lipson & Mortal, 2009). In the main analysis, we use Amihud illiquidity score which is the most popular measure of liquidity (Lipson & Mortal, 2009; Nadarajah et al., 2018). We also test the robustness of our findings using the other three alternative measures. Note that while turnover is a measure of liquidity, the three other measures provide an inverse measure of liquidity (or inverse liquidity).

Specifically, the Amihud (2002) illiquidity measure is defined as the average ratio of the daily absolute stock return divided by the dollar value of volume:

$$LIQ_{i,t,d} = \frac{|R_{i,t,d}|}{DVOL_{i,t,d}} \quad (3)$$

where R_{itd} is the stock return of firm i on day d in year t , $DVOL_{itd}$ is the daily volume in dollars of firm i on day d in year t . This ratio reflects the change of daily stock price related to one trading volume dollar, in other words, the daily price impact of the trading flow.

In this study, we use the annual average of this daily liquidity measure for each stock i :

$$LIQ_{i,t} = 1/D_{i,t} \sum_1^{D_{i,t}} \frac{|R_{i,t,d}|}{DVOL_{i,t,d}} \quad (4)$$

where $D_{i,t}$ is the number of days for which the volume of stock i in year t is positive:

The other three measures of liquidity that we employ are:

1. Following Lesmond et al. (1999) and Goyenko, Holden, and Trzcinka (2009), we define zero-return proportion ($Propzero_{i,t}$) as a proxy for liquidity, which is the proportion of trading days that have no change in price over the year (zero return) from the previous day. This measure is suggested due to two reasons. First, illiquid stocks have a higher probability of having days without any trading volume and hence, zero return. Second, illiquid stocks have higher transaction costs and more difficulties to acquire private information. Consequently, even these stocks have positive trading volume days, they confront the difficulty in obtaining the relevant information and thus, are more likely to have zero-return days.

2. Following Chung and Zhang (2014) and Fong et al. (2017), we also define the daily closing percent quoted spread ($Spread_{i,t}$) as a proxy for liquidity, i.e., daily closing bid-ask spread divided by the midpoint spread averaged over the number of positive volume days. These studies show that the simple daily bid-ask spread measure provides a good approximation of equity liquidity. This measure is also highly correlated with the bid-ask spread from intraday data. Note that this is also an inverse measure of liquidity (essentially measure of trading costs or illiquidity). The annual average of this daily liquidity proxy for each stock i is measured as follows:

$$Spread_{i,t} = 1/D_{i,t} \sum_1^{D_{i,t}} \frac{Closing\ Ask_{i,t,d} - Closing\ Bid_{i,t,d}}{(Closing\ Ask_{i,t,d} + Closing\ Bid_{i,t,d})/2} \quad (5)$$

where $Closing\ Ask_{i,t,d}$ is the closing ask price of stock i on day d in year t , $Closing\ Bid_{i,t,d}$ is the closing bid price of stock i on day d in year t , and $D_{i,t}$ is the number of days for which the volume of stock i in year t is positive.

3. Turnover ($Turnover_{i,t}$) has been widely used as a proxy of liquidity in the literature (e.g., Datar, Naik, and Radcliffe (1998); and Berkman and Nguyen (2010)). The daily turnover is calculated as the ratio of number of shares traded on a day to the total number of shares outstanding. The average value of daily turnover across all trading days in that year defines the yearly turnover of the stock. Using turnover rate as a measure of liquidity has a strong theoretical support. Amihud and Mendelson (1986) document that equity liquidity and trading frequency have a significant correlation. Therefore, the turnover rate is an appropriate indirect proxy of liquidity. Specifically, the higher the turnover is, the more liquid the stock is.

3.2.3. Target leverage

The current literature on capital structure suggests that the target level of a firm's leverage is a function of time-varying firm characteristics and industrial elements (An et al., 2015; Devos et al., 2017; Fama & French, 2002; Flannery & Hankins, 2013; Flannery & Rangan, 2006; Frank & Goyal, 2009; Rajan & Zingales, 1995). There are different sets of determinants that have been used in the previous studies to achieve a reliable estimate of the target leverage ratio. The variables used in the various studies differ but are essentially different variables to proxy for the same firm characteristics. For instance, firm size is measured using either total assets in some studies (e.g., Zhou et al. (2016); Devos et al. (2017)) or sales in other studies (e.g., Halling et al. (2016); Uysal (2011)). Since these proxies are highly correlated, the choice of which one to use is unlikely to be important

(Frank & Goyal, 2009). Following Flannery and Hankins (2013) and An et al. (2015), we regress the observed leverage ratio (LEV) on a set of leverage determinants, that is:

$$LEV_{i,t+1} = \alpha_i + \beta X_{i,t} + \mu_{i+1}, \quad LEV \in \{BLEV, MLEV\} \quad (6)$$

where each firm is indexed by i and time by t . $X_{i,t}$ is a vector of firm and industry variables associated with the operation costs and benefits with different leverage levels including firm size ($Size_{i,t}$), tangibility ($Tang_{i,t}$), growth opportunity ($MTB_{i,t}$), profitability ($Prof_{i,t}$), depreciation ($Dep_{i,t}$), research and development ($RD_{i,t}$), a research and development dummy ($RDDum_{i,t}$), and industry median of leverage ($IndMed_{i,t}$)². The trade-off hypothesis predicts that $\beta \neq 0$, and the variation in $LEV_{i,t+1}$ is nontrivial. We also note that by modeling optimal capital structure in period $t+1$ as a function of determinants observed in period t , then the endogeneity concerns are somewhat mitigated.

We measure the target leverage ratio of each firm as the fitted value obtained from equation (6):

$$LEV_{i,t+1}^* = \hat{\beta} X_{i,t} \quad (7)$$

3.2.4. Leverage deviation

The deviation from the target level is measured as the absolute difference between the target and the observed leverage ratio:

$$Lev_Dev_{i,t} = |LEV_{i,t}^* - LEV_{i,t}| \quad (8)$$

where $LEV_{i,t}^*$ is the target leverage ratio defined above and $LEV_{i,t}$ is the observed leverage ratio of firm i at time t .

² Please refer to Appendix A for the definition of variables.

3.2.5. Target instability

Based on Kayhan and Titman (2007), the instability in the target ratio of leverage is measured as:

$$\Delta Target_{i,t} = LEV_{i,t}^* - LEV_{i,t-1}^* \quad (9)$$

where $LEV_{i,t}^*$ and $LEV_{i,t-1}^*$ are the target leverage ratios of firm i at time t and $t-1$, respectively. The higher level of $\Delta Target_{i,t}$ is, the more unstable the target leverage is.

4. Empirical methods

The dynamic trade-off theory of capital structure argues that firms have an optimal target capital structure. If there is no cost of adjustments, the firm would have no incentive to deviate from this target, and the adjustment speed would be instantaneously one. However, due to market imperfections such as asymmetric information and financing costs, firms may temporarily deviate from their target leverage. The standard partial adjustment model measures the rate at which the firm converges its leverage to the target ratio. There are two methods to estimate this model as suggested by prior research. A two-step method is used by Hovakimian and Li (2011), Chang et al. (2014), An et al. (2015) and Çolak et al. (2018). The first step involves obtaining an estimate of the target leverage ratio following the procedures described previously. The partial adjustment model is then estimated based on the target ratio obtained in the first step to calculate a measure of the leverage SOA. The one-step approach is a reduced-form model from the two-step method to achieve the estimate of the SOA directly (Flannery & Rangan, 2006). The details of the one-step and two-step approaches are provided below.

4.1. Two-step model to estimate SOA

In the two-step model, the SOA is estimated by two steps. First, the target leverage ratio is estimated as in the section 3.2.3. Next, the leverage SOA is obtained by estimating the standard partial adjustment model of capital structure shown below:

$$LEV_{i,t+1} - LEV_{i,t} = \alpha_0 + \partial(LEV_{i,t+1}^* - LEV_{i,t}) + \omega_{i,t+1} \quad (10)$$

where ∂ is a measure of aggregate leverage SOA of firms that diverge away from the target of next period. The gap between the target and actual leverage ratios declines over time and thus, ∂ is greater than zero. Further, because of the existence of adjustment costs, firms do not fully converge to the target level in one period, resulting in ∂ being smaller than one.

4.2. One-step model to estimate SOA

In the one-step approach of partial adjustment model, the target leverage estimated from Eq. (7) is substituted into Eq. (10). The specification is rearranged to yield the model as follows:

$$LEV_{i,t+1} = \alpha_0 + (1 - \partial)LEV_{i,t} + \partial\beta X_{i,t} + \omega_{i,t+1} \quad (11)$$

To test our hypotheses, we follow the one-step method (Flannery & Rangan, 2006; Halling et al., 2016), which gives us the estimates of leverage SOA from estimating a single equation. The advantage of the one-step model is that it does not require a separate estimate of the unobservable target leverage and thus avoid any estimation errors arising from generated regressors as in the two-step models (Pagan, 1984).

4.3. Effect of liquidity on SOA

We follow Cook and Tang (2010), Devos et al. (2017) and Zhou et al. (2016) and augment Eq. (11) with an equity liquidity variable ($LIQ_{i,t}$) and an interaction term to test the

significance of $LIQ_{i,t}$ on the leverage SOA (**H1**). In particular, the equity liquidity variable ($LIQ_{i,t}$) is proxied by Amihud illiquidity measure. The interaction term is the product of the equity liquidity ($LIQ_{i,t}$) and the first lag of the firm's actual leverage ratio. We model this economic relation as follows:

$$LEV_{i,t+1} = \alpha_0 + (1 - \partial)LEV_{i,t} + \beta_1 LIQ_{i,t} + \beta_2 (LIQ_{i,t} \times LEV_{i,t}) + \partial \beta X_{i,t} + \omega_{i,t+1} \quad (12)$$

In Eq. (12), our main focus is the coefficient of the interaction term $LIQ_{i,t} \times LEV_{i,t}$. Since we hypothesize that equity liquidity has a positive impact on the SOA (**H1**), and the variable $LIQ_{i,t}$ is proxied by the Amihud illiquidity measure, we expect the coefficient on the interaction term, β_2 , to be positive³. This implies that the coefficient on the lagged leverage is smaller for firms with higher equity liquidity and hence, they exhibit a faster SOA (∂).

To address the second hypothesis as to whether the effect of equity liquidity on leverage SOA differs for under- and over-levered firms (**H2**), we re-estimate Eq. (12) for both categories of firms. To do so, we divide the sample into two sub-samples with one group being entirely composed of firms whose actual leverage ratio is above its target and the other group composed of firms whose actual leverage ratio is below its target. If the position of actual leverage relative to the target ratio has an impact on the relation between equity liquidity and leverage SOA, we expect that the interaction between equity liquidity and leverage ratio ($LIQ_{i,t} \times LEV_{i,t}$) is more significant and positive for over-levered subsample but far less or even insignificant for under-levered subsample.

³ As ∂ indicates the leverage SOA, a positive β_2 indicates a negative relationship between Amihud score ($LIQ_{i,t}$) and leverage SOA. However, as Amihud score ($LIQ_{i,t}$) is an illiquidity measure (Amihud and Mendelson, 1996), a positive β_2 implies a positive relationship between equity liquidity and leverage SOA.

4.4. Effect of liquidity on SOA: conditional on leverage deviation and target change

Our next hypotheses (**H3** and **H4**) relate to how the relationship between equity liquidity and SOA is conditional on leverage deviation and target stability. To examine this issue, following Devos et al. (2017), we include the triple interaction terms among equity liquidity, actual leverage ratio and leverage deviation/ target stability in the SOA regression (Eq. (12)). Specifically, the augmented models take the following forms:

$$\begin{aligned}
 LEV_{i,t+1} = & \alpha_0 + (1 - \partial_0)LEV_{i,j,t} + \beta_1LIQ_{i,j,t} + \beta_2(LIQ_{i,t} \times LEV_{i,t}) + \beta_3LevDev_{i,t} \\
 & + \beta_4(LIQ_{i,t} \times LevDev_{i,t}) + \beta_5(LevDev_{i,t} \times LEV_{i,t}) \\
 & + \beta_6(LIQ_{i,t} \times LEV_{i,t} \times LevDev_{i,t}) + \partial_j\beta X_{i,t} + \omega_{i,t+1}
 \end{aligned} \tag{13}$$

$$\begin{aligned}
 LEV_{i,t+1} = & \alpha_0 + (1 - \partial_0)LEV_{i,j,t} + \beta_1LIQ_{i,j,t} + \beta_2(LIQ_{i,t} \times LEV_{i,t}) + \beta_3\Delta Target_{i,t} \\
 & + \beta_4(LIQ_{i,t} \times \Delta Target_{i,t}) + \beta_5(\Delta Target_{i,t} \times LEV_{i,t}) \\
 & + \beta_6(LIQ_{i,t} \times LEV_{i,t} \times \Delta Target_{i,t}) + \partial_j\beta X_{i,t} + \omega_{i,t+1}
 \end{aligned} \tag{14}$$

$$\begin{aligned}
 LEV_{i,t+1} = & \alpha_0 + (1 - \partial_0)LEV_{i,j,t} + \beta_1LIQ_{i,j,t} + \beta_2(LIQ_{i,t} \times LEV_{i,t}) + \beta_3LevDev_{i,t} \\
 & + \beta_4(LIQ_{i,t} \times LevDev_{i,t}) + \beta_5(LevDev_{i,t} \times LEV_{i,t}) \\
 & + \beta_6(LIQ_{i,t} \times LEV_{i,t} \times LevDev_{i,t}) + \beta_7\Delta Target_{i,t} \\
 & + \beta_8(LIQ_{i,t} \times \Delta Target_{i,t}) + \beta_9(\Delta Target_{i,t} \times LEV_{i,t}) \\
 & + \beta_{10}(LIQ_{i,t} \times LEV_{i,t} \times \Delta Target_{i,t}) + \partial_j\beta X_{i,t} + \omega_{i,t+1}
 \end{aligned} \tag{15}$$

where Eq. (13) is used to examine the hypothesis **H3**, Eq. (14) is used to examine the hypothesis **H4**, and Eq. (15) is the combination of both hypotheses.

As previously discussed, there is likely to be a negative relationship between the costs of adjusting the leverage ratio and the liquidity of a firm's equity. This will translate into firms with more liquid equity having a greater incentive to adjust to their target ratio. The question

is what the impact of leverage deviation and target instability have on this incentive. We propose that firms with greater leverage deviation and/or target instability would have higher financial risks and pay penalties in the form of higher costs of equity capital and thus, have lower equity liquidity. Hence, we might expect a positive sign on the interaction term $LIQ_{i,t} \times LEV_{i,t}$ and negative signs on the triple interaction terms $LIQ_{i,t} \times LEV_{i,t} \times LevDev_{i,t}$ and $LIQ_{i,t} \times LEV_{i,t} \times \Delta Target_{i,t}$. We use leverage deviation and target instability as dummy variables by assigning “1” for high leverage deviation (high target instability), and “0” for low leverage deviation (low target instability) based on the median value. Specifically, if values of leverage deviation (target instability) are higher than the median, then they represent high leverage deviation (target instability); otherwise, low leverage deviation (target instability). To further confirm the results, we also examine these relationships for over- and under-levered firms by re-estimating the Eq. (15) for the two sub-samples.

4.5. Econometric method

Since all the main specifications in this paper are dynamic panel data models, traditional pooled OLS or firm fixed effects estimators would result in biased and inconsistent estimates (Baltagi, 2008). Specifically, whereas the pooled OLS estimator is likely to overestimate the coefficient of the dynamic variable $(1 - \delta)$ and thus underestimating the level of SOA (δ), the firm fixed effects model produces biased estimates because of the potential correlations between the dynamic variable and the error term. Particularly, the firm fixed effects model underestimates the coefficient of the dynamic variable, hence, overestimates the SOA (Nickell, 1981). The inconsistency is more likely to occur in case of relatively short period of sample data (Flannery & Hankins, 2013). Hence, the use of OLS in this study would have implications for the inferences that we could draw from the findings.

Due to the limitations of the pooled OLS and firm fixed effects models and the dynamic nature of our panel models, we follow the recent research and use Blundell and Bond (1998)'s two-step system GMM. This is the most reliable method to estimate the dynamic short panels with the lagged dependent variable and endogenous independent variables (Flannery & Hankins, 2013; Zhou et al., 2016). In applying the two-step system GMM, we estimate our model by exploring suitable instruments for the dynamic variable(s) (e.g., leverage ratios, interaction terms between leverage ratios and main variables), that is, lagged values of the dynamic term(s).

5. Empirical results

5.1. Descriptive statistics

The summary statistics for the entire sample are presented in Table 1, which includes descriptive statistics (Panel A) and correlation coefficients of the determinants of the target leverage (Panel B). In our sample, the mean book leverage ratio is 0.1793 and the mean market leverage is 0.1981. The extent of the cross-sectional variation is illustrated by the difference between the first quartile of the book (market) leverage ratio of 0.0211 (0.0138) and the third quartile at 0.2805 (0.3099). In terms of the liquidity measure, the means of Amihud, zero-return day's proportion, turnover and daily quoted spread measures are 23.1187, 0.3495, 0.2820 and 0.0531, respectively. The mean book leverage deviation (0.1102) is lower than the mean market leverage deviation (0.1349). On average, the absolute change in target market leverage (0.0085) is higher than that in target book leverage (0.0031). In our sample, the average value of asset tangibility-total assets ratio is 27.35%, market-to-book ratio is 2.528, profitability-total assets ratio is 6.55%, depreciation-total assets ratio is 4.57% and R&D-total assets ratio is 2.22%. Panel B reports the correlations

among the determinants of the target leverage ratio. We see that these correlations are low suggesting that there is little concern with multicollinearity.

Table 1. Summary Statistics

This table reports the descriptive statistics including the mean, standard deviation, minimum, maximum, first quantile, median, and third quantile of firm- level and industry-level variables for the entire sample in Panel A, and correlation coefficients in Panel B. The study period is from 1996 to 2016. The variable definitions are in Appendix A.

Panel A. Descriptive Statistics

Variables	N	Mean	Std. Dev	Min	Max	p25	Median	p75
<i>BLEV</i>	20090	0.1793	0.1725	0.0000	0.7615	0.0211	0.1472	0.2805
<i>MLEV</i>	20090	0.1981	0.2085	0.0000	0.8648	0.0138	0.1405	0.3099
<i>Amihud</i>	18132	23.1187	58.7806	0.0010	407.2400	0.3287	3.3604	16.1732
<i>PropZero</i>	18780	0.3495	0.3594	0.0040	2.5000	0.0711	0.3320	0.4941
<i>Turnover</i>	18102	0.2820	0.2799	0.0115	1.7022	0.1094	0.1998	0.3490
<i>Spread</i>	19957	0.0531	0.0565	0.0006	0.3036	0.0157	0.0361	0.0698
<i>LevDev</i> <i>(BLEV)</i>	16545	0.1102	0.0894	0.0000	0.7024	0.0489	0.0947	0.1444
<i>LevDev</i> <i>(MLEV)</i>	16545	0.1349	0.1151	0.0000	0.8283	0.0550	0.1075	0.1765
Δ <i>Target</i> <i>(BLEV)</i>	13825	0.0031	0.0288	-0.2119	0.3128	-0.0109	0.0029	0.0165
Δ <i>Target</i> <i>(MLEV)</i>	13825	0.0085	0.0513	-0.3079	0.3178	-0.0220	0.0068	0.0355
<i>SIZE</i>	20090	11.4956	1.8997	8.7321	17.0757	10.0095	11.1488	12.6488
<i>TANG</i>	20023	0.2735	0.2558	0.0004	0.9385	0.0566	0.1981	0.4227
<i>MTB</i>	19967	2.5282	2.3529	0.3000	9.5700	0.9600	1.7100	3.1300
<i>PROF</i>	19849	0.0655	0.1904	-0.8162	0.4525	0.0209	0.0995	0.1638
<i>DEP</i>	20015	0.0457	0.0435	0.0001	0.3004	0.0202	0.0367	0.0572
<i>RD</i>	20090	0.0222	0.0786	-0.0084	2.9404	0.0000	0.0000	0.0059
<i>RDDum</i>	20090	0.3142	0.4642	0.0000	1.0000	0.0000	0.0000	1.0000
<i>INDMED</i> <i>(BLEV)</i>	20090	0.1529	0.1381	0.0000	0.7308	0.0441	0.1260	0.2251
<i>INDMED</i> <i>(MLEV)</i>	20090	0.1570	0.1540	0.0000	0.6875	0.0266	0.1167	0.2395

Panel B. Correlation coefficients of determinants of target leverage

	<i>SIZE</i>	<i>TANG</i>	<i>MTB</i>	<i>PROF</i>	<i>DEP</i>	<i>RD</i>	<i>RDDum</i>	<i>INDMED</i> (<i>BLEV</i>)	<i>INDMED</i> (<i>MLEV</i>)
<i>SIZE</i>	1								
<i>TANG</i>	0.1598*	1							
<i>MTB</i>	0.0138	-0.0889*	1						
<i>PROF</i>	0.2488*	0.1555*	0.0996*	1					
<i>DEP</i>	-0.0787*	0.2097*	0.1685*	0.0725*	1				
<i>RD</i>	-0.1411*	-0.1340*	0.1800*	-0.2602*	0.1121*	1			
<i>RDDum</i>	0.0470*	-0.1879*	0.1049*	-0.0563*	0.0603*	0.4170*	1		
<i>INDMED</i> (<i>BLEV</i>)	0.1866*	0.3139*	0.0702*	0.1568*	0.2296*	-0.1077*	-0.1175*	1	
<i>INDMED</i> (<i>MLEV</i>)	0.2143*	0.2617*	-0.2073*	0.0572*	-0.0013	-0.1850*	-0.1450*	0.7143*	1

In order to illustrate the consistency of our target leverage specifications with prior studies, we report the coefficient estimates in Panel A of Table 2 where we use a panel regression with both firm and year fixed effects. We also correct the standard errors for both heteroscedasticity and clustering (Zhou et al., 2016). We confirm that our results are consistent with the findings of the existing literature (An et al., 2015; Flannery & Rangan, 2006; Öztekin & Flannery, 2012; Zhou et al., 2016). Specifically, for both book and market leverages, the use of debt in the target leverage increases with firm size, tangibility, depreciation and industry median leverage, and decreases with the profitability.

Next, the summary statistics for estimated average target leverage during the period 1996 - 2016 are presented in Panel B of Table 2 for both the book leverage and market leverage ratios. Over the sample period, the median target leverage is 0.129 for book leverage and 0.125 for market leverage and the mean annual cross-sectional target leverage fluctuates between -0.099 and 0.225 for book leverage, and between -0.038 and 0.278 for market leverage. Consistent with the existing literature (Frank & Goyal, 2009), the medians of both book and market leverages are below the target leverage.

Table 2. Target capital structure estimation results

This table presents the target capital structure regression results (Panel A)

$$LEV_{i,t+1}^* = \hat{\beta}X_{i,t}$$

and reports the summary statistics of firm's average target leverage ratio for the sample period from 1996 to 2016. In Panel A, the dependent variable is book leverage and market leverage (column 1 and 2, respectively) The first column lists each of target leverage determinants used in the target leverage regression. Appendix A provides detailed definitions and data sources for these variables. We include both firm and year fixed effect in regressions. The standard errors are corrected for heteroscedasticity and firm clustering. *** and ** represent significance at 1% and 5% levels, respectively. The p-values are in parenthesis.

Panel A. Parameter estimates from fixed-effect regressions on determinants of capital structure

VARIABLES	BLEV _{t+1} (1)	MLEV _{t+1} (2)
<i>SIZE</i>	0.0174*** (0.000)	0.0323*** (0.000)
<i>TANG</i>	0.109*** (0.000)	0.117*** (0.000)
<i>MTB</i>	0.0026*** (0.005)	-0.0032*** (0.000)
<i>PROF</i>	-0.0450*** (0.000)	-0.108*** (0.000)
<i>DEP</i>	0.216*** (0.000)	0.235*** (0.001)
<i>RD</i>	0.0291 (0.259)	-0.0035 (0.886)
<i>RDDUM</i>	-0.0024 (0.653)	0.0003 (0.964)
<i>INDMED</i>	0.297*** (0.000)	0.395*** (0.000)
Constant	-0.373*** (0.000)	-0.248*** (0.000)
Year fixed effects	Yes	Yes
Observations	16,545	16,545
R-squared	0.103	0.186
Number of id	2,412	2,412

Panel B. Post target estimation summary statistics

VARIABLES	N	Mean	Std. Dev	Min	P25	Median	P75	Max
Target (BLEV)	16545	0.182	0.070	-0.099	0.463	0.129	0.172	0.225
Target (MLEV)	16545	0.209	0.109	-0.038	0.666	0.125	0.195	0.278

5.2. Equity liquidity and SOA: baseline results

We present the results from the baseline regression (Eq. 12), which determines the equity liquidity – SOA relationship (**H1**), in Table 3. All these regressions are estimated using the two-step system GMM method. The results are presented for both book leverage ($BLEV_{i,t}$) and market leverage ($MLEV_{i,t}$) separately. The variables of interest in this regression are the interaction terms between book/market leverage ($LEV_{i,t}$) and equity liquidity that is proxied by the Amihud illiquidity measure ($LIQ_{i,t}$) (Columns 1-2).

The coefficient on the interaction terms between equity liquidity ($LIQ_{i,t}$) and leverage ratios ($LEV_{i,t}$) are positive and highly significant at the 1% level for both book and market leverage regressions. Since the relationship between equity liquidity and leverage SOA is addressed by the coefficients of the interaction terms of illiquidity measure and leverage, ($LIQ_{i,t} \times LEV_{i,t}$), with the same magnitude but opposite sign, there is a negative relationship between the Amihud illiquidity measure and leverage SOA. However, as a low Amihud score is indicative of high liquidity (Amihud & Mendelson, 1986; Lipson & Mortal, 2009), our findings imply a positive link between equity liquidity and the SOA. It suggests that firms with high (low) liquidity have lower (higher) overall adjustment costs, which results in higher (lower) SOA. This is consistent with our previous discussion, which suggests that firms with illiquid equity would have to offer a larger discount on any new shares issued and incur larger fees associated with the issue.

Table 3. The effects of liquidity on the speed of leverage adjustment – Baseline results

This table reposts the regression results for the effect of liquidity on the speed of adjustment using the two-step system GMM estimator for the following models:

$$LEV_{i,t+1} = \alpha_0 + (1 - \partial_0)LEV_{i,t} + \beta_1 LIQ_{i,t} + \beta_2 LEV_{i,t} * LIQ_{i,t} + \beta_3 X_{i,t} + \omega_{i,t+1},$$

Where the dependent variable (*LEV*) is measured by either book leverage (*BLEV*) or market leverage (*MLEV*). *LIQ* is Amihud illiquidity measure, which is defined as average ratio of the daily absolute stock return to its dollar volume. All the explanatory variables are lagged by one year relative to the dependent variable (*LEV*). The variable definitions are contained in Appendix A. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. The p-values are in parenthesis.

VARIABLE	BLEV_{t+1} (1)	MLEV_{t+1} (2)
<i>LEV</i>	0.6460*** (0.000)	0.8330*** (0.000)
<i>LIQ</i>	-0.0001*** (-0.000)	-0.0001*** (-0.000)
<i>LIQ x LEV</i>	0.0007*** (0.000)	0.0002*** (0.001)
<i>SIZE</i>	0.0051*** (0.000)	0.0004 (0.525)
<i>TANG</i>	0.0618*** (0.000)	0.0864*** (0.000)
<i>MTB</i>	0.0031*** (0.000)	0.0049*** (0.000)
<i>PROF</i>	0.0358*** (0.000)	0.0327*** (0.000)
<i>DEP</i>	0.2140*** (0.000)	-0.0422 (0.366)
<i>RD</i>	-0.0112 (0.621)	-0.0667*** (0.000)
<i>RDDUM</i>	-0.0051* (0.061)	-0.0077*** (0.001)
<i>INDMED</i>	0.0662*** (5.456)	-0.0818*** (0.000)
<i>Constant</i>	-0.0308*** (0.004)	0.0843*** (0.000)
Year FE	Yes	Yes
Observations	14,925	14,925
Number of id	2,260	2,260
AR(2)	0.4406	0.6778
P-value Hansen test	0.3796	0.3121

Regarding the economic significance, a standard deviation increase of one in liquidity increases the SOA by 1.18% - 4.11%, compared with an average adjustment speed of 24.1%

for book leverage and 17.9% for market leverage⁴. In other words, an average firm takes about 2.5 to 3.5 years to adjust half of the deviation between the actual and the target leverage. This duration decreases to about 2 to 3 years for firms with high liquidity⁵. In general, the results support our first hypothesis that liquidity boosts the leverage SOA. Firms with high liquidity are charged lower transaction costs in issuing financial capital and have lower asymmetric information that leads to lower agency costs. Consequently, such firms have a higher leverage SOA.

With regard to the signs and significance levels of the control variables across models, the results are generally consistent with theoretical expectations and prior empirical evidence (An et al., 2015; Öztekin & Flannery, 2012). In particular, firms with larger size, higher tangibility of assets, higher market-to-book ratios, higher profitability or lower R&D investments use more leverage. Meanwhile, the depreciation ratio has mixed results. Furthermore, as reported in Table 3, interestingly, the effect of current equity liquidity on next year's leverage ratio depends on the leverage ratio of this year. Specifically, if the firm has a high level of leverage, the equity liquidity has a negative impact on next year's leverage ratio. In other words, the higher a firm's liquidity, the lower the firm's leverage ratio (Frieder & Martell, 2006; Lipson & Mortal, 2009). However, this negative relationship shrinks with the reducing of the leverage level and turns positive when the leverage ratio is very low. It implies that at the very low level of leverage, liquid firms will take the advantage of liquidity to retire the equity and increase the leverage ratio. This argument is consistent with the trade-off theory⁶.

⁴ To compute the economic significance of liquidity on leverage SOA, we take the product of the coefficients and sample standard deviation of liquidity measure (An et al., 2015; Colak et al., 2018).

⁵ The half-life time is calculated as $\ln(0.5)/\ln(1-SOA)$.

⁶ We also run the regression without the interaction term between leverage ratio and equity liquidity to see how equity liquidity affect next year's leverage level. The results show that there is a negative relationship between equity liquidity and leverage ratio that is consistent with the literature (Frieder and Martell, 2006; Lipson and Mortal, 2009).

We also present results of two diagnostic tests including the AR(2) second-order serial correlation test and the Hansen J test of over-identifying restriction. Specifically, AR(2) tests show the p-values of 0.4406 and 0.6778 for the book and market leverage regressions, respectively. These results imply that our system GMM specifications do not suffer from the second-order serial correlation. Further, the p-values of Hansen J tests of 0.3796 and 0.3121 for book and market leverage regressions, respectively, confirm the validity of all our instruments. In sum, the results of these specifications imply that the dynamic system GMM model specification is appropriate.

5.3. Robustness checks

5.3.1. Two-step approach

Thus far, we have shown that liquidity has positive and statistically significant impacts on leverage SOA using one-step approach. In this specification, following previous literature (Cook & Tang, 2010; Devos et al., 2017; Zhou et al., 2016), we use an interaction term between liquidity and leverage ratio to test the significance of liquidity on SOA. However, given that both liquidity and the first lag of the firm's actual leverage ratio have highly significant impacts on leverage ratio, this method may not fully assess whether including the interaction variable improves the model. In this session, we check the robustness of our baseline results using the two-step approach (Çolak et al., 2018; Dang et al., 2019; Faulkender et al., 2012).⁷

⁷ We thank the anonymous reviewer for pointing out this issue.

Table 4. The effects of liquidity on the speed of leverage adjustment – Two-step approach

This table reports the regression results for the effect of liquidity on the leverage speed of adjustment:

$$\Delta LEV_{i,t+1,j} = \alpha_0 + (\partial_0 + \beta_1 LIQ_{i,t,j} + \theta X_{i,t,j}) (Dist_{i,t,j}) + \omega_{i,t+1,j}$$

The dependent variable is the change in book and market leverage ratio ($\Delta LEV_{i,t+1,j}$). $Dist_{i,t,j}$ is the different between the target leverage ratio and the actual leverage ratio. $LIQ_{i,t,j}$ is proxied by Amihud. $X_{i,t,j}$ is the vector of control variables that includes firm size (*Size*), market to book ratio (*MTB*), profitability (*Prof*), research and development expenses (*RD*), research and development dummy (*RDDum*), Tangibility (*Tang*), Depreciation expenses (*Dep*), Industry-median leverage (*INDMED*). Year fixed effects are included in Models (1) - (2). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A1.

VARIABLES	BLEV _{t+1} (1)	MLEV _{t+1} (2)
<i>Dist</i>	0.4198*** (8.2016)	0.4181*** (10.1673)
<i>LIQ*Dist</i>	0.0005*** (2.8741)	0.0009*** (12.897)
<i>SIZE*DIST</i>	-0.0174*** (-4.5114)	-0.0194*** (-5.7574)
<i>TANG*DIST</i>	-0.0544* (-1.9463)	-0.0749*** (-2.6512)
<i>MTB*DIST</i>	0.0059** (1.9725)	0.0008 (0.1930)
<i>PROF*DIST</i>	0.1466** (2.3782)	-0.1156** (-2.1450)
<i>DEP*DIST</i>	-0.1978 (-0.9407)	0.3542 (1.4117)
<i>RD*DIST</i>	-0.1771 (-1.4627)	-0.4759*** (-4.6397)
<i>RDDUM*DIST</i>	-0.0070 (-0.4121)	-0.0238 (-1.5764)
<i>INDMED*DIST</i>	-0.1196** (-2.5058)	0.1341** (2.2862)
<i>Constant</i>	-0.3225*** (-9.8335)	0.1307*** (5.9600)
Year FE	Yes	Yes
Observations	15,202	15,202
R-square	0.1480	0.1173

In Eq. (10), ∂ is a measure of aggregate SOA of firms that diverge away from the target of the next period. The dynamic trade-off theory suggests that firms should adjust when there

is a gap between the target and the real leverage ratios (estimated as $Dist_{i,t} = LEV_{i,t+1}^* - LEV_{i,t}$). To examine the relationship between liquidity and leverage SOA, we include liquidity in the regression which determines a firm's speed of leverage adjustment. Öztekin and Flannery (2012) also suggest that firm accounting variables may affect both target leverage and SOA. We use a set of covariates that are used in the target leverage estimation (vector $X_{i,t,j}$). Thus, ∂ varies with liquidity and control variables:

$$\partial = \partial_0 + \beta_1 LIQ_{i,t,j} + \theta X_{i,t,j} \quad (16)$$

Substituting Eq. (16) back to Eq. (10) yields the equation for a partial adjustment model with heterogeneity in the leverage SOA:

$$\Delta LEV_{i,t+1,j} = \alpha_0 + (\partial_0 + \beta_1 LIQ_{i,t,j} + \theta X_{i,t,j}) (Dist_{i,t,j}) + \omega_{i,t+1,j} \quad (17)$$

where $\Delta LEV_{i,t+1,j} = LEV_{i,t+1,j} - LEV_{i,t,j}$.

Eq. (17) includes a pooled OLS regression of leverage changes on the product of $Dist_{i,t,j}$ and liquidity and control variables with bootstrapped standard errors to account for the generated regressors (Çolak et al., 2018; Faulkender et al., 2012; Pagan, 1984).

Table 4 reports the results. The coefficients of interaction between liquidity and distance from target are positive and statistically significant across models, implying a positive relationship between liquidity and leverage SOA. This is consistent with our baseline finding.

5.3.2. The impact of outliers

In the baseline analyses, following the literature on dynamic capital structure, all continuous variables are winsorized at the 1st and 99th percentiles to alleviate the impact of outliers (Dang et al., 2019; Devos et al., 2017). Classical statistics such as the mean and standard deviation are sensitive to extreme values. Therefore, we winsorize the variables to robustify

classical statistics by reducing the impact of extreme observations. However, as suggested by Tukey (1960), all of the statistical formulas are based on the assumption that the data are a random sample that contains all of the observed values, even extreme values. He notes that the tails of a distribution are extremely important, and indiscriminately modifying large and small values invalidates many of the statistical analyses that we take for granted.⁸

In this subsection, we re-run the baseline specification with the original data that we get from Datastream without winsorization. The results are presented in Table 5. For brevity, only main coefficients of interest in examining our hypotheses are presented. Specifically, the coefficients on the interaction $LIQ \times LEV$ are positive and statistically significant at the 1% level for both book and market leverage regressions. This indicates that our baseline findings that show the positive relationship between liquidity and leverage SOA (**H1**) are robust even without data adjustments.

5.3.3. Alternative measures of leverage

In the main analyses, both book and market leverages are used as primary measures of the leverage ratio (An, Li, & Yu, 2016; Öztekin, 2015). However, previous research has different definitions of debt (Devos et al., 2017; Zhou et al., 2016). The main difference lies in whether we need to take only long-term debt or total debt that comprises current liability into account. Debt may also be re-measured to include other firm liabilities. Thus, the robustness of our key findings is tested by including two other definitions of corporate leverage ratio: long-term debt to the book value of assets (LDA) and long-term debt to market value of assets (LDM). Details of the measurement of these alternative proxies of leverage are provided in Appendix A.

⁸ We thank the Associate Editor for raising this concern.

Table 5. Robustness check: Baseline results without data winsorization

This table reposts the regression results for the effect of liquidity on the speed of adjustment without data winsorization using the two-step system GMM estimator for the following models:

$$LEV_{i,t+1} = \alpha_0 + (1 - \partial_0)LEV_{i,t} + \beta_1 LIQ_{i,t} + \beta_2 LEV_{i,t} * LIQ_{i,t} + \beta_3 X_{i,t} + \omega_{i,t+1},$$

Where the dependent variable (*LEV*) is measured by either book leverage (*BLEV*) or market leverage (*MLEV*). *LIQ* is Amihud illiquidity measure, which is defined as average ratio of the daily absolute stock return to its dollar volume. All the explanatory variables are lagged by one year relative to the dependent variable (*LEV*). The variable definitions are contained in Appendix A. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. The p-values are in parenthesis.

VARIABLE	BLEV _{t+1} (1)	MLEV _{t+1} (2)
<i>LEV</i>	0.6572*** (47.1003)	0.8049*** (77.4424)
<i>LIQ</i>	-0.0001*** (-3.8361)	-0.0001*** (-4.8934)
<i>LIQ x LEV</i>	0.0007*** (5.8996)	0.0002*** (4.3015)
<i>Control</i>	Yes	Yes
Year fixed effects	Yes	Yes
Observations	14,925	14,925
Number of id	2,260	2,260
AR(2)	0.0405	0.0623
P-value Hansen test	0.5166	0.0550

Table 6. Robustness check: Alternative leverage measures

This table reports the regression results for the effect of liquidity on the speed of adjustment using the two-step system GMM estimator for the following models:

$$LEV_{i,t+1} = \alpha_0 + (1 - \partial_0)LEV_{i,t} + \beta_1 LIQ_{i,t} + \beta_2 LEV_{i,t} * LIQ_{i,t} + \beta_3 X_{i,t} + \omega_{i,t+1},$$

Where the dependent variable (*LEV*) is measured by either long-term book leverage (*LDA*) that is measured as long-term debt to the book value of assets or long-term market leverage (*LDM*) that is measured as long-term debt to the market value of assets. *LIQ* is Amihud illiquidity measure which is defined as average ratio of the daily absolute stock return to its dollar volume. All the explanatory variables are lagged by one year compared to the dependent variable (*LEV*). The variable definitions are in Appendix A. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. The p-values are in parenthesis.

VARIABLES	LDA _{t+1} (1)	LDM _{t+1} (2)
<i>LEV</i>	0.7190*** (0.000)	0.7040*** (0.000)
<i>LIQ</i>	-0.0001*** (0.006)	-0.0000 (0.992)
<i>LIQ x LEV</i>	0.0009*** (0.000)	-0.0002 (0.832)
<i>Control</i>	Yes	Yes
Year fixed effects	Yes	Yes
Observations	10,938	10,938
Number of id	1,609	1,609

We tabulate the robustness test for our baseline results in Table 6. With various measures of financial leverage, Table 6 presents the regression results for the association between equity liquidity and leverage SOA (**H1**). Compared with the key findings from Table 3, the regression results in Table 6 confirm the significantly positive relationship (at the 1% level) between equity liquidity and leverage SOA for book leverage regression, but insignificant for market leverage model.

5.3.4. Alternative measures of liquidity

In this subsection, we examine the robustness of our main finding using alternative measures of equity liquidity, including zero return proportion (*PropZero*), turnover (*Turnover*) and daily closing percent quoted spread (*Spread*). Results are reported in Table 7.

Table 7. Robustness check: Alternative liquidity measures

This tables reports the regression results for the effects of other liquidity measures including proportion of zero-return days, turnover, and daily quoted spread to test the association between equity liquidity and leverage using two-step system GMM for the following models:

$$LEV_{i,t+1} = \alpha_0 + (1 - \partial_0)LEV_{i,t} + \beta_1 PropZero_{i,t} + \beta_2 LEV_{i,t} * PropZero_{i,t} + \beta_3 X_{i,t} + \omega_{i,t+1}$$

$$LEV_{i,t+1} = \alpha_0 + (1 - \partial_0)LEV_{i,t} + \beta_1 Turnover_{i,t} + \beta_2 LEV_{i,t} * Turnover_{i,t} + \beta_3 X_{i,t} + \omega_{i,t+1}$$

$$LEV_{i,t+1} = \alpha_0 + (1 - \partial_0)LEV_{i,t} + \beta_1 Spread_{i,t} + \beta_2 LEV_{i,t} * Spread_{i,t} + \beta_3 X_{i,t} + \omega_{i,t+1}$$

Where the dependent variable (*LEV*) is measured by either book leverage (*BLEV*) or market leverage (*MLEV*). *PropZero_{i,t}* is a liquidity measure which is the proportion of trading days in the year that had zero price change (zero return) from the previous day. *Turnover_{i,t}* is another measure of liquidity, which is defined as the number of shares traded on a day, divided by the total number of share outstanding. Spread is the daily closing percent quoted spread (*Spread_{i,t}*) as daily closing bid-ask spread divided by the midpoint spread averaged over the number of positive volume days. All the explanatory variables are lagged by one year compared to the dependent variable (*LEV*). The variable definitions are in Appendix A. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. The p-values are in parenthesis.

VARIABLES	PropZero		Turnover		Spread	
	BLEV _{t+1} (1)	MLEV _{t+1} (2)	BLEV _{t+1} (3)	MLEV _{t+1} (4)	BLEV _{t+1} (5)	MLEV _{t+1} (6)
<i>LEV</i>	0.840*** (0.000)	0.732*** (0.000)	0.853*** (0.000)	0.884*** (0.000)	0.774*** (0.000)	0.840*** (0.000)
<i>PropZero</i>	-0.0406 (0.144)	-0.0250* (0.066)				
<i>PropZero x LEV</i>	0.284*** (0.008)	0.183*** (0.001)				
<i>Turnover</i>			0.0081** (0.016)	0.0037 (0.328)		
<i>Turnover x LEV</i>			-0.0436*** (0.000)	-0.0541*** (0.000)		
<i>Spread</i>					-0.156*** (0.002)	-0.176*** (0.000)
<i>Spread x LEV</i>					1.168*** (0.000)	0.453*** (0.000)
<i>Control</i>	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	15,469	15,469	14,925	14,925	16,457	16,457
Number of id	2,298	2,298	2,260	2,260	2,400	2,400

Columns 1-2, 3-4 and 5-6 report the results for *PropZero*, *Turnover*, and *Spread*, respectively. We find consistent results as in Table 3. Specifically, in columns 1-2, the coefficients of the interaction term *LEV_{i,t} x PropZero_{i,t}* are positive and statistically significant at the 1% level for both book and market leverage regressions. As *PropZero* is

an illiquidity measure, these results confirm that liquidity has a positive impact on leverage SOA. Next, as a liquidity measure, the negative coefficients of the interaction term $LEV_{i,t} \times Turnover_{i,t}$ also suggest a statistically significant relationship at the 1% level between equity liquidity and leverage SOA (columns 3-4) for both book and market leverage models. The results on *Spread* are similar which indicate a significantly positive liquidity – leverage SOA relation (columns 5-6) at the 1% level. These results further support our baseline finding **(H1)**.

5.4. Effect of liquidity on SOA for under- and over-levered firms

Table 8 presents the results of estimating Eq. (12) separately for under- and over-levered firms for both book and market leverages to examine whether the impact of equity liquidity on leverage SOA differs for under- and over-levered firms **(H2)**. We find that the coefficients of the interaction term between equity liquidity and the leverage ratio are significantly positive at the 1% level for over-levered firms where book and market values are used. However, these same coefficients are statistically insignificant in the case of under-levered firms. It implies that equity liquidity positively affects the SOA of over-levered firms but has no impact for under-levered firms. As explained previously, over-levered firms are most likely to raise equity to correct the imbalance and they are even more motivated to do so if they enjoy high equity liquidity. For under-levered firms, they are most likely to correct the imbalance by issuing debt, which is relatively unaffected by the state of the liquidity of its equity. The analyses on median percentage changes of equity and debt finance for under- and over-levered firms confirm this argument. Specifically, for liquid subsample, while the over-levered firms issue greater amount of equity in the long term and remain at a stable debt level, the under-levered firms issue very high rates of debt and relatively low rates of equity. This result is inconsistent with the recent study of Cheung et al. (2019), which

suggests the high liquidity can significantly reduce the cost of debts rather than the cost of equity. If this is the case, under-levered firms, which need to issue debts to adjust to their target leverage, should also have the significantly positive relation between liquidity and leverage SOA.

Furthermore, our results show that the adjustment of under-levered firms are relatively smaller compared to over-levered firms. It implies that over-levered firms have either lower costs or larger benefits of adjusting back to the targets. Specifically, the coefficients of the lagged value of leverage ratios ($LEV_{i,t}$) that measure the SOA ($1 - \delta$) are around 0.6 for over-levered firms and around 0.9 for under-levered firms. This suggests an annual adjustment speed of around 40% for over-levered firms but only around 10% for under-levered firms. Our results are consistent with Byoun (2008) who suggests that the costs of maintaining an over-levered position is much higher than those of keeping an under-levered position and Faulkender et al. (2012) who suggest that convergence toward targets is more important for over-levered firms. Despite being under-levered, such firms choose to deviate from their target leverage ratios to balance the future financing needs and avoid the cost of re-issuing and repurchasing equity.^{9,10}

⁹ The results of AR(2) second-order serial correlation tests and Hansen J tests of over-identifying restrictions indicate that the dynamic system GMM model is valid.

¹⁰ In unreported tables, we also check the robustness of this finding using alternative measures of leverage and alternative measures of liquidity. The results also confirm the positive linkage between liquidity and leverage SOA for over-levered firms and no relationship for under-levered firms.

Table 8. The effects of liquidity on the speed of leverage adjustment for over- and under-levered firms

This table reposts the regression results for the effect of liquidity on the speed of adjustment for over- and under-levered firms using the two-step system GMM estimator for the following models in two separated subsamples:

$$LEV_{i,t+1} = \alpha_0 + (1 - \partial_0)LEV_{i,t} + \beta_1 LIQ_{i,t} + \beta_2 LEV_{i,t} * LIQ_{i,t} + \beta_3 X_{i,t} + \omega_{i,t+1},$$

Where the dependent variable (*LEV*) is measured by either book leverage (*BLEV*) or market leverage (*MLEV*). *LIQ* is Amihud illiquidity measure, which is defined as average ratio of the daily absolute stock return to its dollar volume. All the explanatory variables are lagged by one year compared to the dependent variable (*LEV*). The variable definitions are in Appendix A. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. The p-values are in parenthesis.

VARIABLES	BLEV _{t+1}		MLEV _{t+1}	
	Over-levered (1)	Under-levered (2)	Over-levered (3)	Under-levered (4)
<i>LEV</i>	0.527*** (0.000)	0.959*** (0.000)	0.601*** (0.000)	0.842*** (0.001)
<i>LIQ</i>	-0.0003*** (0.000)	0.0001 (0.298)	-0.0003*** (0.000)	-0.0008 (0.370)
<i>LIQ x LEV</i>	0.0013*** (0.000)	-0.0008 (0.351)	0.0007*** (0.000)	0.0071 (0.137)
<i>SIZE</i>	0.0038*** (0.001)	0.0048** (0.035)	0.0070*** (0.000)	-0.0023 (0.853)
<i>TANG</i>	0.0478*** (0.000)	0.0141 (0.554)	0.0991*** (0.000)	-0.0682 (0.505)
<i>MTB</i>	0.0041*** (0.000)	0.0048 (0.197)	0.0057*** (0.000)	0.0124 (0.447)
<i>PROF</i>	-0.0014 (0.873)	0.0286* (0.084)	-0.0308*** (0.000)	0.0345 (0.847)
<i>DEP</i>	0.596*** (0.000)	-0.184 (0.250)	0.0989*** (0.000)	-0.591 (0.368)
<i>RD</i>	0.201*** (0.002)	-0.0045 (-0.921)	-0.0517 (0.127)	-0.294 (0.429)
<i>RDDUM</i>	-0.0178*** (0.000)	-0.0023 (0.708)	-0.0131*** (0.000)	0.0394 (0.198)
<i>INDMED</i>	0.0250** (0.030)	-0.212*** (0.001)	0.0012 (0.859)	-0.1830 (0.347)
<i>Constant</i>	0.0748*** (0.000)	-0.0648** (0.017)	0.0216** (0.036)	0.0483 (0.723)
Year fixed effects	Yes	Yes	Yes	Yes
Observations	6,311	8,614	5,558	9,367
Number of id	1,507	1,714	1,493	1,782
AR(2)	0.2002	0.3031	0.1042	0.4170
P-value Hansen test	0.7747	0.0002	0.0941	0.1043

5.5. Effect of liquidity on SOA: conditional on leverage deviation and target change

Next, we investigate whether the positive relationship between equity liquidity and leverage SOA varies conditional on the low and high levels of leverage deviation (**H3**), and low and high levels of target instability (**H4**). Estimation results for Eq. (13-15) are reported in Table 9.

Panel A presents the results for the full sample. The coefficients of the interaction term ($LIQ_{i,t} \times LEV_{i,t}$) are positive and highly significantly (at the 1% level) in the case of both book and market leverages in all regressions (columns 1-6), implying that the equity liquidity has a positive effect on the leverage SOA. Columns 1 and 2 test hypothesis 3 by including the triple interaction term $LIQ_{i,t} \times LEV_{i,t} \times LevDev_{i,t}$. The results show that the coefficients on this triple interaction term are negative and highly significant at the 1% level, indicating that leverage deviation has a negative impact on the positive association between equity liquidity and SOA. Hypothesis 4 is tested in columns 3 and 4. Specifically, the coefficients of the triple interaction term $LIQ_{i,t} \times LEV_{i,t} \times \Delta Target_{i,t}$ are negative and statistically significant at the 1% level, which implies that the positive relation between equity liquidity and leverage SOA is less pronounced for firms with higher target instability. To further confirm these findings, we include both triple interaction terms, $LIQ_{i,t} \times LEV_{i,t} \times LevDev_{i,t}$ and $LIQ_{i,t} \times LEV_{i,t} \times \Delta Target_{i,t}$, in columns 5 and 6. The results confirm that both coefficients are significantly negative, suggesting that the impact of equity liquidity on SOA is greater for firms with a smaller deviation from target and a more stable target leverage ratio. In sum, these results suggest that larger leverage deviation and greater target instability result in higher costs and uncertainty associated with adjusting back to the target (Zhou et al., 2016).

Table 9. The effects of liquidity on the speed of leverage adjustment – Conditional on leverage deviation and target instability

This tables reports the regression results for the effects of liquidity measures on the leverage SOA in high and low leverage deviation firms, and high and low instability in target, based on whether the firm’s leverage deviation position/instability in target is above or below the median for full sample and for over- and under-levered firms separately using two-step system GMM for the following model:

$$\begin{aligned} LEV_{i,t+1} = & \alpha_0 + (1 - \partial_0)LEV_{i,j,t} + \beta_1LIQ_{i,j,t} + \beta_2(LIQ_{i,t} * LEV_{i,t}) + \beta_3LevDev_{i,t} \\ & + \beta_4(LIQ_{i,t} * LevDev_{i,t}) + \beta_5(LevDev_{i,t} * LEV_{i,t}) \\ & + \beta_6(LIQ_{i,t} * LevDev_{i,t} * LEV_{i,t}) + \partial_j\beta X_{i,t} + \omega_{i,t+1}, \end{aligned}$$

$$\begin{aligned} LEV_{i,t+1} = & \alpha_0 + (1 - \partial_0)LEV_{i,j,t} + \beta_1LIQ_{i,j,t} + \beta_2(LIQ_{i,t} * LEV_{i,t}) + \beta_3\Delta Target_{i,t} \\ & + \beta_4(LIQ_{i,t} * \Delta Target_{i,t}) + \beta_5(\Delta Target_{i,t} * LEV_{i,t}) \\ & + \beta_6(LIQ_{i,t} * \Delta Target_{i,t} * LEV_{i,t}) + \partial_j\beta X_{i,t} + \omega_{i,t+1}, \end{aligned}$$

$$\begin{aligned} LEV_{i,t+1} = & \alpha_0 + (1 - \partial_0)LEV_{i,j,t} + \beta_1LIQ_{i,j,t} + \beta_2(LIQ_{i,t} * LEV_{i,t}) + \beta_3LevDev_{i,t} \\ & + \beta_4(LIQ_{i,t} * LevDev_{i,t}) + \beta_5(LevDev_{i,t} * LEV_{i,t}) \\ & + \beta_6(LIQ_{i,t} * LevDev_{i,t} * LEV_{i,t}) + \beta_7\Delta Target_{i,t} + \beta_8(LIQ_{i,t} * \Delta Target_{i,t}) \\ & + \beta_9(\Delta Target_{i,t} * LEV_{i,t}) + \beta_{10}(LIQ_{i,t} * \Delta Target_{i,t} * LEV_{i,t}) + \partial_j\beta X_{i,t} \\ & + \omega_{i,t+1}, \end{aligned}$$

Where the dependent variable (*LEV*) is measured by either book leverage (*BLEV*) or market leverage (*MLEV*). *LIQ* is Amihud illiquidity measure, which is defined as average ratio of the daily absolute stock return to its dollar volume. All the explanatory variables are lagged by one year compared to the dependent variable (*LEV*). The variable definition are in Appendix A. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. The p-values are in parenthesis.

Panel A. Full sample

VARIABLES	Hypothesis 3		Hypothesis 4		Both hypotheses	
	BLEV _{t+1} (1)	MLEV _{t+1} (2)	BLEV _{t+1} (3)	MLEV _{t+1} (4)	BLEV _{t+1} (5)	MLEV _{t+1} (6)
<i>LEV</i>	0.7380*** (0.000)	0.8020*** (0.000)	0.6920*** (0.000)	0.6560*** (0.000)	0.8000*** (0.000)	0.6210*** (0.000)
<i>LIQ</i>	-0.0005*** (0.000)	-0.0002*** (0.000)	-0.0001 (0.122)	-0.0004*** (0.000)	-0.0002*** (0.000)	-0.0024*** (0.000)
<i>LIQ x LEV</i>	0.0024*** (0.000)	0.0005*** (0.000)	0.0007*** (0.000)	0.0004*** (0.006)	0.0012*** (0.000)	0.0063*** (0.000)
<i>LevDev</i>	-0.0260*** (0.000)	0.0176*** (0.000)			-0.0056*** (0.000)	0.0303*** (0.000)
<i>LEV x LevDev</i>	0.0806*** (0.000)	-0.111*** (0.000)			0.0133*** (0.000)	-0.102*** (0.000)
<i>LIQ x LevDev</i>	0.0003*** (0.000)	0.0001*** (0.000)			0.0002*** (0.000)	0.0019*** (0.000)
<i>LIQ x LEV x LevDev</i>	-0.0018*** (0.000)	-0.0004*** (0.000)			-0.0008*** (0.000)	-0.0048*** (0.000)
<i>ΔTarget</i>			-0.0040*** (0.000)	-0.0007 (0.818)	0.0135*** (0.000)	-0.0085** (0.016)
<i>LEV x ΔTarget</i>			-0.0149*** (0.000)	0.0642*** (0.000)	-0.0638*** (0.000)	0.0765*** (0.000)
<i>LIQ x ΔTarget</i>			-0.0000 (0.789)	0.0005*** (0.000)	0.0000*** (0.000)	0.0005*** (0.000)
<i>LIQ x LEV x ΔTarget</i>			-0.0002*** (0.000)	-0.0008*** (0.000)	-0.0004*** (0.000)	-0.0016*** (0.000)
<i>SIZE</i>	0.0025*** (0.000)	-0.0087*** (0.000)	0.0022*** (0.000)	0.0103*** (0.000)	0.0038*** (0.000)	0.0182*** (0.000)
<i>TANG</i>	0.0337*** (0.000)	0.105*** (0.000)	0.0631*** (0.000)	0.0422** (0.036)	0.0319*** (0.000)	-0.0059 (0.593)
<i>MTB</i>	0.0006*** (0.000)	-0.0012*** (0.000)	0.0027*** (0.000)	-0.0087*** (0.000)	0.0011*** (0.000)	-0.0145*** (0.000)
<i>PROF</i>	0.0367*** (0.000)	0.0125*** (0.000)	0.0474*** (0.000)	0.0337*** (0.000)	0.0346*** (0.000)	-0.0190** (0.045)
<i>DEP</i>	0.0312*** (0.000)	0.242*** (0.000)	-0.0128 (0.116)	0.430*** (0.000)	0.0099*** (0.000)	0.0558 (0.385)
<i>RD</i>	0.00142 (0.737)	-0.105*** (0.000)	-0.0074 (0.199)	-0.255*** (0.000)	-0.0187*** (0.000)	-0.292*** (0.000)
<i>RDDUM</i>	-0.0070*** (0.000)	-0.0140*** (0.000)	-0.0117*** (0.000)	0.0256*** (0.000)	-0.0051*** (0.000)	-0.0023 (0.654)
<i>INDMED</i>	-0.0340*** (0.000)	0.0316*** (0.000)	0.0437*** (0.000)	0.0534*** (0.000)	-0.00528*** (0.000)	-0.0162** (0.032)
<i>Constant</i>	0.0173*** (0.000)	-0.0389 (0.875)	-0.0118 (0.144)	0.651 (0.716)	0.0079** (0.041)	-2.620 (0.476)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,938	10,938	4,645	4,037	6,293	6,901
Number of id	1,609	1,609	1,088	1,081	1,206	1,257
AR(2)	0.0894	0.0137	0.4931	0.9131	0.2339	0.3835
P-value Hansen test	0.7275	0.5068	0.3835	0.2722	0.1699	0.2211

Panel B. Over- levered and under-levered firms

VARIABLES	BLEV _{t+1}		MLEV _{t+1}	
	Over-levered (1)	Under-levered (2)	Over-levered (3)	Under-levered (4)
<i>LEV</i>	0.600*** (0.000)	0.911*** (0.000)	0.518*** (0.000)	0.956*** (0.000)
<i>LIQ</i>	-0.0002*** (0.000)	-0.0001 (0.749)	-0.0005*** (0.000)	0.0002 (0.220)
<i>LIQ x LEV</i>	0.0012*** (0.000)	0.0012 (0.351)	0.0007*** (0.000)	-0.0022 (0.193)
<i>LevDev</i>	-0.0262*** (0.000)	0.0222** (0.015)	-0.0549*** (0.000)	0.0192 (0.272)
<i>LEV x LevDev</i>	0.0552*** (0.000)	-0.0995 (0.111)	0.0669*** (0.000)	-0.0444 (0.492)
<i>LIQ x LevDev</i>	0.0001*** (0.000)	-0.0001 (0.666)	0.0006*** (0.000)	-0.0002 (0.573)
<i>LIQ x LEV x LevDev</i>	-0.0005*** (0.000)	-0.0005 (0.641)	-0.0006*** (0.000)	-0.0023 (0.160)
<i>ΔTarget</i>	0.0176*** (0.000)	-0.0196*** (0.004)	0.0511*** (0.000)	-0.0022 (0.816)
<i>LEV x ΔTarget</i>	-0.0618*** (0.000)	0.0732* (0.096)	-0.0706*** (0.000)	-0.0484 (0.377)
<i>LIQ x ΔTarget</i>	0.0001*** (0.000)	0.0004*** (0.000)	0.0002*** (0.000)	-0.0006*** (0.007)
<i>LIQ x LEV x ΔTarget</i>	-0.0004*** (0.000)	-0.0047*** (0.000)	-0.0004*** (0.000)	0.0037*** (0.000)
<i>SIZE</i>	0.0048*** (0.000)	0.0040*** (0.001)	0.0156*** (0.000)	0.0121*** (0.000)
<i>TANG</i>	0.0617*** (0.000)	0.0346*** (0.001)	0.0684*** (0.000)	-0.0691*** (0.009)
<i>MTB</i>	0.0033*** (0.000)	0.0006 (0.634)	0.0014*** (0.000)	-0.0020 (0.466)
<i>PROF</i>	0.0053*** (0.000)	0.0042 (0.708)	-0.2056*** (0.000)	0.0263 (0.225)
<i>DEP</i>	0.103*** (0.000)	-0.141** (0.031)	-0.0287** (0.014)	0.199 (0.120)
<i>RD</i>	0.0775*** (0.000)	-0.0107 (0.596)	0.0131 (0.131)	-0.0305 (0.725)
<i>RDDUM</i>	-0.0130*** (0.000)	0.0054 (0.177)	-0.0102*** (0.000)	-0.0219** (0.013)
<i>INDMED</i>	0.0087*** (0.000)	-0.0676*** (0.006)	0.0770*** (0.000)	-0.109** (0.033)
<i>Constant</i>	0.0527*** (0.000)	-0.410*** (0.000)	0.8255*** (0.002)	-0.241 (0.941)
Year fixed effects	Yes	Yes	Yes	Yes
Observations	4,645	6,293	4,037	6,901
Number of id	1,088	1,206	1,081	1,257
AR(2)	0.1940	0.2438	0.139	0.2005
P-value Hansen test	1.0000	0.0779	0.421	0.1756

We further consider the impact of leverage deviation and target stability on the equity liquidity-SOA relationship for over- and under-levered subsamples. We re-run Eq. (15) and report the results in panel B of Table 9. Columns 1 and 3 present the regression results for

over-levered firms. We continue to find that equity liquidity has a positive effect on leverage SOA for over-levered firms as shown by the highly statistically significant and positive signs of the coefficients on the interaction term $LIQ_{i,t} \times LEV_{i,t}$. This relationship, though, is weaker for firms with higher leverage deviation and/or higher instability in target levels, as shown by the significantly negative coefficients (at the 1% level) on the triple interaction terms $LIQ_{i,t} \times LEV_{i,t} \times LevDev_{i,t}$ and $LIQ_{i,t} \times LEV_{i,t} \times \Delta Target_{i,t}$. The results for under-levered firms are shown in columns 2 and 4 of panel B. Again, consistent with hypothesis 2, we find that equity liquidity has no significant effect on leverage SOA of under-levered firms.¹¹

6. Conclusion

In this study, we investigate how equity liquidity, along with the deviation from target leverage ratio and the instability of that target, affects the behavior of a firm's SOA. Based on a sample of more than 2,000 UK firms over the period from 1996 to 2016, we find a positive association between equity liquidity and leverage SOA, indicating that firms with high equity liquidity adjust more quickly to their targets. This important finding proves to be robust to a battery of checks, including alternative empirical methods, alternative samples without data adjustment, and alternative proxies for leverage ratios and equity liquidity. Most importantly, we find that the positive impact of equity liquidity on SOA is confined to over-levered firms: over-levered firms tend to quickly adjust to their target ratio and this trend is further enhanced for firms with higher equity liquidity; under-levered firms adjust slower to their target ratio and this is unaffected by their equity liquidity. We further observe that both the leverage deviation and the target instability have a negative impact on the

¹¹ We also check the robustness of these results using alternative measures of leverage and alternative measures of liquidity in unreported tables. The results confirm that the positive association between equity liquidity and SOA is less pronounced for firms with greater leverage deviation and higher target instability.

strength of the relationship between equity liquidity and the SOA. Indeed, for firms with both a large leverage deviation and a large target change, any positive impact that equity liquidity has on their SOA is almost eliminated.

We contribute to the existing literature in several ways. First, given the theoretical prediction and empirical evidence that equity liquidity and leverage SOA may be related, we are the first to enrich the literature on leverage adjustments by identifying equity liquidity as a new determinant of SOA. We further investigate the distinct impact of equity liquidity on leverage SOA for under- and over-levered firms. Moreover, whilst several studies have examined the capital structure choices of UK firms but do not investigate the dynamic leverage adjustments, our study contributes to the empirical literature on the association between equity liquidity and firms' capital structure decisions in the UK. Next, we provide new empirical evidence of the joint effect of equity liquidity, leverage deviation and target instability on leverage SOA. The positive impact on equity liquidity on the SOA is greater for firms that are relatively close to their target and whose target is relatively stable.

We will end with an outline of areas for further research. Our study examines the impact of liquidity on leverage SOA in the UK market. In the future, our study could thus be extended in other markets in the different stock trading mechanisms such as pure order-driven trading system with the absence of market makers, or emerging markets that rely less on capital market financing. This is, therefore, desirable for future research to consider. Moreover, the observation is that our findings suggest that firms in an under-levered position display only a weak propensity to move back to their target ratios. Another important topic for future analysis would involve a closer examination of what drives the different behaviors of over- and under-levered firms.

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Appendix A. Variable definitions

Variables	Acronym	Description	Data source
A. Firm-level variable			
A.1. Leverage			
Book leverage	BLEV	Book value of total debt divided by book value of total assets	WorldScope
Market leverage	MLEV	Book value of total debt divided by the sum of market value of equity and the book value of total debt	WorldScope
Long-term debt-book value of asset	LDA	Long-term debt to the book value of asset	WorldScope
Long-term debt-market value of asset	LDB	Long-term debt to the market value of asset	WorldScope
A2. Liquidity variables			
Amihud illiquidity	LIQ	Ratio of the daily absolute stock return to its dollar volume averaged over the number of positive volume days	Datastream
Zero return proportion	PropZero	Proportion of trading days in the year that had zero price change (zero return) from the previous day	Datastream
Turnover	Turnover	The number of shares traded on a day, divided by the total number of share outstanding. The turnover for each stock, for each year, is calculated as the average turnover across all trading days in a year.	Datastream
Daily closing percent quoted spread	Spread	Daily closing bid-ask spread divided by the midpoint spread averaged over the number of positive volume days	Datastream

A3. Target leverage variables			
Leverage deviation	LevDev	Absolute difference between target and observed leverage ratio	Self-calculated
Target change	Δ Target	Difference between target leverage of this period and target leverage of last period	Self-calculated
A4. Other firm-level characteristics			
Firm size	SIZE	Natural logarithm of book value of total assets	WorldScope
Tangibility	TANG	Net property, plant and equipment divided by book value of assets	WorldScope
Growth opportunity	MTB	Ratio of book value of assets less book value of equity plus market value of equity to book value of assets	WorldScope
Profitability	PROF	Earning before interests, taxes, depreciation and amortization divided by book value of assets	WorldScope
Depreciation	DEP	Depreciation and amortization divided by book value of assets	WorldScope
Research and development	RD	Research and development expenses divided by book value of assets	WorldScope
Research and development dummy	RDDUM	Dummy variable that equals to one if research and development expenses are not reported and zero otherwise	WorldScope
B. Industry-level variable			
Industry median of leverage	INDMED	The median leverage ratio of an industry to which a firm belongs	WorldScope

Liquidity and speed of leverage adjustment

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Abstract

This article investigates the effect of liquidity on the speed of adjustment (SOA) of corporate leverage at the individual company level. Using panel analysis of data from 35 countries between 1996 and 2016, we find that high-liquidity firms have a significantly faster SOA than less liquid firms. This result survives a series of robustness checks and holds after addressing the endogeneity concern using exogenous shocks and additional control variables. We find that the positive effect of liquidity on the SOA exists only for over-levered firms, and this impact is moderated in countries with bankruptcy codes. We further find that the positive liquidity-SOA relationship is less (more) pronounced for firms in strong (weak) institutional environments. The results provide new insights into the role of liquidity in firms' capital structure decisions and the determinants of capital structure dynamics.

JEL Classification: **G12, G32**

Keywords

Dynamic trade-off theory, institutional environments, leverage SOA, liquidity

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1. Introduction

The static trade-off theory of capital structure predicts that a firm can maximize its value by operating at a target debt ratio that balances the benefits and costs of debt financing. The dynamic trade-off view suggests that when firms deviate from their target ratios, they will make adjustments to move back to the target (Fischer et al., 1989; Goldstein et al., 2001; Leary and Roberts, 2005). However, due to financing frictions, this adjustment can involve nontrivial costs, making the capital structure adjustment dynamic in nature and the speed of adjustment (SOA) unexpectedly slow.

In recent years, there has been growing interest in the critical role of liquidity in capital structure decisions. According to the static trade-off model, more liquid firms have lower floatation costs for equity issuance, which makes equity financing more attractive than debt financing. As a result, high-liquidity firms are likely to have lower leverage. Lipson and Mortal (2009) and Udomsirikul et al. (2011) show the negative impact of liquidity on capital structure in the US and Thailand markets, respectively. Using a global dataset, Gao and Zhu (2015) document that high-liquidity firms are expected to have lower debt financing in their capital structure and that this relationship is more pronounced in countries with weak institutional environments. Exploring the Australian context, Nadarajah et al. (2018) suggest a significantly negative liquidity-leverage relationship and find that high-liquidity firms have significantly negative corporate governance-leverage relationships whereas low-liquidity firms do not have this association. These studies, however, focus on the static trade-off view of capital structure. It is, therefore, interesting to know how liquidity affects the dynamic nature of capital structure, specifically the speed at which firms adjust their capital structure toward the target. Furthermore, given the increasingly important role of institutional environments in firms' financial policies (Bancel and Mittoo, 2004; Demirgüç-Kunt and Maksimovic, 1999; Öztekin, 2015; Öztekin and Flannery, 2012), we are motivated to investigate the liquidity-leverage SOA relationship, in conjunction with the impacts of a country's institutional environments.

Theories of corporate finance have highlighted the important role of liquidity in reducing transaction costs (Amihud and Mendelson, 1986; Butler et al., 2005; Dang et al., 2015; Lipson and Mortal, 2009). An issuer of either debt or equity will have to pay additional costs to underwriters/intermediaries (such as investment banks and financial institutions) when raising more capital. Butler et al. (2005) find that underwriters charge higher fees when they assist illiquid firms in the issuance process. In addition, lower transaction costs can come from improvement in the corporate governance of high-liquidity firms (Edmans et al., 2013; Maug, 1998; Noe, 2002). Liquidity can facilitate the exercise of governance activities because it allows large shareholders to engage in correcting managerial failures and covering monitoring costs through informed trading. As a result, it reduces information asymmetry, agency costs, and the costs of leverage adjustment (Chang et al., 2014; Liao et al., 2015). The bottom line is that a liquid firm will face lower costs associated with issuing new securities and thus be more inclined to rapidly correct any deviation of its actual leverage ratio from its target ratio.

Based on the above arguments, we expect that a firm's liquidity has an impact on the leverage SOA to the target leverage ratio. To date, however, this important link between firm-level liquidity and dynamic capital structure has been overlooked in the literature. In this article, we fill this gap and examine the hypothesis that a firm's liquidity tends to increase its leverage SOA. In addition, the pecking order theory suggests that the leverage SOA is asymmetric as over-levered firms are faced with more costly funding channels than under-levered firms (Byoun, 2008). We argue that liquidity decreases the adjustment costs of equity financing and may affect over-levered firms rather than under-levered firms (Butler et al., 2005). Accordingly, we empirically examine whether liquidity has a distinct impact on leverage SOA in over- and under-levered firms.

Furthermore, at the country level, we investigate how institutional strength affects the relationship between firm-level liquidity and leverage SOA. Institutional environments are widely perceived as external control mechanisms that reduce agency conflicts and serve as a “cheap” form of macro-level investor protection. For firms that operate in countries with strong legal and political institutions, the monitoring costs of large shareholders could be lower than those of firms operating in countries with weak institutional strength. Moreover, in countries with a strong institutional environment, firm-level information tends to be released to the market in a more accurate and timely manner, which lowers the firm’s external financing costs and accelerates the leverage SOA (Öztekin and Flannery, 2012). Strong institutional settings and liquidity, therefore, can substitute each other in improving a firm’s leverage SOA by reducing the adjustment costs. As an alternative argument, strong institutional environments can also enhance the capital market efficiency, provide better enforcement mechanisms and more transparent information, and ensure investor and creditor protection (An et al., 2015). Firms operating in these countries can enjoy less asymmetric information and have higher liquidity. In general, strong institutional environments and liquidity can complement each other in reducing the costs of adjusting corporate leverage.

To test our hypotheses, we use an international sample of 35 countries from 1996 to 2016. Our empirical results are consistent with our hypotheses and suggest three key findings. First, firm-level liquidity has a significant and positive effect on the SOA to the target leverage ratio. We find that high firm-level liquidity not only reduces equity financing costs but also improves corporate governance, which results in lower costs of leverage adjustment. This finding is consistent with the previous literature on microfinance (Amihud and Mendelson, 1986; Chang et al., 2014; Dang et al., 2015; Liao et al., 2015; Lipson and Mortal, 2009; Maug, 1998; Noe, 2002). Second, we find that liquidity only has a significantly positive impact on the leverage SOA of over-levered firms, and this impact is moderated in countries that have bankruptcy codes. For under-levered firms, however, the association is ambiguous. Third, we find that strong institutional environments, as proxied by the strength of law and order, risk of expropriation, risk of contract repudiation by government, level of corruption (La Porta et al., 1998), creditor rights enforcement (Djankov et al., 2003), and the significance of the banking sector (Demirgüç-Kunt and Maksimovic, 1996), tend to attenuate the positive association between liquidity and leverage SOA.

Our results contribute to the current literature in the following aspects. First, by using dynamic partial adjustment models of capital structure to analyze the determinants of SOA, this article introduces new evidence of the impact of firm-level liquidity on SOA. Consistent with the extant empirical literature on dynamic capital structure adjustments, we contribute to the growing literature on the determinants of the leverage SOA (An et al., 2015; Çolak et al., 2018; Devos et al., 2017; Faulkender et al., 2012; Öztekin and Flannery, 2012). In particular, this article adds to recent research on the relationship between the sensitivity of cost of equity on leverage deviation and leverage SOA (Zhou et al., 2016). Our article shows that firm-level liquidity affects both capital structure (Lipson and Mortal, 2009) and the SOA of leverage, and this effect is vastly different between over- and under-levered firms.

Second, we contribute to the current literature on the importance that firms place on the target leverage level by investigating the distinct impacts of liquidity on the leverage SOA for over- and under-levered firms. Byoun (2008) shows that firms have differential adjustment speeds conditional on whether the actual leverage ratios are below or above the targets. Warr et al. (2012) suggest that the impact of equity mispricing on the speed of leverage adjustment depends on whether the firm is above or below its target leverage. An et al. (2015) also conclude that the position of the target leverage ratio affects the relationship between crash-risk exposure and corporate leverage SOA. In this article, we add to this strand of the literature by showing that the

impact of liquidity on leverage SOA is asymmetric and depends on whether the firm is over or under its target leverage ratio.

Third, by using an international sample, we investigate how country-level environments affect the sensitivity of leverage SOA to liquidity, thus contributing to the extant literature on the effects of macro-level institutional environments on corporate capital structure decisions and aggregate financial markets. For instance, Öztekin and Flannery (2012) find evidence that firms that operate in countries with better institutional settings have lower external financing costs and higher leverage SOA. Çolak et al. (2018) conclude that high-quality institutions attenuate the adverse effects of uncertainty on leverage adjustment. Shleifer and Wolfenzon (2002) and La Porta et al. (2002) demonstrate that liability enforcement and strict legal disclosure requirements benefit financial market developments, establishing the links between institutional environments and the aggregate financial markets.

The article proceeds as follows. Section 2 reviews the related literature and develops the hypotheses. Section 3 presents the data and constructs the variables in our empirical study. Section 4 explains the empirical methods. Section 5 presents the empirical results, including the descriptive statistics, correlation analysis, baseline results, and the endogeneity correction. Section 6 concludes the article.¹

2. Related literature and hypotheses development

2.1. Literature on leverage adjustment

Our hypotheses are developed based on the literature relating to dynamic leverage adjustment. This strand of literature focuses on the adjustment of firms' leverage ratios toward their target levels, and specifically, the determinants of leverage SOA.

Following the fundamental framework of Modigliani and Miller (1958), multiple studies have emphasized the trade-off theory—a principal view of capital structure (Fischer et al., 1989; Goldstein et al., 2001; Strebulaev, 2007). This body of research has shown that firms have a time-varying target leverage at which various costs (e.g. agency costs due to the conflict between debtholders and stockholders, and bankruptcy costs or financial distress costs) and benefits (e.g. tax savings, and mitigating agency costs arising from the conflict between stockholders and managers) of debt are optimally balanced. Existing empirical studies also support this view that firms have target leverages and attempt to move toward these targets (Byoun, 2008; Flannery and Rangan, 2006; Huang and Ritter, 2009).

However, the process of adjusting to the target levels is costly. The literature on capital structure shows that the speed at which firms converge to their targets varies, with each firm facing different adjustment costs. These costs can include issuance costs and/or opportunity costs. For instance, Strebulaev (2007) and Goldstein et al. (2001) find that firms with lower transaction costs adjust their leverage more frequently. Faulkender et al. (2012) suggest that the variation in speed of leverage adjustments is due to the differences in sunk and incremental costs. This has motivated a line of research into the cross-sectional variations in the SOA and conditions on specific opportunity costs that affect the SOA. In particular, Drobetz and Wanzenried (2006) argue that faster-growing firms and those that diverge further away from their optimal leverage will adjust their capital structure positions more quickly. Chang et al. (2014) and Liao et al. (2015) provide evidence for the association between corporate governance and dynamic capital structure. An et al. (2015) show that a firm's crash-risk exposure has a significantly negative impact on leverage SOA. Zhou et al. (2016) and Devos et al. (2017) examine the impact of the cost of equity and debt covenants, respectively, on leverage SOA. Most recently, Dang et al.

(2019) show that firms with greater news coverage and more positive news sentiment have greater leverage adjustment speeds. In general, these studies imply that firms adjust faster to their target leverage when the adjustment costs are low.

Another strand of research shows that market timing as equity mispricing has a significant impact on the costs of leverage adjustment (Flannery and Rangan, 2006; Liu, 2009; Warr et al., 2012). When a firm's equity is overvalued, it is cheaper for the firm to adjust its leverage ratio through equity instead of debt. Flannery and Rangan (2006) consider the effect of market timing that is proxied by a firm's market-to-book ratio on leverage adjustment models. Liu (2009) shows that historical market-to-book ratios as a proxy for stock market misvaluation have a significant effect on leverage ratio even when firms do not attempt to time the market. More recently, Warr et al. (2012) find that equity mispricing affects a firm's SOA, although this impact depends on whether the firm is under- or over-levered.

The effects of macroeconomic conditions, business cycles, institutional factors, and political uncertainty on the SOA have also been investigated (Çolak et al., 2018; Cook and Tang, 2010; Drobetz et al., 2015; Öztekin and Flannery, 2012). Hackbarth et al. (2006) show that if firms make financial decisions based on the business cycle, macroeconomic conditions should have a significant impact on leverage adjustments. Cook and Tang (2010) confirm this inference by demonstrating that firms move faster to the targets in good macroeconomic states compared to bad states. Elsas and Florysiak (2011) provide empirical evidence of firms adjusting their leverage faster in countries with low expected bankruptcy costs and low default risks. In analyses of a wide range of institutional determinants, Öztekin and Flannery (2012) and Öztekin (2015) also confirm that good legal and institutional environments lower a firm's leverage adjustment costs. Most recently, Çolak et al. (2018) illustrate that political and economic uncertainty dramatically slows down the speed of a firm's leverage adjustments.

2.2. Liquidity in determining leverage SOA

The important role of liquidity in capital structure transaction costs is well documented in the literature. Stoll and Whaley (1983) note that when evaluating equity investments, investors should consider transaction costs as an important element. This type of cost, they argue, may explain the higher required rates of return on illiquid stocks. Amihud and Mendelson (1986) also propose that due to high transaction costs, such as tax, illiquid equity has high required rates of return. Similarly, Butler et al. (2005) concentrate on issuance costs and find that investment banks charge lower fees for high-liquidity firms. In addition, liquidity is also found to improve the corporate governance that is considered by underwriters and thus lead to a lower fee for equity issuance (Edmans et al., 2013; Kahn and Winton, 1998; Maug, 1998; Noe, 2002). Liquidity allows large shareholders to monitor corporate management and cover monitoring costs through informed trading, thus enabling the exercise of governance activities. To the extent that liquidity can enhance corporate governance, it may also reduce information asymmetry, agency costs, and therefore the cost of leverage adjustment (Chang et al., 2014; Liao et al., 2015). In general, this body of research suggests that stocks with higher liquidity have lower transaction costs, which are among the main elements of leverage adjustment costs.

Brennan and Subrahmanyam (1996) and Brennan et al. (1998) also provide empirical evidence to support a negative relationship between liquidity and cost of equity. However, there is a strand of literature that establishes a relationship between cost of equity and leverage SOA. For instance, Öztekin and Flannery (2012) argue that firms with low trading costs enjoy significantly higher estimated adjustment speeds. Zhou et al. (2016) report an indirect link between the cost of equity and leverage SOA. Combining these two strands of literature together may address the implications of equity liquidity for leverage SOA.

An alternative explanation of the relationship between liquidity and the SOA in capital structures can be drawn from the pecking order theory introduced by Myers and Majluf (1984). This theory argues that adverse selection problems will be smaller for firms with higher liquidity. Consequently, such firms face lower adverse costs and thus lower transaction costs, which will translate to a faster SOA.

Based on the above discussion, we propose our main hypothesis as:

H1. Liquidity has a positive and significant impact on leverage SOA.

2.3. The distinction between over-levered and under-levered firms

To investigate the importance that firms place on a target leverage ratio, we separately examine the relationship between liquidity and the leverage SOA for over- and under-levered firms. To adjust to the target ratio, an over-levered firm (i.e. leveraged above its target levels) usually needs to substitute equity for debt. Therefore, for over-levered firms, those with high liquidity have low costs for access to equity capital and thus adjust their leverage at relatively low marginal costs (Frieder and Martell, 2006; Lipson and Mortal, 2009). Consequently, the SOA toward their target levels is likely to be faster for those with high liquidity than for their low-liquidity counterparts.

On the other hand, an under-levered firm (i.e. leveraged below its target levels) needs to substitute debt for equity to adjust to the target. As suggested by Lipson and Mortal (2009), firms with high liquidity prefer equity financing when raising capital. These firms have a lower cost of equity and greater reliance on equity financing. If the firm's investment opportunities are so substantial that funding them requires external capital, the firm's managers may consider that the benefits of increasing the firm's capital by increasing equity and deviating further from targets outweigh the value enhancement by moving closer to their targets. Conversely, if firms have few investment opportunities, under-levered high-liquidity firms face low costs of accessing the equity capital market but may rarely do so as they consider the benefits of adjusting to the targets are higher than the benefits of increasing the firm's equity capital. Consequently, liquidity is less likely to affect the leverage SOA of under-levered firms.

From the above discussion, we propose the next hypothesis:

H2. The impact of liquidity on the SOA is more (less) pronounced for over-levered (under-levered) firms.

2.4. The role of institutional environments

Institutional environments are generally perceived as external governance mechanisms to reduce agency conflicts and as "low-cost" forms of macro-level investor protection. They are commonly set beyond the control of firms and are less costly control mechanisms than internal ones. The literature shows that countries with better institutions have more information transparency and lower transaction costs. Furthermore, in countries with strong institutional environments, firm-level information tends to be released to the market in a more accurate and timely manner (An et al., 2015; Çolak et al., 2018; Öztekin, 2015; Öztekin and Flannery, 2012). For instance, Doidge et al. (2007) find that country- and economic-level characteristics can explain transparency much better than firm-level characteristics. Öztekin and Flannery (2012) and Öztekin (2015) show that the transaction cost of external financing is lower and the SOA is higher in countries with better information environments. Çolak et al. (2018) conclude that high-quality institutions can be redesigned

to offset the adverse impacts of uncertainty on leverage SOA. Thereby, we argue that due to the greater information transparency, there is a more limited role for price information revelation through trading, and thus a more limited role for liquidity in countries with good institutions. On the other hand, in countries with poorer institutions and less transparent information, stock market liquidity facilitates price information revelation through trading, and hence lower transaction costs, implying a stronger relationship between liquidity and leverage SOA. Therefore, strong institutional settings and liquidity may substitute each other in improving a firm's leverage SOA by reducing the adjustment costs. Thus, our third hypothesis is proposed as:

H3a. The impact of liquidity on the SOA is less (more) pronounced in countries with strong (weak) institutional environments.

As an alternative argument, strong institutional environments and liquidity can complement each other in reducing the costs of adjusting firms' leverage. Since strong institutional environments enhance capital market efficiency, provide better enforcement mechanisms and more transparent information, and ensure investor and creditor protection, firms operating in these countries can enjoy lower transaction costs, less asymmetric information, and higher liquidity. Brockman and Chung (2003) show that a good institutional environment diminishes information asymmetries and decreases the probability of trading against informed traders, which leads to lower bid-ask spread and better liquidity. Doidge et al. (2007) suggest that country-level factors have much higher explanatory power for governance quality and transparency of firms compared to firm-level factors. Thus, an alternative hypothesis to H3a is as follows:

H3b. The impact of liquidity on the SOA is more (less) pronounced in countries with strong (weak) institutional environments.

3. Data and variable definitions

3.1. Data

We obtain annual firm-level and industry-level accounting data from Worldscope and daily trading data (e.g. share prices, stock returns, and trading volumes) from Datastream for publicly traded firms around the world. We also retrieve information about macro-level institutional environments from La Porta et al. (1998), Djankov et al. (2003), and Djankov et al. (2008). Country-level data for control variables are obtained from the World Development Indicators (WDI) and OECD databases. Only firms with common securities are included and those with special features, such as warrants, trusts, funds, and non-equity stocks, are excluded. We also disregard financial and utility corporations since these corporations are subject to special regulations on financing policies. Our initial sample consists of 763,131 observations. To reduce short panel bias, we require the firms to have data for all variables for at least two consecutive years (552,168 observations). We also remove observations with leverage ratios beyond the unit interval (18,839 observations). Following Çolak et al. (2018), we exclude countries that have fewer than 10 firms with available accounting data to ensure reasonable cross-sectional variations within a country (1371 observations). We winsorize all the continuous variables at the 1st and 99th percentiles to mitigate the potential impact of extreme values. After applying these filters, our final sample consists of 190,754 firm-year observations for 16,963 unique firms in 35 countries over the period spanning 1996 to 2016.²

3.2. Variable construction

3.2.1. Leverage. We measure our dependent variable, leverage, using both the book ratio (*BLEV*) and the market ratio (*MLEV*) following existing studies (An et al., 2015; Chang et al., 2014; Flannery and Rangan, 2006; Öztekin and Flannery, 2012). Book leverage is measured as the ratio of the book value of total debt and the book value of total assets. Market leverage is calculated as the book value of total debt divided by the sum of the market value of equity and the book value of total debt.

3.2.2. Liquidity. Following the literature in liquidity, we use three proxies for liquidity: Amihud illiquidity (Amihud, 2002; Lipson and Mortal, 2009; Nadarajah et al., 2018), Turnover (Berkman and Nguyen, 2010; Goyenko et al., 2009; Lipson and Mortal, 2009), and High Low impact (Corwin and Schultz, 2012; Fong et al., 2017). These are the most popular measures of liquidity in major analyses, especially for international data.

Specifically, the Amihud (2002) illiquidity measure is defined as the average ratio of the daily absolute stock return divided by the dollar value of volume. This ratio reflects the daily price change related to one dollar of trading volume, or the daily price impact of the order flow. In this study, we use the annual average of this daily liquidity measure for each stock i

$$Amihud_{i,t,j} = 1 / D_{i,t,j} \sum_1^{D_{i,t,j}} \frac{|R_{i,t,d}|}{DVOL_{i,t,d}}$$

where $D_{i,t}$ is the number of days for which the volume of stock i in year t . The Amihud illiquidity measure represents the price movement associated with trading volume or the price impact of the order flow. Stocks are considered as illiquid if small volume trades lead to high price movement. In relation to different price impact measures, Hasbrouck (2009) shows that Amihud illiquidity is the strongest measure that reflects the price impact of stocks. To improve the interpretation of the results, we multiply the Amihud illiquidity measure by (-1) to convert it into a liquidity proxy. We also multiply the ratio by 10^5 as in the standard liquidity literature.

Second, stock turnover ($Turn_{i,t,j}$), which has been used as a general measure of liquidity in a large number of previous studies (Berkman and Nguyen, 2010; Datar et al., 1998) is defined as the number of shares traded in a day, divided by the total number of shares outstanding

$$Turn_{i,t,j} = \frac{VOL_{i,t,j}}{share_{i,t,j}}$$

where $VOL_{i,t,j}$ is the total trading volume for stock i in year t , in country j and $share_{i,t,j}$ is the number of shares outstanding for stock i in year t , and country j . Volume data for each stock is obtained on a daily basis, while data on the number of shares outstanding are obtained on a yearly basis.³ The use of turnover rate as a measure of liquidity has strong theoretical support (Chai et al., 2010; Chan and Faff, 2003), especially in relation to turnover denoting the average holding period of stocks. The smaller the turnover ratio, the longer is the average holding period. Based on the work of Amihud and Mendelson (1986), stocks with higher spread have comparatively longer expected holding periods. Therefore, turnover should be negatively associated with spread and positively associated with liquidity.

Third, we use the high-low impact estimator introduced by Corwin and Schultz (2012) as a proxy for capturing high-frequency liquidity benchmarks on a global basis (Fong et al., 2017).⁴ For a given firm i , the high-low impact is measured as

$$HighLow_{i,t,j} = \frac{2(\exp(\alpha) - 1)}{\exp(\alpha) + 1}$$

where

$$\alpha = \frac{\sqrt{2\beta} - \sqrt{\beta}}{3 - 2\sqrt{2}} - \sqrt{\frac{\gamma}{3 - 2\sqrt{2}}}$$

$$\beta = \left[\log\left(\frac{H_t}{L_t}\right) \right]^2 + \left[\log\left(\frac{H_{t+1}}{L_{t+1}}\right) \right]^2$$

$$\gamma = \left[\log\left(\frac{\max\{H_t, H_{t+1}\}}{\max\{L_t, L_{t+1}\}}\right) \right]^2$$

Assuming that during day t , the highest trading price H_t and the lowest trading price L_t are from buy and sell trades, respectively. The high-low ratio reflects the information asymmetry of the two trading sides. A high High-Low estimator implies high liquidity and a low discrepancy between the highest and lowest trading prices across a 2-day period.

3.2.3. Country-level variables. Next, in order to study how institutional environments impact the relationship between liquidity and leverage SOA, following previous studies (An et al., 2015; Gao and Zhu, 2015; Öztekin, 2015; Öztekin and Flannery, 2012), we consider several macro-level variables from La Porta et al. (1998), Djankov et al. (2003), and Gao and Zhu (2015). Specifically, La Porta et al. (1998) suggest that the strength of law and order can protect investors against expropriation by management and ensure the implementation of investors' rights when necessary, thereby lowering firms' leverage adjustment costs. Consequently, we account for law and order, *RulLaw*, which measures the law and order tradition in the country. Good governments also respect property rights, encourage informed trading on stock markets, and are associated with better investor protections, leading to reduced costs of adjusting to target leverage and increased SOA (Morck et al., 2000). Following La Porta et al. (1998), we define good governments in terms of the risk of expropriation (*RisExp*), risk of contract repudiation by government (*RisCon*), and level of corruption (*Corrup*). Furthermore, Rajan and Zingales (1995) show that strong creditor rights enforcement enhances ex ante contractibility, making it easier to access the debt market, lower a firm's rebalance costs, and speed up firms' leverage SOA. To measure the enforcement of debt contract, following Öztekin and Flannery (2012) and Öztekin (2015), we use creditor rights enforcement (*CreEnf*), which measures substantive and procedural statutory intervention in judicial cases (Djankov et al., 2003). Furthermore, a sophisticated banking system helps firms to access external finance, increasing the leverage adjustment speed (Gao and Zhu, 2015). We use the ratio of domestic credit provided by the banking sector to gross domestic product (GDP) to measure the significance of the banking sector (*Bank*) (Demirgüç-Kunt and Maksimovic, 1996).

4. Empirical design

4.1. Target leverage

The existing literature models each firm's target leverage in a specific country or institutional framework as a function of the firm's time-varying characteristics, industrial elements, and

macroeconomic factors (Frank and Goyal, 2009). Following Flannery and Rangan (2006), Öztekin and Flannery (2012), and An et al. (2015), we regress the observed leverage ratio (LEV) on a set of leverage determinants to estimate the optimal point for both book leverage ratio (BLEV) and market leverage ratio (MLEV). Using this regression, we model the possibility that target leverage might differ across firms or over time

$$LEV_{i,t+1,j} = \alpha_i + \beta X_{i,t,j} + f_{i,j} + y_{t,j} + \mu_{i,t,j} \quad (1)$$

where each firm is indexed by i , time by t , and j by country. $X_{i,t,j}$ is a vector of firm, industry, and macroeconomic variables related to the costs and benefits of operating with various leverage ratios including firm size, tangibility, growth opportunity, profitability, depreciation, research and development, research and development dummy, industry median of leverage, inflation rate, and GDP growth rate. We also control for year fixed effects $y_{t,j}$ and firm fixed effects $f_{i,j}$ in equation (1) to account for unobserved heterogeneity across time and firm.

The target leverage ratio of each firm is measured as the fitted value obtained from regression (1)

$$LEV_{i,t+1,j}^* = \hat{\beta} X_{i,t,j} + \hat{f}_{i,j} + \hat{y}_{t,j} \quad (2)$$

4.2. Partial adjustment model of leverage

We next estimate the standard partial adjustment model of capital structure

$$LEV_{i,t+1,j} - LEV_{i,t,j} = \alpha_0 + \partial_j (LEV_{i,t+1,j}^* - LEV_{i,t,j}) + \omega_{i,t+1,j} \quad (3)$$

where ∂_j is a measure of aggregate SOA of firm leverage in a specific country that diverges away from the target of the next period.

While the leverage adjustment speed ∂_j in equation (3) is constant for all firms in a specific country, to test our hypotheses, we allow liquidity to affect the firm's SOA toward its target ratio. Öztekin and Flannery (2012) show that firm accounting variables may affect both target leverage and leverage SOA. We use a set of covariates that are used in target leverage estimation (vector $X_{i,t,j}$). Thus, ∂_j varies with liquidity and control variables

$$\hat{\partial}_{i,t,j} = \hat{\partial}_0 + \beta_1 LIQ_{i,t,j} + \theta X_{i,t,j} \quad (4)$$

where $LIQ_{i,t,j}$ is proxied by liquidity measures including the Amihud measure ($Amihud_{i,t,j}$), Turnover ($Turn_{i,t,j}$) and High-Low impact ($HighLow_{i,t,j}$).⁵

Substituting equation (4) back to equation (3) yields the equation for a partial adjustment model with heterogeneity in the leverage SOA

$$\Delta LEV_{i,t+1,j} = \alpha_0 + (\hat{\partial}_0 + \beta_1 LIQ_{i,t,j} + \theta X_{i,t,j})(Dist_{i,t,j}) + \omega_{i,t+1,j} \quad (5)$$

where $\Delta LEV_{i,t+1,j} = LEV_{i,t+1,j} - LEV_{i,t,j}$ and $Dist_{i,t,j} = LEV_{i,t+1,j}^* - LEV_{i,t,j}$.

Equation (5) includes a pooled OLS regression of leverage changes on the product of $Dist_{i,t,j}$ and the main variable affecting leverage SOA (i.e. liquidity) and control variables with bootstrapped standard errors to account for the generated regressors (Çolak et al., 2018; Faulkender et al., 2012; Pagan, 1984).

5. Empirical results

5.1. Descriptive statistics and correlation analysis

Table 1 presents the summary statistics for each country and for the entire sample including descriptive statistics (Panel A) and correlation coefficients of the determinants of target leverage (Panel B). The average firm in the sample has a book leverage ratio of 0.229 and a market leverage of 0.288. In terms of the liquidity measures, the means of Amihud, Turnover, and HighLow are 2.393, 3.757, and 0.031, respectively. Firms in Korea have the highest liquidity while firms in Greece have the lowest liquidity. Panel B reports the correlations between the determinants of the target leverage ratio. In this instance these correlations are low, suggesting that there is little concern with multicollinearity.

5.2. Liquidity and leverage SOA

We present the baseline regression results (equation (5)), which determine the stock liquidity–SOA relationship (H1), in Table 2. All these regressions are estimated using the pooled OLS method with bootstrapped standard errors. The results are presented separately for book leverage (BLEV) and market leverage (MLEV), as indicated by the column headings. Our independent variable of interest is the interaction term between book (market) target deviation and liquidity, which is proxied by the Amihud (columns 1 and 2), turnover (columns 3 and 4), and high-low impact (columns 5 and 6).

The coefficients of these interaction terms are positive and highly significant for both book and market leverage regressions, which indicates a positive relation between stock liquidity and leverage SOA. Our findings imply that firms with high liquidity not only have a lower net cost of equity but also lower adverse selection problems, resulting in lower transaction costs, lower overall adjustment costs, and high leverage SOA. The result is consistent with our expectations and with the findings of prior empirical studies of US markets (e.g. Lipson and Mortal, 2009; Zhou et al., 2016).

The coefficients of target distance ($Dist_{i,t,j}$) are positive and highly significant at the 1% level across models, with magnitudes ranging between 0.072 (column 6) and 0.272 (column 1). This result implies that the base SOA, which does not consider the effects of liquidity, firm size, tangibility, growth opportunity, profitability, depreciation, research and development, research and development dummy, industry median of leverage, inflation rate, and GDP growth rate, is about 7.2%–27.2%. These results are consistent with the findings of dynamic trade-off studies in capital structure literature (Fischer et al., 1989; Goldstein et al., 2001; Strebulaev, 2007).

5.3. Liquidity and leverage SOA for over- and under-levered firms

Next, to analyze the difference in liquidity–leverage SOA sensitivity for over- and under-levered firms, we examine equation (5) separately for each subsample. Panel A of Table 3 reports the results. Specifically, the coefficients of the interaction terms between leverage deviation and liquidity proxies ($Dist \times (-Amihud)$, $Dist \times Turn$ and $Dist \times HighLow$) across models (1)–(6) are positive and statistically significant at the 1% level for both book and market leverage regressions, indicating that liquidity has positive impacts on the leverage SOA of over-levered firms. This is consistent with our expectations that highly liquid over-levered firms can easily increase their equity, then decrease the leverage ratio and adjust more quickly to their target leverage.

For under-levered firms, the coefficients of the interaction terms between leverage deviation and liquidity measures ($Dist \times (-Amihud)$, $Dist \times Turn$, and $Dist \times HighLow$) are statistically insignificant for models (7), (9), (10), and (12) and statistically significant for models (8) and (11). The magnitudes of these coefficients are also smaller than the coefficients of the

Table 1. Summary statistics.

Panel A: Descriptive statistics

	Country	BLEV	MLEV	PROF	MTB	DEP	SIZE	TANG	R&D	INFL	GGDP	AMIHUD	TURN	HIGHLOW
1	Argentina	0.222	0.327	0.142	1.439	0.048	12.370	0.411	0.000	0.085	0.036	3.370	0.489	0.188
2	Australia	0.199	0.223	0.086	2.165	0.038	12.152	0.313	0.008	0.025	0.029	8.136	2.136	0.025
3	Belgium	0.240	0.308	0.116	2.002	0.052	13.150	0.283	0.017	0.019	0.016	3.755	1.323	0.023
4	Canada	0.195	0.226	0.063	2.051	0.055	12.623	0.476	0.019	0.019	0.021	3.826	2.334	0.357
5	Chile	0.230	0.300	0.110	1.414	0.038	12.874	0.444	0.000	0.034	0.041	0.019	0.811	0.010
6	China	0.259	0.200	0.081	3.828	0.028	12.974	0.326	0.005	0.024	0.091	0.002	14.555	0.036
7	Colombia	0.155	0.262	0.107	1.001	0.031	13.797	0.449	0.000	0.063	0.037	0.009	1.153	0.012
8	Croatia	0.218	0.359	0.064	1.911	0.039	12.145	0.547	0.000	0.019	0.003	2.084	0.905	0.021
9	Denmark	0.242	0.303	0.100	2.255	0.050	12.360	0.313	0.035	0.019	0.013	0.852	1.996	0.024
10	Finland	0.226	0.309	0.116	2.211	0.052	12.681	0.261	0.029	0.016	0.015	3.295	2.013	0.025
11	France	0.226	0.309	0.095	1.961	0.047	12.822	0.193	0.017	0.014	0.015	5.072	1.846	0.025
12	Germany	0.193	0.254	0.099	2.146	0.054	12.594	0.232	0.030	0.014	0.013	7.209	0.402	0.032
13	Greece	0.327	0.448	0.072	1.653	0.035	11.969	0.366	0.003	0.025	0.003	20.067	1.771	0.044
14	Hong Kong	0.187	0.258	0.045	1.585	0.029	12.524	0.262	0.004	0.021	0.034	1.293	2.714	0.036
15	India	0.323	0.463	0.102	1.601	0.032	10.549	0.383	0.001	0.082	0.073	2.672	1.241	0.048
16	Indonesia	0.303	0.391	0.123	2.538	0.041	12.068	0.404	0.000	0.087	0.047	0.044	1.725	0.030
17	Israel	0.313	0.409	0.096	1.808	0.033	12.144	0.257	0.015	0.018	0.037	2.252	1.350	0.026
18	Italy	0.271	0.376	0.082	1.855	0.047	13.294	0.231	0.005	0.018	0.002	1.227	3.217	0.029
19	Japan	0.229	0.342	0.074	1.335	0.033	12.887	0.308	0.012	0.001	0.008	0.014	3.281	0.023
20	Korea	0.270	0.436	0.077	1.011	0.033	12.822	0.370	0.007	0.027	0.039	0.001	11.857	0.038
21	Malaysia	0.226	0.323	0.083	1.220	0.031	11.630	0.382	0.000	0.024	0.048	9.036	1.983	0.026
22	Mexico	0.257	0.357	0.116	1.713	0.040	13.773	0.434	0.000	0.054	0.025	4.338	1.419	0.020
23	Netherlands	0.230	0.266	0.117	2.558	0.049	13.484	0.240	0.012	0.020	0.020	1.434	3.784	0.026
24	Norway	0.317	0.363	0.074	1.834	0.054	12.888	0.375	0.010	0.020	0.017	1.183	3.654	0.032
25	Pakistan	0.278	0.370	0.159	1.838	0.036	11.730	0.452	0.000	0.087	0.040	0.988	3.147	0.028
26	Peru	0.207	0.388	0.168	2.367	0.046	12.356	0.490	0.000	0.030	0.054	3.878	0.935	0.010
27	Philippines	0.230	0.351	0.095	1.596	0.040	12.010	0.416	0.000	0.043	0.050	2.092	1.044	0.025
28	Singapore	0.202	0.298	0.080	1.366	0.034	11.988	0.302	0.002	0.019	0.053	14.386	2.357	0.028
29	Spain	0.268	0.318	0.105	2.542	0.043	13.687	0.328	0.005	0.022	0.021	0.588	2.937	0.027
30	Sweden	0.199	0.229	0.088	2.969	0.045	12.395	0.198	0.026	0.011	0.023	0.644	3.041	0.031

(Continued)

Table 1. (Continued)

Panel A: Descriptive statistics														
Country	BLEV	MLEV	PROF	MTB	DEP	SIZE	TANG	R&D	INFL	GGDP	AMIHUD	TURN	HIGHLOW	
31 Switzerland	0.205	0.242	0.110	2.470	0.045	13.297	0.296	0.029	0.005	0.019	0.726	2.136	0.023	
32 Thailand	0.263	0.316	0.122	1.588	0.047	11.566	0.405	0.000	0.024	0.033	2.292	4.700	0.025	
33 Turkey	0.230	0.289	0.121	1.883	0.040	12.231	0.344	0.003	0.150	0.051	0.344	12.001	0.036	
34 UK	0.180	0.211	0.069	2.527	0.044	12.365	0.277	0.023	0.020	0.020	2.817	3.009	0.031	
35 US	0.210	0.194	0.085	3.071	0.048	13.305	0.264	0.052	0.020	0.021	0.740	0.877	0.039	
36 All sample	0.229	0.288	0.084	2.101	0.039	12.676	0.309	0.018	0.021	0.029	2.393	3.757	0.031	
Panel B: Correlation coefficients														
BLEV	MLEV	SIZE	TANG	MTB	PROF	DEP	R&D	RDDUM	INDMED (BLEV)	INDMED (MLEV)	AMIHUD	TURN	HIGHLOW	
BLEV	1													
MLEV	0.7888*	1												
SIZE	0.1791*	0.1166*	1											
TANG	0.2947*	0.2737*	0.0816*	1										
MTB	0.0014	-0.2497*	0.0322*	-0.0904*	1									
PROF	-0.0819*	-0.1252*	0.1788*	0.0938*	0.0532*	1								
DEP	0.0861*	0.0110*	-0.0021	0.3023*	0.0401*	0.1299*	1							
RD	-0.1406*	-0.1891*	-0.0720*	-0.1947*	0.1467*	-0.3038*	0.0682*	1						
RDDUM	-0.1195*	-0.1172*	0.1634*	-0.1902*	0.0366*	-0.0493*	-0.0016	0.3744*	1					
INDMED (BLEV)	0.6496*	0.5663*	0.1479*	0.3212*	-0.0556*	0.0080*	0.0581*	-0.2121*	-0.1842*	1				
INDMED (MLEV)	0.5297*	0.7228*	0.0884*	0.2799*	-0.2375*	-0.0479*	-0.0108*	-0.2219*	-0.1448*	0.7848*	1			
AMIHUD	0.0418*	0.1239*	-0.2479*	0.0113*	-0.0775*	-0.0987*	0.0363*	-0.0359*	-0.1123*	0.0390*	0.1084*	1		
TURN	0.0764*	0.0162*	0.0063*	-0.0024	0.0737*	-0.0547*	-0.0805*	-0.0498*	0.0661*	0.0390*	-0.0045	-0.0985*	1	
HIGHLOW	0.0726*	0.0526*	-0.1923*	-0.0688*	0.0707*	-0.2943*	0.0801*	0.1791*	0.0524*	-0.0174*	-0.0362*	0.1156*	0.2446*	1

This table reports the means of firm-level variables by country and for the entire sample. The study period is from 1996 to 2016. The variable definitions are given in Appendix A1 in Online Supplemental Material.

Table 2. The effect of liquidity on leverage SOA—baseline results.

Variables	Amihud		Turn		HighLow	
	$\Delta BLEV_{t+1}$ (1)	$\Delta MLEV_{t+1}$ (2)	$\Delta BLEV_{t+1}$ (3)	$\Delta MLEV_{t+1}$ (4)	$\Delta BLEV_{t+1}$ (5)	$\Delta MLEV_{t+1}$ (6)
<i>Dist</i> × (<i>-Amihud</i>)	0.0006** (2.383)	0.0006*** (3.012)				
<i>Dist</i> × <i>Turn</i>			0.0016*** (6.682)	0.0034*** (12.43)		
<i>Dist</i> × <i>HighLow</i>					2.1130*** (13.56)	2.276*** (15.96)
<i>Dist</i>	0.2720*** (20.71)	0.1920*** (13.65)	0.2550*** (22.32)	0.1670*** (14.24)	0.1490*** (11.86)	0.0716*** (4.607)
<i>Dist</i> × <i>Size</i>	-0.0128*** (-12.67)	-0.0069*** (-6.519)	-0.0119*** (-14.30)	-0.0058*** (-6.283)	-0.0086*** (-8.379)	-0.0031*** (-2.615)
<i>Dist</i> × <i>MTB</i>	0.0026*** (4.855)	0.0040*** (3.303)	0.0026*** (5.574)	0.0038*** (3.311)	0.0024*** (4.880)	0.0037*** (3.801)
<i>Dist</i> × <i>Prof</i>	0.2470*** (9.186)	0.0219 (0.758)	0.2570*** (11.26)	0.0429** (2.133)	0.3190*** (13.97)	0.1170*** (4.729)
<i>Dist</i> × <i>RD</i>	0.21*** (3.632)	0.1960** (2.286)	0.2400*** (5.208)	0.2290*** (2.858)	0.1990*** (3.520)	0.1650** (2.020)
<i>Dist</i> × <i>RDDum</i>	-0.0075** (-2.190)	-0.0180*** (-4.035)	-0.0010** (-2.505)	-0.0232*** (-6.019)	-0.0081* (-1.845)	-0.0158*** (-3.621)
<i>Dist</i> × <i>Tang</i>	-0.0568*** (-5.815)	-0.0374*** (-3.310)	-0.0567*** (-6.013)	-0.0364*** (-3.325)	-0.0432*** (-4.179)	-0.0238** (-2.377)
<i>Dist</i> × <i>Dep</i>	-0.1400* (-1.689)	0.5250*** (6.880)	-0.1280* (-1.844)	0.5450*** (7.551)	-0.3460*** (-5.007)	0.2610*** (3.031)
<i>Dist</i> × <i>Infl</i>	0.0025*** (3.543)	0.0049*** (7.264)	0.0026*** (3.946)	0.0047*** (6.928)	0.0008 (1.249)	0.0027*** (3.630)
<i>Dist</i> × <i>GGDP</i>	0.0049*** (8.812)	0.0105*** (16.28)	0.0041*** (6.012)	0.0091*** (11.76)	0.0050*** (8.771)	0.0106*** (14.15)
Constant	0.0150*** (3.934)	0.0129** (2.014)	0.0150*** (3.400)	0.0131*** (2.731)	0.0153*** (3.766)	0.0137* (1.690)
Observations	190,754	190,754	190,754	190,754	190,754	190,754
R ²	0.057	0.113	0.057	0.114	0.060	0.116
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

SOA: speed of adjustment; FE: fixed effect.

This table reports the regression results for the effect of liquidity, proxied by Amihud illiquidity, Turnover, and High-low impact on the leverage speed of adjustment $\Delta LEV_{i,t+1} = \alpha_0 + (\beta_0 + \beta_1 LIQ_{i,t} + \beta_2 X_{i,t}) (Dist_{i,t}) + \omega_{i,t+1}$

The dependent variable is the change in book and market leverage ratio ($\Delta LEV_{i,t+1}$). $Dist_{i,t}$ is the different between the target leverage ratio and the actual leverage ratio. $LIQ_{i,t}$ is proxied by Amihud (*Amihud*), Turnover (*Turn*), and high-low impact (*HighLow*), respectively. $X_{i,t}$ is the vector of control variables that includes firm size (*Size*), market-to-book ratio (*MTB*), profitability (*Prof*), research and development expenses (*RD*), research and development dummy (*RDDum*), Tangibility (*Tang*), Depreciation expenses (*Dep*), Inflation rate (*INFL*), and annual GDP growth rate (*GGDP*). Year and country fixed effects are included in Models (1) to (6). ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. *T*-statistics are reported in parenthesis. The variable definitions are in Appendix A1 in Online Supplemental Material.

Table 3. The effect of liquidity on leverage SOA—over- and under-levered firms.

Panel A: The effects of liquidity on leverage SOA for over-levered and under-levered firms

Variables	Over-levered firms					Under-levered firms						
	Amihud	Turn	HighLow	Amihud	Turn	HighLow	Amihud	Turn	HighLow	Amihud	Turn	HighLow
	$\Delta BLEV_{t,t+1}$ (1)	$\Delta BLEV_{t,t+1}$ (2)	$\Delta BLEV_{t,t+1}$ (3)	$\Delta BLEV_{t,t+1}$ (4)	$\Delta BLEV_{t,t+1}$ (5)	$\Delta BLEV_{t,t+1}$ (6)	$\Delta BLEV_{t,t+1}$ (7)	$\Delta BLEV_{t,t+1}$ (8)	$\Delta BLEV_{t,t+1}$ (9)	$\Delta BLEV_{t,t+1}$ (10)	$\Delta BLEV_{t,t+1}$ (11)	$\Delta BLEV_{t,t+1}$ (12)
Dist X (-Amihud)	0.0010*** (3.46)	0.0023*** (9.61)					0.0003 (1.21)	0.0018*** (4.94)	0.0007 (1.53)	0.0008 (1.36)		
Dist X Turn			0.0023*** (6.30)	0.0049*** (10.11)								
Dist X HighLow					2.0699*** (10.04)	0.9223*** (3.99)					0.9772*** (4.27)	0.2821 (1.48)
Dist	0.5173*** (4.04)	0.4976*** (17.69)	0.4848*** (25.10)	0.4110*** (15.45)	0.3330*** (15.92)	0.1338*** (7.14)	0.1052*** (5.28)	0.1148*** (6.44)	0.0479*** (2.07)	0.1042*** (5.81)	0.0940*** (5.91)	0.0514*** (4.41)
Dist X Size	-0.0316*** (-20.10)	-0.0278*** (-13.19)	-0.0299*** (-20.41)	-0.0231*** (-12.50)	0.0222*** (13.99)	0.0110*** (8.20)	-0.0126*** (-7.29)	-0.0125*** (-8.13)	-0.0098*** (-5.32)	-0.0101*** (-6.08)	-0.0114*** (-7.00)	-0.0056*** (-7.66)
Dist X MTB	0.0009 (1.62)	0.0103*** (3.55)	0.0010 (1.24)	0.0103*** (3.95)	-0.0000 (-0.26)	0.0001 (0.50)	-0.0002 (-0.72)	0.0007*** (2.44)	-0.0001 (-0.49)	0.0007*** (2.98)	-0.0001 (-0.53)	-0.0001 (-0.67)
Dist X Prof	0.8728*** (19.04)	0.5531*** (9.86)	0.8847*** (25.87)	0.5856*** (10.73)	-0.6489*** (-9.65)	-0.3958*** (-2.94)	0.2444*** (4.98)	0.2208*** (7.91)	0.2400*** (4.68)	0.2262*** (5.47)	0.2265*** (3.57)	0.1753*** (5.25)
Dist X RD	0.4929*** (7.06)	0.3750*** (3.19)	0.5249*** (6.71)	0.4121*** (2.91)	0.3782*** (9.98)	0.3066*** (2.45)	0.0332 (0.47)	-0.3371*** (-6.01)	-0.0910 (-1.03)	-0.3125*** (-6.93)	-0.1063 (-1.20)	-0.0642 (-0.87)
Dist X RDDum	-0.0027 (-0.42)	-0.0041 (-0.47)	-0.0062 (-0.91)	-0.0101 (-1.55)	-0.0020 (-0.30)	-0.0056 (-1.39)	-0.0260*** (-5.97)	-0.0105** (-2.26)	-0.0045 (-0.88)	-0.0317*** (-5.31)	-0.0050 (-0.89)	-0.0062** (-2.37)
Dist X Tong	-0.0864*** (-6.33)	-0.0951*** (-6.13)	-0.0883*** (-5.80)	-0.0954*** (-7.09)	-0.0886*** (-5.75)	-0.0488*** (-4.84)	0.0266** (2.37)	0.0879*** (7.84)	0.0461*** (3.43)	0.0881*** (5.51)	0.0512*** (5.06)	0.0344*** (4.69)
Dist X Dup	-0.8865*** (-9.51)	0.3840*** (3.10)	-0.8833*** (-8.81)	0.3790*** (3.43)	-0.7930*** (-5.66)	-0.2764* (-1.78)	0.0640 (0.68)	-0.3316*** (-4.64)	-0.1465*** (-2.00)	-0.2419*** (-2.85)	-0.2039** (-2.32)	-0.0711 (-1.05)
Dist X Invf	0.0026*** (2.69)	0.0021 (1.47)	0.0025** (2.34)	0.0017* (1.90)	0.0021* (1.84)	-0.0005 (-0.57)	0.0037*** (5.03)	0.0034*** (3.45)	0.0001 (0.16)	0.0070*** (5.95)	-0.0004 (-0.36)	-0.0004 (-0.70)
Dist X GDP	0.0057*** (5.93)	0.0079*** (5.43)	0.0047*** (3.94)	0.0060*** (4.07)	0.0064*** (7.75)	0.0042*** (3.73)	0.0055*** (7.07)	0.0022*** (2.75)	0.0017** (2.01)	0.0039*** (5.12)	0.0020** (2.53)	0.0011** (2.03)
Constant	0.0067 (0.95)	-0.0045 (-0.42)	0.0059 (1.03)	-0.0070 (-0.54)	0.0040 (0.55)	0.0012 (0.19)	0.0188*** (11.86)	0.0322*** (4.57)	0.0267*** (6.75)	0.0231*** (21.99)	0.0273*** (6.16)	0.0279*** (5.77)
Observations	85,624	83,017	85,624	83,017	85,624	85,624	105,130	107,737	105,130	107,737	105,130	105,130
R ²	0.0786	0.1287	0.0790	0.1294	0.0775	0.0324	0.0192	0.0670	0.0270	0.0617	0.0275	0.0205
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

(Continued)

Table 3. (Continued)

Panel B: The effects of liquidity on leverage SOA for over-levered firms conditional on the impacts of bankruptcy protection

Variables	Amhud			Turn			HighLow					
	$\Delta BLEV_{t+1}$ (1)	$\Delta BLEV_{t+1}$ (2)	$\Delta BLEV_{t+1}$ (3)	$\Delta BLEV_{t+1}$ (4)	$\Delta BLEV_{t+1}$ (5)	$\Delta BLEV_{t+1}$ (6)	$\Delta BLEV_{t+1}$ (7)	$\Delta BLEV_{t+1}$ (8)	$\Delta BLEV_{t+1}$ (9)	$\Delta BLEV_{t+1}$ (10)	$\Delta BLEV_{t+1}$ (11)	$\Delta BLEV_{t+1}$ (12)
$Dist \times (-Amhud)$	0.0011*** (5.19)		0.0028*** (10.55)									
$Dist \times (-Amhud) \times Bankrp$	-0.0008** (-2.08)		-0.0015*** (-2.65)									
$Dist \times Turn$				0.0011*** (8.99)	0.0080*** (8.99)							
$Dist \times Turn \times Bankrp$				-0.0009* (-1.83)	-0.0048*** (-4.93)							
$Dist \times HighLow$									1.9831*** (11.10)			
$Dist \times HighLow \times Bankrp$									-0.3458** (-2.13)			
$Dist$	0.4422*** (26.48)		0.4982*** (22.39)		0.4104*** (25.64)		0.4016*** (16.00)		0.3604*** (11.27)		0.9100*** (3.98)	
$Dist \times Bankrp$	0.0028 (0.56)		-0.0036 (-0.39)		-0.0013 (-0.24)		0.0342*** (3.56)		-0.0002 (-0.03)		0.0635*** (5.47)	
$Dist \times Size$	-0.0271*** (-2.174)		-0.0282*** (-18.50)		-0.0246*** (-20.18)		-0.0246*** (-13.78)		-0.0262*** (-13.26)		-0.0200*** (-13.07)	
$Dist \times MTB$	0.0001 (0.23)		0.0176*** (15.84)		0.0002 (0.63)		0.0173*** (12.75)		0.0008 (0.93)		0.0176*** (21.89)	
$Dist \times Prof$	0.8090*** (49.51)		0.5502*** (8.39)		0.8199*** (50.26)		0.5838*** (10.38)		0.9239*** (42.31)		0.5929*** (25.30)	
$Dist \times RD$	0.4593*** (14.91)		0.3246** (2.15)		0.4837*** (15.63)		0.3591*** (2.69)		0.4799*** (6.13)		0.3668*** (7.76)	
$Dist \times RD.Dum$	-0.0063 (-1.38)		-0.0057 (-0.86)		-0.0086* (-1.88)		-0.0121* (-1.66)		-0.0058 (-1.03)		-0.0013 (-0.23)	

(Continued)

Table 3. (Continued)

Variables	Amihud			Turn			HighLow		
	$\Delta BLEV_{t+1}$ (1)	$\Delta MLEV_{t+1}$ (2)	$\Delta BLEV_{t+1}$ (3)	$\Delta MLEV_{t+1}$ (4)	$\Delta BLEV_{t+1}$ (5)	$\Delta MLEV_{t+1}$ (6)			
Dist \times Tong	-0.0660*** (-7.08)	-0.0869*** (-6.22)	-0.0704*** (-7.57)	-0.0877*** (-5.23)	-0.0775*** (-3.06)	-0.1115*** (-9.46)			
Dist \times Dep	-0.6473*** (-9.84)	0.3546*** (2.61)	-0.6714*** (-10.24)	0.3437** (2.42)	-0.9789*** (-9.45)	0.4255*** (5.11)			
Dist \times Mff	0.0011 (1.58)	0.0029*** (2.61)	0.0029*** (4.10)	0.0029** (2.48)	-0.0013 (-1.00)	0.0001 (0.08)			
Dist \times GGDP	0.0070*** (10.03)	0.0072*** (6.46)	0.0041*** (5.21)	0.0052*** (4.30)	0.0071*** (9.04)	0.0330*** (37.67)			
Constant	0.0016*** (4.15)	0.0060 (1.21)	0.0148*** (7.55)	0.0050 (1.06)	0.0005 (0.98)	0.0053*** (7.92)			
Observations	81,539	81,539	81,539	81,539	84,168	81,539			
R ²	0.0731	0.1328	0.0784	0.1336	0.0729	0.0731			
Year FE	Yes	Yes	Yes	Yes	Yes	Yes			
Country FE	Yes	Yes	Yes	Yes	Yes	Yes			

SOA: speed of adjustment; FE: fixed effect.

This table reports the regression results for the effect of liquidity on the SOA for over- and under-levered firms (Panel A), and the impacts of bankruptcy protection on liquidity-leverage SOA association for over-levered firms (Panel B). The dependent variable is the change in book and market leverage ratio ($\Delta BLEV_{t+1}$, $\Delta MLEV_{t+1}$). $Dist_{t+1}$ is the difference between the target leverage ratio and the actual leverage ratio. Liquidity LQ_{t+1} is proxied by Amihud (Amihud), Turnover (Turn), and High-low impact (HighLow) measures. $Bonp_{it}$ is the bankruptcy code. Control variables include firm size (Size), market-to-book ratio (MTB), profitability (Prof), research and development expenses (RD), research and development dummy (RDDum), Tangibility (Tang), Depreciation expenses (Dep), inflation rate (INR), and annual GDP growth rate (GGDP). ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parentheses. The variable definitions are given in Appendix A1 in Online Supplemental Material.

interaction terms between leverage deviation and liquidity proxies for over-levered firms. These results indicate that the impact of liquidity on leverage SOA is ambiguous and less pronounced for under-levered firms, supporting our hypothesis H2 that firms with high liquidity have a lower cost of equity and prefer equity financing when raising capital. Growing, liquid, under-levered firms have great investment opportunities and require external capital. These firms consider the value enhancement gained by issuing more equity to finance investment opportunities outweighs the benefits of adjusting back to target leverages. This result is in line with the findings of Frieder and Martell (2006) and Lipson and Mortal (2009) that high-liquidity firms prefer and largely rely on equity financing. This result is, however, inconsistent with Cheung et al. (2019), who suggest that the impacts of liquidity on the cost of debt are much greater than the cost of equity. Specifically, high liquidity increases information disclosure, reduces uncertainty about the firm's future cash flow, reduces the default risk and hence, decreases the cost of debt. Thereby, high liquidity will also speed up the leverage SOA of under-levered firms by enhancing these firms' debt issuance.

Because of the high level of debt, the threat of bankruptcy is generally more severe for over-levered firms. In adjusting to target leverage, over-levered firms substitute equity for debt and decrease their threat of bankruptcy. Indeed, in some countries that have defined bankruptcy procedures with explicit bankruptcy codes, the rights and claims of lenders are specified and limited; reorganization of the firm is facilitated; and debt payments are deferred (Claessens et al., 2003; Davydenko and Franks, 2008). We conjecture that in countries with explicit bankruptcy codes, the threat of bankruptcy of over-levered firms is less severe, which leads to the impacts of liquidity on leverage SOA for over-levered firms being moderated. To examine the impacts of explicit bankruptcy codes on the liquidity–leverage SOA association for over-levered firms, we follow Gao and Zhu (2015) and Fan et al. (2012) in constructing a dummy variable (“bankruptcy code”) based on the country's legal system that defines bankruptcy procedures (Djankov et al., 2008). This variable takes a value of one for those countries in which an insolvent firm can undergo a court-supervised reorganization proceeding. Panel B of Table 3 reports the results. The coefficients of the triple interaction terms between liquidity measures, target distance, and dummies for explicit bankruptcy codes ($Dist \times (-Amihud) \times Bankrp$, $Dist \times Turn \times Bankrp$, and $Dist \times HighLow \times Bankrp$) across models (1) to (6) are negative and statistically significant, indicating that in countries with explicit bankruptcy codes, the association between liquidity and leverage SOA is less pronounced for firms with higher level of debts relative to target ratios. The implication is that explicit bankruptcy codes reduce the threat of bankruptcy for over-levered firms, which lowers the incentive of these firms to substitute equities for debts to adjust back to target leverage, thereby moderating the positive impacts of liquidity on leverage SOA of such firms.

5.4. Impacts of institutional environments on the liquidity–leverage SOA relationship

We further examine the impact of institutional environments on the relationship between liquidity and SOA. To examine this issue, we include the interaction terms between stock liquidity and institutional indicators ($IE_{i,t,j}$), including rule of law, risk of expropriation, risk of contract repudiation, level of corruption, creditor rights enforcement, and banking sector, in the SOA specification (equation (4))

$$\hat{\partial}_{i,t,j} = \hat{\partial}_0 + \beta_1 LIQ_{i,t,j} + \beta_2 IE_{i,t,j} + \beta_3 IE_{i,t,j} * LIQ_{i,t,j} + \theta X_{i,t,j} \quad (6)$$

Substituting equation (6) into equation (3) and simplifying yields

$$\begin{aligned} \Delta LEV_{i,t+1,j} = & \alpha_0 + (\hat{\alpha}_0 + \beta_1 LIQ_{i,t,j} + \beta_2 IE_{i,t,j} + \beta_3 IE_{i,t,j} * LIQ_{i,t,j} \\ & + \theta X_{i,t,j})(Dist_{i,t,j}) + \omega_{i,t+1,j} \end{aligned} \quad (7)$$

Table 4 reports the regression results. The coefficients of the interaction term $Dist_{i,t,j} * LIQ_{i,t,j}$ remain positive and statistically significant. More importantly, the coefficients of the triple interaction term $Dist_{i,t,j} * LIQ_{i,t,j} * IE_{i,t,j}$, which captures the role of institutional environments in reshaping the liquidity–leverage SOA relationship, are negative and statistically significant for book and market leverage regression across models (1)–(36). Specifically, our first institutional environment proxy is *RulLaw*. Models (1)–(6) in Table 4 show that all six coefficients of the interaction terms between leverage deviation, equity liquidity, and law and order are significantly negative. This set of results is consistent with our hypothesis H3a that the positive impact of equity liquidity on SOA is weaker in countries with strong law and order. In addition, we examine the role of good governments in reshaping the effect of liquidity on SOA. We define a good government using the variables *RisExp*, *RisCon*, and *Corrup*. Results are summarized in models (7)–(24) of Table 4. In general, the three alternative good government measures deliver consistent results with *RulLaw*. We find that the interactions between leverage deviation, liquidity, and the three good government measures have significantly positive coefficients. There is thus strong evidence that a good government moderates the positive relationship between liquidity and leverage SOA. We next measure institutional environments using *CreEnf* (models (25)–(30)) and *Bank* (models (31)–(32)). The results are consistent with previous proxies for institutional environments. Specifically, the interaction terms between leverage deviation, liquidity, and creditor right enforcement and between leverage deviation, liquidity, and the significance of banking sector have negative coefficients. These results imply that the positive association between liquidity and SOA is less pronounced in countries with strong creditor rights enforcement and sophisticated banking systems (H3a).

In general, the results are consistent with our hypothesis H3a that the positive impact of liquidity on SOA is weaker in countries with high-quality institutional settings. Furthermore, the coefficients of interaction terms $Dist_{i,t,j} * IE_{i,t,j}$ are positive and significant across the panels, indicating that firms operating in better institutional environments adjust more rapidly to their target levels. These results further confirm the findings of Öztekin and Flannery (2012), Öztekin (2015), and Çolak et al. (2018).

5.5. Endogeneity problems

Section 5 presents the relationship between liquidity and firms' leverage SOA. However, these findings may be plagued by potential endogeneity problems, including reverse causality and omitted variables bias. We address these concerns by using a shock to equity liquidity and controlling for additional determining factors of leverage SOA that may be associated with equity liquidity.

5.5.1. The introduction of the Directive on Markets in Financial Instruments. It may be that investors prefer to trade stocks of firms operating closer to their target level and with higher leverage SOAs, as these firms are at their highest value (Fischer et al., 1989). That is, higher leverage SOA causes higher stock liquidity (i.e. reverse causality). We address this potential issue by using an exogenous shock to liquidity.

We follow Cumming et al. (2011) and use the introduction of the Directive on Markets in Financial Instruments (MiFID) in European countries as a plausible exogenous shock to liquidity to assess the causal impact of liquidity on leverage SOA. Specifically, in November 2007, MiFID, a major legislative change in the European Union's Financial Services Action Plan (FSAP), became

Table 4. The effect of liquidity on leverage SOA—impact of institutional environments.

Variables	IE = RiskExp																	
	Amihud			Turn			HighLow			Amihud			Turn			HighLow		
	BLEV _{t,t-1} (1)	MLEV _{t,t-1} (2)	MLEV _{t,t-1} (3)	BLEV _{t,t-1} (4)	MLEV _{t,t-1} (5)	MLEV _{t,t-1} (6)	BLEV _{t,t-1} (7)	MLEV _{t,t-1} (8)	BLEV _{t,t-1} (9)	MLEV _{t,t-1} (10)	BLEV _{t,t-1} (11)	MLEV _{t,t-1} (12)						
Dist × (-Amihud)	0.0036*** (3.97)	0.0029*** (2.69)					0.0055*** (3.78)	0.0034*** (2.77)										
Dist × (-Amihud) × IE	-0.0004*** (-3.22)	-0.0003** (-1.99)					-0.0006*** (-3.20)	-0.0003** (-2.16)										
Dist × Turn			0.0058*** (4.39)	0.0060*** (6.08)					0.0107*** (3.43)	0.0108*** (4.59)								
Dist × Turn × IE			-0.0004** (-2.17)	-0.0002* (-1.79)					-0.0009*** (-2.59)	-0.0008*** (-2.88)								
Dist × HighLow					1.2465*** (3.50)	0.8793** (2.13)					2.0981*** (3.04)	2.1304*** (2.70)						
Dist × HighLow × IE					-0.1044** (-2.53)	-0.1403*** (-2.92)					-0.0085 (-0.11)	-0.0051 (-0.06)						
Dist	0.2098*** (12.75)	0.1176*** (5.61)	0.1519*** (8.52)	0.0557*** (3.66)	0.1158*** (6.51)	0.0760*** (3.65)	0.2371*** (10.12)	0.1554*** (6.81)	0.1493*** (5.55)	0.0633*** (2.81)	0.1123*** (3.91)	0.0542* (1.66)						
Dist × IE	0.0086*** (6.16)	0.0132*** (7.59)	0.0130*** (7.34)	0.0173*** (14.60)	0.0041** (2.35)	0.0057*** (2.86)	0.0035 (1.40)	0.0080*** (3.68)	0.0110*** (4.05)	0.0144*** (6.65)	0.0029 (0.96)	0.0062* (1.85)						
Dist × Size	-0.0140*** (-13.21)	-0.0104*** (-7.71)	-0.0133*** (-13.63)	-0.0095*** (-9.38)	-0.0091*** (-10.19)	-0.0070*** (-6.69)	-0.0127*** (-11.68)	-0.0097*** (-9.14)	-0.0119*** (-9.91)	-0.0082*** (-7.97)	-0.0080*** (-9.00)	-0.0057*** (-5.48)						
Dist × MTB	0.0032*** (5.08)	0.0051*** (8.38)	0.0032*** (5.67)	0.0051*** (8.62)	0.0031*** (9.32)	0.0048*** (7.92)	0.0034*** (5.14)	0.0052*** (8.52)	0.0034*** (6.01)	0.0052*** (8.47)	0.0032*** (6.73)	0.0050*** (6.21)						
Dist × Prof	0.2278*** (9.43)	0.0306 (1.29)	0.2413*** (12.09)	0.0545*** (3.99)	0.3013*** (26.96)	0.1160*** (7.97)	0.2287*** (10.60)	0.0258* (1.83)	0.2403*** (10.20)	0.0478*** (3.39)	0.2988*** (26.73)	0.1135*** (7.80)						
Dist × RD	0.1780*** (3.16)	0.1586** (2.19)	0.2016*** (3.88)	0.1892*** (5.34)	0.1595*** (6.67)	0.1036*** (2.83)	0.2043*** (4.09)	0.1575*** (4.32)	0.2271*** (3.97)	0.1925*** (5.28)	0.1867*** (7.83)	0.1350*** (3.69)						
Dist × ADDUM	-0.0110** (-2.29)	-0.0164*** (-3.34)	-0.0148*** (-3.15)	-0.0219*** (-5.97)	-0.0106*** (-3.19)	-0.0144*** (-3.82)	-0.0120*** (-2.62)	-0.0203*** (-5.36)	-0.0158*** (-3.13)	-0.0261*** (-6.87)	-0.0116*** (-3.47)	-0.0173*** (-4.57)						
Dist × Tang	-0.0515*** (-4.60)	-0.0262*** (-2.62)	-0.0510*** (-6.11)	-0.0232*** (-3.02)	-0.0407*** (-6.08)	-0.0108 (-1.36)	-0.0579*** (-6.30)	-0.0288*** (-3.62)	-0.0581*** (-5.60)	-0.0284*** (-3.57)	-0.0455*** (-6.79)	-0.0185** (-2.33)						
Dist × Dep	-0.2347*** (-3.26)	0.3546*** (4.22)	-0.2382*** (-2.71)	0.3474*** (6.39)	-0.4359*** (-9.21)	0.1327** (2.31)	-0.1695** (-2.27)	0.4549*** (8.13)	-0.1666** (-2.27)	0.4542*** (8.14)	-0.3625*** (-7.67)	0.2302*** (4.03)						
Dist × Invf	0.0047*** (7.56)	0.0072*** (7.47)	0.0051*** (7.97)	0.0075*** (12.96)	0.0027*** (5.00)	0.0048*** (7.91)	0.0031*** (3.79)	0.0054*** (8.96)	0.0033*** (4.35)	0.0054*** (9.04)	0.0012** (2.27)	0.0031*** (5.04)						

(Continued)

Table 4. (Continued)

Variables	IE = Ris Con				IE = Comp							
	Amihud		Turn		HighLow		Amihud		Turn		HighLow	
	BLEV _{t-1} (13)	MLEV _{t-1} (14)	BLEV _{t-1} (15)	MLEV _{t-1} (16)	BLEV _{t-1} (17)	MLEV _{t-1} (18)	BLEV _{t-1} (19)	MLEV _{t-1} (20)	BLEV _{t-1} (21)	MLEV _{t-1} (22)	BLEV _{t-1} (23)	MLEV _{t-1} (24)
Dist × Size	-0.0127*** (-11.77)	-0.0097*** (-6.48)	-0.0117*** (-9.83)	-0.0072*** (-6.61)	-0.0084*** (-8.73)	-0.0051*** (-5.02)	-0.0134*** (-11.56)	-0.0096*** (-7.90)	-0.0122*** (-10.12)	-0.0080*** (-7.77)	-0.0085*** (-9.62)	-0.0052*** (-5.28)
Dist × MTB	0.0034*** (5.88)	0.0053*** (7.80)	0.0035*** (6.03)	0.0055*** (5.80)	0.0031*** (5.11)	0.0050*** (8.51)	0.0033*** (6.04)	0.0053*** (6.62)	0.0034*** (6.83)	0.0053*** (7.16)	0.0031*** (6.50)	0.0050*** (5.54)
Dist × Prof	0.2306*** (8.91)	0.0278 (1.52)	0.2425*** (15.93)	0.0475*** (3.40)	0.3071*** (12.07)	0.1221*** (8.66)	0.2310*** (11.32)	0.0330 (1.37)	0.2449*** (11.33)	0.0562* (1.77)	0.3057*** (27.35)	0.1236*** (6.13)
Dist × RD	0.2112*** (4.46)	0.1689** (2.02)	0.2415*** (6.35)	0.2314*** (3.18)	0.1847*** (3.47)	0.1643*** (4.66)	0.1912*** (3.74)	0.1719** (2.00)	0.2213*** (4.54)	0.2066** (2.47)	0.1711*** (7.23)	0.1404** (2.05)
Dist × RDum	-0.0126*** (-3.06)	-0.0215*** (-3.40)	-0.0163*** (-5.87)	-0.0254*** (-4.97)	-0.0131*** (-2.93)	-0.0182*** (-4.96)	-0.0108** (-2.52)	-0.0162*** (-3.11)	-0.0144*** (-3.19)	-0.0212*** (-5.08)	-0.0101*** (-3.05)	-0.0128*** (-2.61)
Dist × Tong	-0.0570*** (-5.00)	-0.0289* (-1.79)	-0.0591*** (-5.54)	-0.0362*** (-3.39)	-0.0404*** (-3.89)	-0.0208*** (-2.70)	-0.0523*** (-5.75)	-0.0292*** (-3.22)	-0.0526*** (-4.66)	-0.0287*** (-3.55)	-0.0408*** (-6.11)	-0.0197*** (-2.08)
Dist × Dep	-0.1680** (-1.99)	0.4760*** (4.27)	-0.1429** (-2.09)	0.4909*** (9.02)	-0.4184*** (-5.41)	0.1883*** (3.46)	-0.2009*** (-2.97)	0.4114*** (5.73)	-0.1926** (-2.47)	0.4180*** (4.59)	-0.4187*** (-8.94)	0.1545** (2.33)
Dist × Infl	0.0037*** (4.76)	0.0060*** (4.28)	0.0038*** (3.95)	0.0057*** (7.50)	0.0032*** (3.60)	0.0049*** (7.77)	0.0049*** (7.92)	0.0071*** (9.59)	0.0052*** (7.99)	0.0073*** (9.55)	0.0030*** (5.48)	0.0050*** (6.10)
Dist × GDP	0.0068*** (8.09)	0.0110*** (11.91)	0.0069*** (15.34)	0.0116*** (13.03)	0.0080*** (10.08)	0.0130*** (21.01)	0.0075*** (11.52)	0.0126*** (16.41)	0.0075*** (10.98)	0.0124*** (19.06)	0.0081*** (14.56)	0.0132*** (16.93)
Constant	0.0153*** (3.85)	0.0041 (0.77)	0.0154*** (3.30)	0.0147** (2.03)	0.0155*** (3.26)	0.0149*** (2.63)	0.0151*** (4.28)	0.0138** (2.21)	0.0152*** (4.16)	0.0141** (2.33)	0.0154*** (3.80)	0.0145** (2.04)
Observations	176,108	176,108	176,108	176,108	176,108	176,108	176,108	176,108	176,108	176,108	176,108	176,108
R ²	0.0573	0.0531	0.0578	0.1129	0.0612	0.1148	0.0576	0.1125	0.0583	0.1135	0.0610	0.1150
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

(Continued)

Table 4. (Continued)

Variables	IE = CreErf			IE = Bank						
	Amihud	Turn	HighLow	Amihud	Turn	HighLow				
	BLEV _{t+1} (25)	MLEV _{t+1} (26)	BLEV _{t+1} (28)	MLEV _{t+1} (30)	BLEV _{t+1} (31)	MLEV _{t+1} (32)	BLEV _{t+1} (33)	MLEV _{t+1} (34)	BLEV _{t+1} (35)	MLEV _{t+1} (36)
Dist × (-Amihud)	0.0015*** (2.69)	0.0032*** (3.47)			0.0013*** (6.74)	0.0014*** (6.98)				
Dist × (-Amihud) × IE	-0.0003 (-1.59)	-0.0009*** (-2.85)			-0.0019*** (-3.41)	-0.0021*** (-3.77)				
Dist × Turn			0.0063*** (3.30)				0.0016*** (3.92)	0.0033*** (9.78)		
Dist × Turn × IE			-0.0014** (-2.29)				-0.0002 (-0.56)	-0.0002 (-0.36)		
Dist × HighLow				5.4296*** (8.85)					1.9680*** (12.01)	1.8915*** (9.76)
Dist × HighLow × IE				-1.2212*** (-6.01)					-0.1782 (-1.08)	-0.5603*** (-3.17)
Dist	0.3676*** (28.40)	0.2664*** (14.54)	0.3384*** (17.15)	0.0992*** (4.59)	0.0402** (2.08)	0.2176*** (13.81)	0.2775*** (15.97)	0.1837*** (15.60)	0.1735*** (8.98)	0.0969*** (5.94)
Dist × IE	-0.0345*** (-15.37)	-0.0251*** (-9.41)	-0.0320*** (-9.04)	0.0160** (2.50)	0.0151*** (3.23)	-0.0314*** (-8.02)	-0.0360*** (-7.82)	-0.0231*** (-6.73)	-0.0376*** (-6.49)	-0.0330*** (-5.09)
Dist × Size	-0.0131*** (-15.14)	-0.0074*** (-7.27)	-0.0120*** (-9.74)	-0.0084*** (-8.89)	-0.0038*** (-3.78)	-0.0067*** (-6.81)	-0.0111*** (-9.84)	-0.0055*** (-5.81)	-0.0079*** (-6.22)	-0.0031** (-2.51)
Dist × MTB	0.0027*** (8.82)	0.0041*** (4.34)	0.0026*** (3.90)	0.0025*** (5.30)	0.0038*** (7.60)	0.0060*** (7.53)	0.0028*** (7.20)	0.0038*** (7.81)	0.0026*** (4.50)	0.0055*** (8.66)
Dist × Prof	0.2559*** (23.79)	0.0318 (1.26)	0.2695*** (8.60)	0.3311*** (14.90)	0.1255*** (8.75)	0.2474*** (9.77)	0.2583*** (12.76)	0.0435* (1.83)	0.3182*** (11.89)	0.1151*** (5.13)
Dist × RD	0.1996*** (8.52)	0.1868** (2.33)	0.2308*** (4.74)	0.1895*** (4.10)	0.1367*** (3.82)	0.2121*** (4.41)	0.1667** (4.54)	0.2089*** (2.71)	0.1960*** (3.29)	0.1391** (2.00)

(Continued)

Table 4. (Continued)

Variables	IE = CreEnf						IE = Bank					
	Amihud		Turn		HighLow		Amihud		Turn		HighLow	
	BLEV _{t,t-1} (25)	MLEV _{t,t-1} (26)	BLEV _{t,t-1} (27)	MLEV _{t,t-1} (28)	BLEV _{t,t-1} (29)	MLEV _{t,t-1} (30)	BLEV _{t,t-1} (31)	MLEV _{t,t-1} (32)	BLEV _{t,t-1} (33)	MLEV _{t,t-1} (34)	BLEV _{t,t-1} (35)	MLEV _{t,t-1} (36)
Dist × RD Dum	-0.0031 (-0.96)	-0.0139*** (-2.88)	-0.0058 (-1.34)	-0.0194*** (-4.55)	-0.0039 (-0.90)	-0.0144*** (-3.91)	-0.0016 (-0.37)	-0.0126*** (-3.23)	-0.0041 (-0.80)	-0.0185*** (-3.87)	-0.0079 (-1.01)	-0.0116** (-2.36)
Dist × Tong	-0.0499*** (-7.73)	-0.0330*** (-3.33)	-0.0497*** (-6.32)	-0.0319*** (-2.81)	-0.0394*** (-4.82)	-0.0171** (-2.23)	-0.0585*** (-5.15)	-0.0366*** (-4.12)	-0.0591*** (-5.47)	-0.0365*** (-3.78)	-0.0454*** (-4.83)	-0.0232*** (-2.73)
Dist × Dep	-0.1681*** (-3.71)	0.5039*** (7.04)	-0.1522** (-2.36)	0.5206*** (9.16)	-0.3742*** (-5.91)	0.2297*** (4.18)	-0.1501** (-2.31)	0.4851*** (5.46)	-0.1281* (-1.84)	0.5262*** (7.77)	-0.3445*** (-5.34)	0.2324*** (3.33)
Dist × Invf	0.0034*** (7.17)	0.0054*** (6.43)	0.0033*** (5.78)	0.0053*** (7.69)	0.0017*** (2.93)	0.0030*** (5.49)	-0.0007 (-0.85)	0.0026*** (3.26)	-0.0003 (-0.38)	0.0029*** (3.30)	-0.0015* (-1.76)	0.0018** (2.11)
Dist × GGDp	0.0055*** (12.43)	0.0107*** (17.11)	0.0046*** (7.82)	0.0090*** (15.40)	0.0055*** (8.74)	0.0106*** (19.91)	0.0024*** (3.79)	0.0083*** (11.13)	0.0021*** (3.01)	0.0075*** (11.14)	0.0032*** (7.56)	0.0095*** (14.80)
Constant	0.0158*** (3.86)	0.0141*** (2.25)	0.0157*** (3.71)	0.0144*** (2.94)	0.0155*** (3.60)	0.0044 (0.80)	0.0146*** (3.36)	0.0118* (1.91)	0.0147*** (3.35)	0.0122* (1.75)	0.0150*** (5.77)	0.0127* (1.94)
Observations	190,754	190,754	190,754	190,754	190,754	190,754	187,997	187,997	187,997	187,997	187,997	187,997
R ²	0.0583	0.1136	0.0588	0.1145	0.0617	0.0574	0.0583	0.1144	0.0583	0.1150	0.0612	0.1169
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

SOA: speed of adjustment. FE: fixed effect.
 This table reports the regression results for the effect information environments on liquidity—leverage SOA relationship using the following models:
 $\Delta LEV_{t,t-1} = \alpha_0 + \beta_1 \Delta LQ_{t,t-1} + \beta_2 IE_{t,t-1} + \beta_3 LQ_{t,t-1} + \beta_4 X_{t,t-1} + \beta_5 (Dist_{t,t-1}) + \omega_{t,t-1}$
 The dependent variable is the change in book and market leverage ratio ($\Delta LEV_{t,t-1}$). $Dist_{t,t-1}$ is the different between the target leverage ratio and the actual leverage ratio. Liquidity $LQ_{t,t-1}$ is proxied by Amihud (Amihud), Turnover (Turn), and High-low impact (HighLow) measure. $IE_{t,t-1}$ is the institutional environment indicators including rule of law (RuleLaw), Risk of Expropriation (RiskExp), Risk of Contract Repudiation (RiskCon), Creditor Right Enforcement (CreEnf), Level of Corruption (Corrup), and Banking sector (Bank). $X_{t,t-1}$ is the vector of control variables that includes firm size (Size), market-to-book ratio (MTB), profitability (Prof), research and development expenses (RD), research and development dummy (RDDum), Tangibility (Tang), Depreciation expenses (Dep), Inflation rate (INR), and annual GDP growth rate (GGDP). Year and country fixed effects are included in Models (1) to (36). ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are given in Appendix A1 in Online Supplemental Material.

effective. This gave rise to more detailed rules and more transparent investor protection for the European exchanges. Cumming et al. (2011) show that firms experienced a substantial increase in stock liquidity after the MiFID. The change in this legislation is likely to be exogenous to firms' strategies and decisions, and thus unlikely to directly drive leverage SOA. Moreover, because the introduction of MiFID affected only countries in the European Union, it created a natural experimental setting to assess the effect of liquidity on leverage SOA.

To test the impact of a change in liquidity on leverage SOA, we use the difference-in-differences regression using a control group to subtract other changes occurring at the same time as MiFID, assuming these other changes were identical between the treatment group (the European countries that were subject to MiFID) and the control group (the other countries) as in equation (8)

$$\Delta LEV_{i,t+1,j} = \alpha_0 + (\partial_0 + \beta_1 Treat_i * After_t + \theta X_{i,t,j})(Dist_{i,t,j}) + \omega_{i,t+1,j} \quad (8)$$

where *Treat* is a dummy variable that is set as one for countries subject to MiFID and zero otherwise, and *After* is a dummy variable that is set as one for every year after 2007 and zero in all prior years.

Table 5 presents the regression results. The coefficients of the interaction terms *Dist**Treat*After** are positive and statistically significant for both book and market leverage regressions, which is in line with our conjecture that an exogenous increase in liquidity resulting from the introduction of MiFID is associated with a higher leverage SOA. Overall, the results of the natural experimental setting provide some evidence of a causal impact of liquidity on leverage SOA.

5.5.2. Additional controls. There is another potential source of endogeneity issue pertaining to this study, which is the presence of time-varying omitted variables. Specifically, it is possible that stock liquidity is significantly associated with other firm-level and country-level variables, which are typically correlated with leverage SOA, thus biasing the article's inference. We address this issue by controlling for additional determinants of leverage SOA that may have significant impacts on liquidity.

We first include stock capitalization and term spread in our leverage SOA regression (equation (4)). Using term spread, defined as the difference between the 10-year government bond yield series and the 3-month interest rate series, as a predictor for good economy, Cook and Tang (2010) propose that firms operating in good economies adjust their leverage faster toward the targets relative to firms operating in bad economies. Öztekin and Flannery (2012) and Çolak et al. (2018) also suggest that if a country has a good sized stock market, firms in that country are likely to have higher SOA. We re-estimate equation (5) using these additional controls and present the results in panel A of Table 6. The coefficients of the interaction terms between liquidity proxies and leverage deviation are all positive and statistically significant for both book and market leverage regressions across models (1)–(6). The effects of macro-level control variables are also positive and statistically significant, implying that firms in countries with better economies adjust faster to their target leverage. These results are consistent with not only our baseline results but also the previous literature.

We next control for additional firm-level factors that are known to have effects on leverage SOA and liquidity. Specifically, Faulkender et al. (2012) argue that deviation from target leverage and cash flow status are two important determinants of leverage SOA. They note that the adjustment costs and thus leverage SOA depend on whether firms are over- or under-levered in relation to target leverage, as well as whether they are deficit or surplus financing. We therefore include these two firm-level control variables in the leverage SOA specification (equation (4)). Panel B of Table 6 presents the results of this additional examination. Consistent with Faulkender et al. (2012), our

Table 5. The introduction of MiFID as an exogenous shock.

Variables	$\Delta BLEV_{t+1}$	$\Delta MLEV_{t+1}$
	(1)	(2)
<i>Dist</i> × <i>Treat</i> × <i>After</i>	0.0061** (2.17)	0.0264*** (3.25)
<i>Dist</i>	0.2587*** (14.12)	0.1714*** (12.57)
<i>Dist</i> × <i>Size</i>	-0.0119*** (-10.75)	-0.0058*** (-5.22)
<i>Dist</i> × <i>MTB</i>	0.0027*** (12.82)	0.0040*** (3.34)
<i>Dist</i> × <i>Prof</i>	0.2495*** (1,066.13)	0.0271 (0.98)
<i>Dist</i> × <i>RD</i>	0.2200 (1.51)	0.1948** (2.55)
<i>Dist</i> × <i>RDDum</i>	-0.0067* (-1.82)	-0.0157*** (-3.26)
<i>Dist</i> × <i>Tang</i>	-0.0568*** (-16.20)	-0.0345*** (-4.19)
<i>Dist</i> × <i>Dep</i>	-0.1487*** (-3.36)	0.5022*** (6.93)
<i>Dist</i> × <i>Infl</i>	0.0025*** (2.93)	0.0047*** (6.57)
<i>Dist</i> × <i>GGDP</i>	0.0052*** (7.69)	0.0110*** (15.38)
Constant	0.0150*** (3.91)	0.0130** (2.25)
Observations	190,754	190,754
R ²	0.0570	0.1130
Year FE	Yes	Yes
Country FE	Yes	Yes

MiFID: Markets in Financial Instruments; FE: fixed effect.

This table reports the regression results of the following model:

$$\Delta LEV_{i,t+1} = \alpha_0 + (\hat{\alpha}_0 + \beta_1 \text{Treat}_i * \text{After}_t + \theta X_{i,t}) (\text{Dist}_{i,t}) + \omega_{i,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta LEV_{i,t+1}$). $\text{Dist}_{i,t}$ is the different between the target leverage ratio and the actual leverage ratio. *Treat* is a dummy variable that is equal to one for countries subject to MiFID and zero otherwise, and *After*_{*t*} is a dummy variable that is set to one for every year after 2007 and zero in all prior years. $X_{i,t}$ is the vector of control variables that includes firm size (*Size*), market-to-book ratio (*MTB*), profitability (*Prof*), research and development expenses (*RD*), research and development dummy (*RDDum*), Tangibility (*Tang*), Depreciation expenses (*Dep*), Inflation rate (*INFL*), and annual GDP growth rate (*GGDP*). Year and country fixed effects are included in Models (1) and (2). ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. *T*-statistics are reported in parenthesis. The variable definitions are given in Appendix A1 in Online Supplemental Material.

results show that while the coefficients of the interaction term *Dist* × *Surplus* are positive and significant at the 1% level, the coefficients of the interaction term *Dist* × *UnderLev* are negative and significant at the 1% level. The results imply that firms with financing surplus adjust faster to their targets and under-levered firms have lower leverage SOA. More importantly, the coefficients

Table 6. Different sets of control variables.

Variables	Amihud		Turn		HighLow	
	$\Delta BLEV_{t+1}$ (1)	$\Delta MLEV_{t+1}$ (2)	$\Delta BLEV_{t+1}$ (3)	$\Delta MLEV_{t+1}$ (4)	$\Delta BLEV_{t+1}$ (5)	$\Delta MLEV_{t+1}$ (6)
Dist \times (-Amihud)	0.0007** (1.97)	0.0007*** (3.31)				
Dist \times Turn			0.0024*** (6.01)	0.0030*** (8.01)		
Dist \times HighLow					1.8174*** (12.09)	1.4731*** (8.48)
Dist	0.2166*** (12.71)	0.1313*** (8.48)	0.1869*** (9.41)	0.0972*** (5.40)	0.1131*** (6.32)	0.0549*** (3.26)
Dist \times Size	-0.0139*** (-10.84)	-0.0105*** (-9.07)	-0.0129*** (-9.66)	-0.0092*** (-6.72)	-0.0086*** (-6.86)	-0.0067*** (-6.14)
Dist \times MTB	0.0037*** (5.19)	0.0046*** (6.63)	0.0037*** (5.95)	0.0044*** (4.97)	0.0037*** (6.48)	0.0046*** (4.81)
Dist \times Prof	0.2059*** (7.21)	0.0586*** (3.71)	0.2160*** (7.80)	0.0762*** (3.19)	0.2639*** (8.91)	0.1153*** (3.61)
Dist \times RD	0.1402** (2.52)	0.1226*** (3.49)	0.1638** (2.34)	0.1498* (1.82)	0.1463*** (2.66)	0.1195 (1.63)
Dist \times RD.Dumm	0.0002 (0.05)	-0.0053 (-1.28)	-0.0025 (-0.46)	-0.0094* (-1.70)	-0.0010 (-0.20)	-0.0051 (-1.09)
Dist \times Toneg	-0.0236** (-2.01)	-0.0113 (-1.27)	-0.0245** (-2.18)	-0.0131 (-0.88)	-0.0154 (-1.33)	-0.0050 (-0.41)
Dist \times Defj	-0.2369** (-2.29)	0.3016*** (5.12)	-0.2260** (-2.38)	0.3171*** (4.50)	-0.4175*** (-5.12)	0.1365* (1.66)
Dist \times lnIj	0.0099*** (6.70)	0.0100*** (8.40)	0.0099*** (6.24)	0.0096*** (5.71)	0.0053*** (2.79)	0.0057*** (4.18)

(Continued)

Table 6. (Continued)

Panel A: Controlling for additional macro-level variables						
Variables	Amihud	$\Delta MLEV_{t+1}$	Turn	HighLow		
	$\Delta BLEV_{t+1}$	$\Delta MLEV_{t+1}$	$\Delta BLEV_{t+1}$	$\Delta MLEV_{t+1}$	$\Delta MLEV_{t+1}$	
	(1)	(2)	(3)	(4)	(5)	
	(6)	(7)	(8)	(9)	(10)	
Dist \times StockCap	0.0005*** (6.62)	0.0009*** (14.24)	0.0006*** (7.28)	0.0010*** (11.97)	0.0003*** (4.62)	0.0007*** (8.27)
Dist \times TermSpread	0.0042** (2.57)	0.0201*** (13.90)	0.0038** (2.48)	0.0198*** (11.34)	0.0008 (0.62)	0.0167*** (8.94)
Dist \times GGDP	0.0058*** (5.51)	0.0105*** (11.92)	0.0053*** (6.04)	0.0098*** (8.01)	0.0071*** (8.17)	0.0116*** (8.71)
Constant	0.0027 (1.15)	-0.0103*** (-3.35)	0.0028 (1.17)	-0.0101*** (-3.46)	0.0028 (1.22)	-0.0103*** (-3.30)
Observations	122,442	122,442	122,442	122,442	122,442	122,442
R ²	0.0624	0.1185	0.0629	0.1192	0.0649	0.1197
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: Controlling for additional firm-level variables						
Variables	Amihud	$\Delta MLEV_{t+1}$	Turn	HighLow		
	$\Delta BLEV_{t+1}$	$\Delta MLEV_{t+1}$	$\Delta BLEV_{t+1}$	$\Delta MLEV_{t+1}$	$\Delta MLEV_{t+1}$	
	(1)	(2)	(3)	(4)	(5)	
	(6)	(7)	(8)	(9)	(10)	
Dist \times (-Amihud)	0.0009*** (3.27)	0.0014*** (4.47)				
Dist \times Turn			0.0020*** (4.26)	0.0030*** (5.68)		
Dist \times HighLow					1.7989*** (8.36)	1.9630*** (11.67)

(Continued)

Table 6. (Continued)

Variables	Amihud		Turn		HighLow	
	$\Delta BLEV_{t+1}$ (1)	$\Delta MLEV_{t+1}$ (2)	$\Delta BLEV_{t+1}$ (3)	$\Delta MLEV_{t+1}$ (4)	$\Delta BLEV_{t+1}$ (5)	$\Delta MLEV_{t+1}$ (6)
Dist	0.3587*** (19.29)	0.3679*** (15.53)	0.3241*** (16.98)	0.3106*** (13.01)	0.2199*** (14.82)	0.2114*** (12.47)
Dist \times Size	-0.0170*** (-12.20)	-0.0141*** (-9.12)	-0.0153*** (-12.06)	-0.0112*** (-6.43)	-0.0118*** (-12.42)	-0.0083*** (-7.25)
Dist \times MTB	0.0028*** (4.13)	0.0054*** (5.23)	0.0029*** (4.09)	0.0053*** (5.30)	0.0028*** (4.17)	0.0052*** (6.45)
Dist \times Prof	0.2195*** (7.40)	-0.0295 (-0.94)	0.2255*** (6.79)	-0.0157 (-0.43)	0.2700*** (9.54)	0.0430 (1.32)
Dist \times RD	0.2510*** (4.31)	0.2013*** (2.79)	0.2768*** (4.09)	0.2378*** (2.95)	0.2415*** (4.23)	0.1863** (2.32)
Dist \times RDum	-0.0147*** (-3.01)	-0.0204*** (-3.91)	-0.0159*** (-3.04)	-0.0221*** (-4.02)	-0.0130*** (-2.73)	-0.0153*** (-3.04)
Dist \times Tang	-0.0604*** (-5.67)	-0.0446*** (-3.93)	-0.0626*** (-5.66)	-0.0465*** (-4.33)	-0.0561*** (-4.30)	-0.0397*** (-3.64)
Dist \times Dep	-0.3231*** (-4.07)	0.1997** (2.09)	-0.3115*** (-3.71)	0.2127** (2.13)	-0.4990*** (-4.50)	-0.0190 (-0.20)
Dist \times Surplus	0.0256*** (4.53)	0.0523*** (7.98)	0.0282*** (5.19)	0.0555*** (8.30)	0.0329*** (5.31)	0.0580*** (8.31)
Dist \times UnderLev	-0.0473*** (-7.16)	-0.1327*** (-17.58)	-0.0442*** (-6.21)	-0.1276*** (-21.06)	-0.0297*** (-3.85)	-0.1099*** (-15.99)
Dist \times Infl	0.0018* (1.90)	0.0024** (2.50)	0.0021* (1.94)	0.0030*** (2.66)	0.0004 (0.38)	0.0007 (0.65)
Dist \times GGDP	0.0027*** (2.67)	0.0055*** (5.88)	0.0029*** (3.42)	0.0057*** (5.54)	0.0042*** (4.59)	0.0073*** (7.94)

(Continued)

Table 6. (Continued)

Variables	Amihud		Turn		HighLow	
	$\Delta BLEV_{t+1}$ (1)	$\Delta MLEV_{t+1}$ (2)	$\Delta BLEV_{t+1}$ (3)	$\Delta MLEV_{t+1}$ (4)	$\Delta BLEV_{t+1}$ (5)	$\Delta MLEV_{t+1}$ (6)
Constant	0.0130** (2.17)	0.0553*** (5.81)	0.0129** (2.18)	0.0552*** (4.79)	0.0131* (1.77)	0.0552*** (6.00)
Observations	110,854	110,854	110,854	110,854	110,854	110,854
R ²	0.0628	0.1213	0.0629	0.1215	0.0647	0.1229
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

SOA: speed of adjustment; FE: fixed effect

This table reports the regression results for the effects of liquidity on the SOA after controlling for additional macro-level variables (Panel A) and firm-level variables (Panel B) for following regression:

$$\Delta LEV_{t,t+1} = \alpha_0 + (\hat{\rho}_0 + \beta_1 LQ_{t,t}) + \hat{\rho}_1 X_{t,t} + \beta_2 StockMarket_{t,t} + \beta_3 BondMarket_{t,t} + \beta_4 (Dist_{t,t}) + \omega_{t,t+1}$$

$$\Delta LEV_{t,t+1} = \alpha_0 + (\hat{\rho}_0 + \beta_1 LQ_{t,t}) + \beta_2 X_{t,t} + \beta_3 Surplus_{t,t} + \beta_4 UnderLev_{t,t} + \beta_5 (Dist_{t,t}) + \omega_{t,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta LEV_{t,t+1}$). $Dist_{t,t}$ is the different between the target leverage ratio and the actual leverage ratio. Liquidity $LQ_{t,t}$ is proxied by Amihud (Amihud), Turnover (Turn), and High-low impact (HighLow) measure. Control variables include vector $X_{t,t}$ that are firm size (Size), market-to-book ratio (MTB), profitability (Prof), research and development expenses (RD), research and development dummy (RDDum), Tangibility (Tang), Depreciation expenses (Dep), Inflation rate (INF), and annual GDP growth rate (GGDP), and additional variables. The first set of additional control variables including stock market capitalization (StockCap) and term spread (TermSpread) (Panel A). The second set of additional control variables including a financing surplus dummy variable (Surplus), that equals one if the firm has a financing surplus, and zero otherwise and an under-target leverage dummy variable (UnderLev) that equals one if the firm is under-levered relative to target leverage, and zero otherwise (Panel B). Year and country fixed effects are included in Models (1) to (6) in both Panel A and Panel B. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are given in Appendix A1 in Online Supplemental Material.

of interaction terms between leverage distance and liquidity proxies remain positive and statistically significant, indicating that our baseline results are robust in the presence of additional controlling variables.

6. Conclusion

In this study, we investigate how firm-level liquidity affects the speed with which firms converge back to their leverage targets in an international setting. Based on a sample of 16,963 firms in 35 countries over the period between 1996 and 2016, we find a positive association between liquidity and leverage SOA, indicating that firms with highly liquid equity adjust more quickly to their targets. This important finding is robust after using a range of alternative proxies for liquidity, an alternative leverage measure, an alternative econometric method, and correcting for endogeneity. More interestingly, we show that liquidity has a distinct effect on the leverage SOA of over- and under-levered firms: highly liquid firms that are over-levered tend to adjust quickly to their targets and this positive impact is attenuated in countries with explicit bankruptcy codes, whereas the positive association between liquidity and leverage SOA is ambiguous for under-levered firms. In addition, we confirm a substitution effect between country-level institutions and firm-level liquidity by documenting that the relationship between liquidity and the SOA is more (less) pronounced for firms operating in weak (strong) institutional environments.

This study contributes to the literature in several ways. It is the first to enrich the literature of leverage adjustment by identifying liquidity as a new determinant of SOA. Second, it provides further evidence that the impact of liquidity on leverage SOA is not homogeneous but distinct for over- and under-levered firms as a result of the different financing behaviors of these firms. It also highlights the important roles of institutional environments in shaping a firm's capital structure decisions by providing new empirical evidence of the joint effect of liquidity and institutional contexts.

This study has several implications. Firms' managers may improve equity liquidity at the firm-level to enhance its positive impact on leverage SOA. Moreover, policy makers may use regulations to strengthen their law and order traditions, create good government, enforce creditor rights, and improve the banking sector. Better institutional environments create higher leverage SOA.

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Supplemental material

Supplemental material for this article is available online.

Notes

1. Please see the robustness tests in Appendix B in Online Supplemental Material.

2. The start date of 1996 is chosen as trading information is available from 1996 onwards (Gao and Zhu, 2015).
3. Our method of calculating stock turnover over a year is similar to that used in Chan and Faff (2003) and Chai et al. (2010). An alternative method is to use daily outstanding. However, these data are not readily available to us over our sample period.
4. We thank the anonymous referee for recommending this excellent proxy of liquidity.
5. We further check robustness with zero-return proportion measures and closing percent quoted spread in Appendix B4 in Online Supplemental Material.

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Appendix A1. Variable definitions

Variables	Acronym	Description	Data source
A. Firm-level variable			
A.1. Leverage			
	LEV		
Book leverage	BLEV	Book value of total debt divided by book value of total assets	Worldscope
Market leverage	MLEV	Book value of total debt divided by the sum of market value of equity and the book value of total debt	Worldscope
Active leverage	ALEV	Book value of total debt divided by the sum book value of total assets and the total net income	Worldscope
A2. Liquidity variables			
Amihud illiquidity	Amihud	Ratio of the daily absolute stock return to its dollar volume averaged over the number of positive volume days	Datastream
Turnover	Turn	The number of shares traded on a day, divided by the total number of share outstanding. The turnover for each stock, for each year, is calculated as the average turnover across all trading days in a year.	Datastream
High-low impact	HighLow	A function of the high-to-low price ratio for a single two-day period and the high-to-low ratios for two consecutive single days.	Datastream
Zero return proportion	PropZero	Proportion of trading days in the year that had zero price change (zero return) from the previous day	Datastream
Alternative zero return proportion	PropZero2	Proportion of trading days in the year that had positive volume zero price change (zero return) from the previous day	Datastream
Daily closing percent quoted spread	Spread	Daily closing bid-ask spread divided by the midpoint spread averaged over the number of positive volume days	Datastream
A3. Target leverage variables			
Leverage deviation	Dist	Difference between target and observed leverage ratio	Self-calculated
A4. Other firm-level characteristics			
Firm size	SIZE	Natural logarithm of book value of total assets	Worldscope
Tangibility	TANG	Net property, plant and equipment dividend by book value of assets	Worldscope
Growth opportunity	MTB	Ratio of book value of assets less book value of equity plus market value of equity to book value of assets	Worldscope
Profitability	PROF	Earning before interests, taxes, depreciation and amortization divided by book value of assets	Worldscope
Depreciation	DEP	Depreciation and amortization divided by book value of assets	Worldscope

Research and development	RD	Research and development expenses divided by book value of assets	Worldscope
Research and development dummy	RDDUM	Dummy variable that equals to one if research and development expenses are not reported and zero otherwise	Worldscope
Financing surplus	Surplus	A dummy that equals one if the firm has a financing surplus and zero otherwise	Worldscope
Under-target leverage	UnderLcv	A dummy that equals one if firm is under-levered relative to target leverage and zero otherwise	Worldscope
B. Industry-level variable			
Industry median of leverage	INDMED	The median leverage ratio of an industry to which a firm belongs	Self-calculated
C. Country-level variable			
GDP growth rate	GGDP	Annual GDP growth rate	World Development Indicator
Inflation rate	INFL	Annual Inflation rate	World Development Indicator
Stock market capitalization to GDP (%)	StockCap	Total shares traded on the stock market exchange to GDP.	World Development Indicator
Term spread	TermSpread	Difference between the ten-year government bond yield series and the three-month interest rate series	OECD Database
Bankruptcy code	Bankrp	Dummy variable that takes the value of one for those countries in which an insolvent firm can undergo a court-supervised reorganisation proceeding	Djankov et al., 2008
Rule of law	RulLaw	Assessment of the law and order tradition in the country produced by the country risk rating agency International Country Risk (ICR). Average of the guide months of April and October of the monthly index between 1982 and 1995. Scale from zero to 10, with lower scores for less tradition for law and order (we changed the scale from its original range going from zero to six)	La Porta et al. (1998)
Risk of expropriation	RisExp	Assessment of the risk of “outright confiscation” or “forced nationalization.” Average of the months of April and October of the monthly index between 1982 and 1995. Scale from zero to 10, with lower scores for higher risks	La Porta et al. (1998)
Repudiation of contracts by government	RisCon	Assessment of the “risk of a modification in a contract taking the form of a repudiation, postponement, or scaling down” due to “budget cutbacks, indigenization pressure, a change in government, or a change in government economic and social priorities.” Average of the months of	La Porta et al. (1998)

		April and October of the monthly index between 1982 and 1995. Scale from zero to 10, with lower scores for higher risks	
Creditor right enforcement	CreEnf	An index that measures substantive and procedural statutory intervention in judicial cases at lower-level civil trial courts, and is formed by adding up the following indices: (i) professional versus laymen, (ii) written versus oral elements, (iii) legal justification, (iv) statutory regulation of evidence, (v) control of superior review, (vi) engagement formalities, and (vii) independent procedural actions. The index ranges from zero to seven where seven means a higher level of control or intervention in the judicial process	Djankov, La Porta, Lopez-de-Silanes, and Shleifer, 2003
Corruption in government	Corrup	Principal components of corruption in government, risk of expropriation, and repudiation of contracts by government	La Porta et al. (1998)
Banking sector	Bank	Domestic credit provided by the banking sector scale by GDP	World Development Indicator

Appendix A2. Data structure and estimates of the leverage SOA

This table reports the data structure and the average of leverage SOA for each country. The study period is from 1996 to 2016. The variable definitions are in Appendix A1.

Country	Data structure		SOA estimates	
	No. of firms	No. of obs.	BLEV	MLEV
1 Argentina	40	427	15.02%	24.98%
2 Australia	220	2,452	18.74%	26.17%
3 Belgium	70	970	19.08%	33.80%
4 Canada	711	6,401	21.31%	27.38%
5 Chile	111	1,219	14.62%	8.61%
6 China	1,324	14,194	15.47%	24.95%
7 Colombia	25	242	28.20%	29.81%
8 Croatia	76	452	28.13%	17.92%
9 Denmark	106	1,315	16.00%	21.00%
10 Finland	109	1,443	21.64%	31.26%
11 France	567	5,750	14.77%	17.24%
12 Germany	463	4,568	14.52%	17.53%
13 Greece	251	2,798	9.74%	18.88%
14 Hong Kong	726	8,374	23.52%	22.53%
15 India	459	3,319	10.55%	12.35%
16 Indonesia	278	3,275	17.45%	21.57%
17 Israel	233	2,076	9.33%	13.79%
18 Italy	208	2,481	9.69%	12.55%
19 Japan	2,846	39,049	5.78%	7.95%
20 Korea	668	9,009	17.18%	18.86%
21 Malaysia	725	9,116	10.91%	12.43%
22 Mexico	105	1,218	10.34%	21.86%
23 Netherland	122	1,510	24.96%	34.62%
24 Norway	154	1,454	23.87%	23.01%
25 Pakistan	125	1,477	13.48%	17.23%
26 Peru	66	586	9.38%	20.36%
27 Philippines	120	1,342	20.47%	18.26%
28 Singapore	499	5,596	13.00%	14.03%
29 Spain	110	1,316	23.90%	27.01%
30 Sweden	269	2,802	19.21%	26.07%
31 Switzerland	182	2,333	14.03%	26.61%
32 Thailand	403	5,213	13.05%	20.38%
33 Turkey	209	2,389	15.27%	23.00%
34 UK	1,369	11,914	15.96%	20.35%
35 US	3,014	32,674	14.96%	18.23%
36 All sample	16,963	190,754	13.13%	15.70%

Appendix B. Robustness checks

We examine the robustness checks of our results by using: (1) the one-step model suggested by Öztekin and Flannery (2012); (2) alternative measures of leverage; (3) an alternative econometric method; (4) alternative measures of liquidity; and (5) different subsamples.

B1. One-step model

Following Öztekin and Flannery (2012) and An et al. (2015) we estimate the one-step regression for high and low liquidity subsamples and compared the leverage SOA to examine the impact of liquidity on SOA. In particular, we substitute the target leverage model (Eq. (1)) into the partial adjustment specification (Eq. (3)) and rearrange to yield the following estimation specification:

$$LEV_{i,t+1,j} = \alpha_0 + (1 - \partial_j)LEV_{i,t,j} + \partial\beta X_{i,t,j} + \partial_j F_{i,t} + \omega_{i,t+1,j} \quad (9)$$

where $F_{i,t}$ is the firm fixed effects. We obtain consistent results, presented in Table B1. Specifically, the coefficients of leverage variables ($LEV_{i,t,j}$) are always positive and statistically significant. The coefficients of high liquidity groups (Model (1), (3), (5), (7), (9), (11)) are lower than the coefficients for low liquidity groups (Model (2), (4), (6), (8), (10), (12)), indicating that the leverage SOAs of high-liquidity firms are higher than the leverage SOAs of low-liquidity firms.

B2. Alternative measure of leverage

The standard partial adjustment model as presented in Eq. (3) assumes that a leverage adjustment runs from the leverage of the current period $LEV_{i,t,j}$ to the next period $LEV_{i,t+1,j}$. However, if there is no active leverage adjustment, leverage will change from $LEV_{i,t,j}$ when the firm posts its annual income to its equity account. An active adjustment requires the firm to access capital markets in some way, including paying dividends. Because only active adjustments involve transaction costs, examinations of target leverage adjustment should focus on active adjustment. Following Faulkender et al. (2012), we apply a partial active adjustment model:

$$LEV_{i,t+1,j} - LEV_{i,t,j}^p = \alpha_0 + \partial_j(LEV_{i,t+1,j}^* - LEV_{i,t,j}^p) + \omega_{i,t+1,j} \quad (10)$$

where $LEV_{i,t,j}^p = \frac{D_{i,t,j}}{TA_{i,t,j} + NI_{i,t+1,j}}$ and $NI_{i,t+1,j}$ is the net income during the year ending at time $t+1$. Leverage at $t+1$ would be $LEV_{i,t,j}^p$ if the firm engages in no net capital market activities. The left-hand side of Eq. (10) thus equals the firm's active adjustment toward its

target leverage ratio. We obtain qualitatively consistent results that are reported in Models (1) - (3) of Table B2 using the active adjustment measure. The impacts of liquidity measured by Amihud, turnover, and high-low impact on a firm's leverage SOA are positive and statistically significant. In sum, our main finding is robust to the alternative leverage measures that only capture active adjustments.

B3. Alternative measure of econometric method

Next, we estimate our models using the firm fixed effect model suggested by An et al. (2015) to control for time-variant unobserved firm-specific factors that may be associated with liquidity proxies and the speed of leverage adjustment. Standard errors are also robust to heteroskedasticity. We still find qualitatively consistent results, as presented in Table B3. Specifically, Models (1)-(6) of Table B3 show that the coefficients of *Dist x (-Amihud)*, *Dist x Turn* and *Dist x HighLow* are positive and statistically significant at 1%, suggesting that our evidence of a positive relationship between liquidity and the speed of leverage adjustments is robust when applying the firm fixed effect model as an alternative econometric approach.

B4. Alternative measures of liquidity

Following Lesmond et al. (1999) and Goyenko et al. (2009), we use the zero-return proportion (*Propzero_{i,t,j}*) as a proxy for liquidity, which is defined as:

$$Propzero_{i,t,j} = \frac{zeroreturn_{i,t,j}}{tradingday_{i,t,j}}$$

where *zeroreturn_{i,t,j}* is the number of zero daily return days for stock *i* in year *t*, and country *j*, and *tradingday_{i,t,j}* is the number of trading days for stock *i* in year *t*, and country *j*. There are two important arguments to support this measure. First, illiquid stocks have a higher probability of having zero-volume days and hence, zero-return days. Second, it is more difficult to acquire private information about stocks with lower liquidity or higher transaction costs. Therefore, even on positive volume days, they are more likely to have no-information-revelation and thus, zero-return days.

An alternative version of this measure (*Propzero2_{i,t,j}*) is defined as:

$$Propzero2_{i,t,j} = \frac{positive_zeroreturn_{i,t,j}}{tradingday_{i,t,j}}$$

where *positive_zeroreturn_{i,t,j}* is the number of positive volume days with zero daily return for stock *i* in year *t*, and country *j*. To convert the measures into liquidity proxies, they are modified as $1 - Propzero_{i,t,j}$ and $1 - Propzero2_{i,t,j}$.

Lastly, following Chung and Zhang (2014) and Fong et al. (2017), we also define the daily closing percent quoted spread (*Spread_{i,t}*) as a proxy for liquidity; that is, daily closing

bid-ask spread divided by the midpoint spread averaged over the number of positive volume days. These studies show that the simple daily bid-ask spread measure provides a good approximation of, and is highly correlated with, the bid-ask spread from intra-day data. This is shown as a direct measure of transaction costs. The annual average of this daily liquidity proxy for each stock i is measured as follows:

$$Spread_{i,t} = 1/D_{i,t} \sum_1^{D_{i,t}} \frac{Closing\ Ask_{i,t,d} - Closing\ Bid_{i,t,d}}{(Closing\ Ask_{i,t,d} + Closing\ Bid_{i,t,d})/2}$$

where $Closing\ Ask_{i,t,d}$ is the closing ask price of stock i on day d year t , $Closing\ Bid_{i,t,d}$ is the closing bid price of stock i on day d year t , and $D_{i,t}$ is the number of days for which the volume of stock i in year t is positive. Note that this is also an inverse measure of liquidity (essentially a measure of trading costs or illiquidity). To make the liquidity proxies consistent, we flip the sign of the closing percent quoted spread ($Spread_{i,t}$) to make it a liquidity measure.

The results in Table B4 show that the coefficients of the interaction terms including $Dist\ x\ (1-Propzero)$, $Dist\ x\ (1-Propzero2)$, and $Dist\ x\ (-Spread)$ are positive and statistically significant, suggesting that the positive impacts of liquidity and leverage SOA still hold with these alternative measures of liquidity.

B5. Different subsamples

We perform a further robustness check on different subsamples to control for the differences in the institutional features of the countries in our samples. Since the US and Japan are the countries with the greatest number of firms and observations in our sample, we ran a subsample analysis for US vs. non-US firms and Japanese vs. non-Japanese firms. The results in Panel A and B of Table B5 continue to present positive and significant coefficients for the interaction terms between liquidity and leverage deviation across the subsamples. These results further confirm the positive relationship between liquidity and leverage SOA and show that our baseline results are not driven by the dominance of US and/or Japanese firms in the sample.

Table B1. One-step model

This table reports the robustness checks using one-step model for following regressions:

$$LEV_{i,t+1,j} = \alpha_0 + (1 - \partial_j)LEV_{i,t,j} + \partial\beta X_{i,t,j} + \partial_j F_{i,t} + \omega_{i,t+1,j}$$

The dependent variable is the change in active leverage ratio ($\Delta LEV_{i,t+1,j}$). $Dist_{i,t,j}$ is the different between the target leverage ratio and the actual leverage ratio. Liquidity $LIQ_{i,t,j}$ is proxied by Amihud (*Amihud*), Turnover(*Turn*), and High-low impact (*HighLow*) measure. $X_{i,t,j}$ is the vector of control variables that includes firm size (*Size*), market to book ratio (*MTB*), profitability (*Prof*), research and development expenses (*RD*), research and development dummy (*RDDum*), Tangibility (*Tang*), Depreciation expenses (*Dep*), Inflation rate (*INFL*), and annual GDP growth rate (*GGDP*). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A1.

VARIABLES	Amihud				Turn				HighLow			
	BLEV		MLEV		BLEV		MLEV		BLEV		MLEV	
	High (1)	Low (2)	High (3)	Low (4)	High (5)	Low (6)	High (7)	Low (8)	High (9)	Low (10)	High (11)	Low (12)
<i>LagLEV</i>	0.6282*** (54.87)	0.6346*** (163.16)	0.5423*** (51.66)	0.5803*** (156.23)	0.6178*** (123.30)	0.6447*** (116.01)	0.5651*** (119.07)	0.5920*** (115.28)	0.6140*** (120.39)	0.6502*** (127.41)	0.5379*** (110.82)	0.6214*** (135.39)
<i>Size</i>	0.0346*** (11.58)	0.0315*** (34.53)	0.0759*** (18.92)	0.0489*** (44.33)	0.0304*** (26.46)	0.0316*** (23.14)	0.0440*** (31.16)	0.0513*** (31.81)	0.0297*** (25.53)	0.0311*** (25.87)	0.0467*** (32.59)	0.0485*** (31.99)
<i>MTB</i>	0.0012** (2.06)	0.0016*** (8.82)	-0.0082*** (-9.20)	-0.0056*** (-24.82)	0.0017*** (7.56)	0.0012*** (4.48)	-0.0072*** (-22.85)	-0.0045*** (-15.68)	0.0010*** (4.92)	0.0024*** (7.09)	-0.0070*** (-25.78)	-0.0033*** (-11.92)
<i>Prof</i>	-0.1983*** (-19.25)	-0.2312*** (-46.71)	-0.1553*** (-11.94)	-0.2378*** (-42.97)	-0.2454*** (-39.41)	-0.2074*** (-33.65)	-0.2338*** (-32.05)	-0.2224*** (-31.98)	-0.2103*** (-39.42)	-0.2758*** (-37.78)	-0.1880*** (-31.35)	-0.3295*** (-35.47)
<i>RD</i>	-0.0473 (-1.33)	-0.0606*** (-3.60)	0.0058 (0.13)	-0.0754*** (-5.87)	-0.0681*** (-2.63)	-0.0607*** (-3.29)	-0.0724*** (-2.85)	-0.0853*** (-6.52)	-0.0563*** (-3.32)	-0.0531 (-1.47)	-0.0592*** (-4.29)	-0.0372 (-1.10)
<i>RDDUM</i>	-0.0003 (-0.06)	-0.0068*** (-6.01)	-0.0020 (-0.34)	-0.0100*** (-6.86)	-0.0094*** (-6.17)	-0.0007 (-0.42)	-0.0116*** (-5.86)	-0.0012 (-0.56)	-0.0098*** (-5.83)	-0.0029** (-2.26)	-0.0152*** (-7.03)	-0.0050*** (-2.76)
<i>Tang</i>	0.0996*** (8.38)	0.0918*** (20.21)	0.1274*** (8.56)	0.1257*** (21.91)	0.1081*** (18.07)	0.0758*** (13.34)	0.1343*** (18.48)	0.1194*** (15.95)	0.1046*** (17.16)	0.0752*** (13.95)	0.1496*** (19.83)	0.1043*** (14.92)
<i>Dep</i>	0.0860* (1.66)	-0.0888*** (-3.90)	0.0433 (0.60)	-0.1874*** (-7.01)	-0.0498* (-1.68)	-0.0529* (-1.86)	-0.1253*** (-3.52)	-0.1743*** (-4.73)	-0.0076 (-0.27)	-0.0627** (-2.13)	-0.1020*** (-3.00)	-0.1037*** (-2.68)
<i>Infl</i>	-0.0007 (-1.19)	0.0010*** (6.18)	-0.0013* (-1.75)	0.0006*** (3.20)	0.0010*** (5.28)	0.0007*** (2.63)	0.0007*** (2.94)	0.0003 (0.87)	0.0010*** (5.09)	0.0008*** (3.08)	0.0001 (0.30)	0.0012*** (3.36)
<i>GGDP</i>	-0.0003 (-1.04)	0.0004*** (2.77)	-0.0033*** (-6.68)	-0.0021*** (-8.98)	0.0001 (0.53)	0.0001 (0.47)	-0.0028*** (-9.10)	-0.0033*** (-11.21)	-0.0003 (-1.49)	0.0010*** (5.18)	-0.0038*** (-12.25)	-0.0019*** (-6.73)
Constant	-0.2793*** (-8.60)	-0.2971*** (-25.84)	-0.5891*** (-13.45)	-0.4270*** (-30.43)	-0.2788*** (-19.28)	-0.2863*** (-17.31)	-0.3606*** (-19.69)	-0.4367*** (-22.23)	-0.2529*** (-17.84)	-0.2993*** (-19.73)	-0.3457*** (-19.65)	-0.4515*** (-23.26)
Observations	20,352	147,848	20,352	147,848	84,955	83,245	84,955	83,245	82,082	86,118	82,082	86,118
R-squared	0.4828	0.5143	0.4155	0.4926	0.4980	0.5143	0.4752	0.4883	0.4675	0.5530	0.4242	0.5605
Number of id	4,822	15,957	4,822	15,957	12,798	12,791	12,798	12,791	14,498	13,178	14,498	13,178
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table B2. Robustness check – Alternative leverage measure

This table reports the robustness checks using partial active leverage adjustment for following regressions:

$$\Delta LEV_{i,t+1,j} = \alpha_0 + (\partial_0 + \beta_1 LIQ_{i,t,j} + \Theta X_{i,t,j}) (Dist_{i,t,j}) + \omega_{i,t+1,j}$$

The dependent variable is the change in active leverage ratio ($\Delta LEV_{i,t+1,j}$). $Dist_{i,t,j}$ is the different between the target leverage ratio and the actual leverage ratio. Liquidity $LIQ_{i,t,j}$ is proxied by Amihud (*Amihud*), Turnover (*Turn*), and High-low impact (*HighLow*) measure. $X_{i,t,j}$ is the vector of control variables that includes firm size (*Size*), market to book ratio (*MTB*), profitability (*Prof*), research and development expenses (*RD*), research and development dummy (*RDDum*), Tangibility (*Tang*), Depreciation expenses (*Dep*), Inflation rate (*INFL*), and annual GDP growth rate (*GGDP*). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A1.

VARIABLES	Amihud (1)	Turn (2)	HighLow (3)
<i>Dist x (-Amihud)</i>	0.0005* (1.79)		
<i>Dist x Turn</i>		0.0015*** (3.96)	
<i>Dist x HighLow</i>			1.5840*** (10.55)
<i>Dist</i>	0.2617*** (22.54)	0.2458*** (13.21)	0.1674*** (8.79)
<i>Dist x Size</i>	-0.0102*** (-10.17)	-0.0094*** (-7.36)	-0.0070*** (-4.60)
<i>Dist x MTB</i>	0.0024*** (3.88)	0.0024*** (3.64)	0.0024*** (3.14)
<i>Dist x Prof</i>	-0.2686*** (-12.77)	-0.2599*** (-10.83)	-0.2103*** (-9.59)
<i>Dist x RD</i>	0.1995*** (3.05)	0.2224*** (2.88)	0.1991*** (2.73)
<i>Dist x RDDum</i>	-0.0113** (-2.08)	-0.0136** (-2.54)	-0.0123** (-2.57)
<i>Dist x Tang</i>	-0.0738*** (-9.54)	-0.0740*** (-5.96)	-0.0630*** (-5.36)
<i>Dist x Dep</i>	0.3795*** (6.12)	0.3915*** (4.57)	0.2204** (2.32)
<i>Dist x Infl</i>	0.0020** (2.43)	0.0019** (2.50)	0.0008 (1.25)
<i>Dist x GGDP</i>	0.0051*** (6.92)	0.0043*** (6.50)	0.0051*** (8.24)
Constant	0.0131*** (3.43)	0.0133*** (2.76)	0.0134*** (3.10)
Observations	171,647	171,647	171,647
R-squared	0.0663	0.0666	0.0681
Year FE	YES	YES	YES
Country FE	YES	YES	YES

Table B3. Robustness check – Alternative econometric method

This table reports the robustness checks using fixed effect regression robust to the heteroskedasticity for following regression:

$$\Delta LEV_{i,t+1,j} = \alpha_0 + (\partial_0 + \beta_1 LIQ_{i,t,j} + \Theta X_{i,t,j}) (Dist_{i,t,j}) + \omega_{i,t+1,j}$$

The dependent variable is the change in book and market leverage ratio ($\Delta LEV_{i,t+1,j}$). $Dist_{i,t,j}$ is the different between the target leverage ratio and the actual leverage ratio. Liquidity $LIQ_{i,t,j}$ is proxied by Amihud (*Amihud*), Turnover (*Turn*), and High-low impact (*HighLow*) measure. $X_{i,t,j}$ is the vector of control variables that includes firm size (*Size*), market to book ratio (*MTB*), profitability (*Prof*), research and development expenses (*RD*), research and development dummy (*RDDum*), Tangibility (*Tang*), Depreciation expenses (*Dep*), Inflation rate (*INFL*), and annual GDP growth rate (*GGDP*). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	Amihud		Turn		HighLow	
	$\Delta BLEV_{t+1}$ (1)	$\Delta MLEV_{t+1}$ (2)	$\Delta BLEV_{t+1}$ (3)	$\Delta MLEV_{t+1}$ (4)	$\Delta BLEV_{t+1}$ (5)	$\Delta MLEV_{t+1}$ (6)
<i>Dist x (-Amihud)</i>	0.0006*** (2.74)	0.0008*** (3.93)				
<i>Dist x Turn</i>			0.0017*** (6.14)	0.0041*** (13.13)		
<i>Dist x HighLow</i>					2.1185*** (15.75)	2.2574*** (16.42)
<i>Dist</i>	0.2743*** (18.61)	0.2087*** (13.92)	0.2566*** (17.87)	0.1783*** (12.23)	0.1503*** (10.31)	0.0849*** (5.72)
<i>Dist x Size</i>	-0.0130*** (-11.82)	-0.0079*** (-6.98)	-0.0121*** (-11.21)	-0.0065*** (-5.90)	-0.0087*** (-8.26)	-0.0039*** (-3.52)
<i>Dist x MTB</i>	0.0026*** (4.95)	0.0038*** (3.47)	0.0026*** (4.83)	0.0036*** (3.44)	0.0025*** (4.64)	0.0036*** (3.64)
<i>Dist x Prof</i>	0.2426*** (10.54)	0.0200 (0.84)	0.2533*** (10.95)	0.0459* (1.93)	0.3147*** (13.31)	0.1153*** (4.80)
<i>Dist x RD</i>	0.2184*** (4.08)	0.1685** (2.23)	0.2449*** (4.54)	0.2090*** (2.72)	0.2020*** (3.85)	0.1396* (1.93)
<i>Dist x RDDum</i>	-0.0088** (-2.07)	-0.0193*** (-4.33)	-0.0115*** (-2.68)	-0.0257*** (-5.67)	-0.0094** (-2.23)	-0.0169*** (-3.85)
<i>Dist x Tang</i>	-0.0534*** (-5.65)	-0.0292*** (-2.89)	-0.0533*** (-5.64)	-0.0281*** (-2.78)	-0.0399*** (-4.23)	-0.0157 (-1.57)
<i>Dist x Dep</i>	-0.1274* (-1.73)	0.5180*** (6.69)	-0.1147 (-1.56)	0.5409*** (6.99)	-0.3347*** (-4.53)	0.2512*** (3.25)
<i>Dist x Infl</i>	0.0024*** (3.87)	0.0048*** (6.47)	0.0024*** (3.87)	0.0045*** (6.11)	0.0007 (1.12)	0.0026*** (3.51)
<i>Dist x GGDP</i>	0.0047*** (8.27)	0.0102*** (14.99)	0.0038*** (6.36)	0.0085*** (12.14)	0.0048*** (8.35)	0.0104*** (15.35)
Constant	0.0008*** (4.39)	0.0015*** (5.54)	0.0010*** (5.12)	0.0018*** (6.78)	0.0013*** (6.82)	0.0022*** (8.09)
Observations	190,754	190,754	190,754	190,754	190,754	190,754
R-squared	0.0504	0.0520	0.0507	0.0533	0.0537	0.0547
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES

Table B4. Robustness check – Alternative measures of liquidity

This table reports the robustness checks using alternative measures of liquidity for following regression:

$$\Delta LEV_{i,t+1,j} = \alpha_0 + (\partial_0 + \beta_1 LIQ_{i,t,j} + \theta X_{i,t,j}) (Dist_{i,t,j}) + \omega_{i,t+1,j}$$

The dependent variable is the change in book and market leverage ratio ($\Delta LEV_{i,t+1,j}$). $Dist_{i,t,j}$ is the different between the target leverage ratio and the actual leverage ratio. Liquidity $LIQ_{i,t,j}$ is proxied by *Propzero*, *Propzero2*, and *Spread*. *Propzero* is the proportion of trading days in the year that had zero price change (zero return) from the previous day, for firm i in year t. *Propzero2* is the proportion of positive-volume trading days in the year that had zero price change (zero return) from the previous day, for firm i in year t. *Spread* is the daily closing percent quoted spread, i.e., daily closing bid-ask spread divided by the midpoint spread averaged over the number of positive volume days. $X_{i,t,j}$ is the vector of control variables that includes firm size (*Size*), market to book ratio (*MTB*), profitability (*Prof*), research and development expenses (*RD*), research and development dummy (*RDDum*), Tangibility (*Tang*), Depreciation expenses (*Dep*), Inflation rate (*INFL*), and annual GDP growth rate (*GGDP*). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	Propzero		Propzero2		Spread	
	$\Delta BLEV_{t+1}$	$\Delta MLEV_{t+1}$	$\Delta BLEV_{t+1}$	$\Delta MLEV_{t+1}$	$\Delta BLEV_{t+1}$	$\Delta MLEV_{t+1}$
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Dist x (1-Propzero)</i>	0.0035** (2.37)	0.0100*** (7.86)				
<i>Dist x (1-Propzero2)</i>			0.0035** (2.39)	0.0100*** (7.89)		
<i>Dist x (-Spread)</i>					0.0265 (1.64)	0.0865*** (4.87)
<i>Dist</i>	0.2663*** (20.41)	0.1964*** (14.75)	0.2663*** (20.10)	0.1964*** (14.46)	0.2485*** (13.97)	0.1702*** (10.90)
<i>Dist x Size</i>	-0.0126*** (-11.50)	-0.0078*** (-7.21)	-0.0126*** (-13.68)	-0.0078*** (-7.25)	-0.0105*** (-8.02)	-0.0048*** (-4.18)
<i>Dist x MTB</i>	0.0026*** (5.02)	0.0040*** (3.87)	0.0026*** (4.88)	0.0040*** (4.09)	0.0023*** (3.66)	0.0044*** (3.99)
<i>Dist x Prof</i>	0.2492*** (11.48)	0.0260 (1.04)	0.2492*** (11.10)	0.0260 (1.06)	0.2269*** (7.71)	-0.0018 (-0.07)
<i>Dist x RD</i>	0.2166*** (3.79)	0.1904** (2.39)	0.2166*** (4.37)	0.1904*** (2.60)	0.1832*** (3.22)	0.1808* (1.82)
<i>Dist x RDDum</i>	-0.0076 (-1.64)	-0.0192*** (-5.03)	-0.0076* (-1.65)	-0.0192*** (-4.58)	-0.0097** (-2.00)	-0.0174*** (-3.87)
<i>Dist x Tang</i>	-0.0556*** (-5.69)	-0.0322*** (-3.83)	-0.0556*** (-5.77)	-0.0322*** (-3.30)	-0.0553*** (-5.46)	-0.0360*** (-4.10)
<i>Dist x Dep</i>	-0.1530* (-1.93)	0.4964*** (5.77)	-0.1530** (-2.19)	0.4964*** (6.25)	-0.2365*** (-3.06)	0.4455*** (5.58)
<i>Dist x Infl</i>	0.0026*** (4.66)	0.0050*** (6.59)	0.0026*** (4.43)	0.0050*** (6.03)	0.0037*** (4.21)	0.0057*** (7.38)
<i>Dist x GGDP</i>	0.0050*** (8.73)	0.0104*** (16.59)	0.0050*** (9.49)	0.0104*** (14.55)	0.0040*** (6.56)	0.0098*** (13.37)
Constant	0.0150*** (3.00)	0.0130* (1.82)	0.0150*** (3.67)	0.0130** (2.03)	0.0188*** (3.83)	0.0007 (0.09)
Observations	190,754	190,754	190,754	190,754	163,867	163,867
R-squared	0.0571	0.1133	0.0571	0.1133	0.0548	0.1187
Year FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES

Table B5. Robustness check – Different subsamples

This table reports the robustness checks using different subsamples including U.S v.s. non-US firms, and Japan v.s. non-Japan firms for following regression:

$$\Delta LEV_{i,t+1,j} = \alpha_0 + (\partial_0 + \beta_1 LIQ_{i,t,j} + \Theta X_{i,t,j}) (Dist_{i,t,j}) + \omega_{i,t+1,j}$$

The dependent variable is the change in book and market leverage ratio ($\Delta LEV_{i,t+1,j}$). $Dist_{i,t,j}$ is the different between the target leverage ratio and the actual leverage ratio. Liquidity $LIQ_{i,t,j}$ is proxied by Amihud (*Amihud*), Turnover (*Turn*), and High-low impact (*HighLow*) measure. $X_{i,t,j}$ is the vector of control variables that includes firm size (*Size*), market to book ratio (*MTB*), profitability (*Prof*), research and development expenses (*RD*), research and development dummy (*RDDum*), Tangibility (*Tang*), Depreciation expenses (*Dep*), Inflation rate (*INFL*), and annual GDP growth rate (*GGDP*). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	U.S. firms						Non-U.S. firms					
	Amihud		Turn		HighLow		Amihud		Turn		HighLow	
	ΔBLEV_{t+1} (1)	ΔMLEV_{t+1} (2)	ΔBLEV_{t+1} (3)	ΔMLEV_{t+1} (4)	ΔBLEV_{t+1} (5)	ΔMLEV_{t+1} (6)	ΔBLEV_{t+1} (7)	ΔMLEV_{t+1} (8)	ΔBLEV_{t+1} (9)	ΔMLEV_{t+1} (10)	ΔBLEV_{t+1} (11)	ΔMLEV_{t+1} (12)
<i>Dist x (-Amihud)</i>	0.0012** (2.11)	-0.0001 (-0.10)					0.0006*** (2.75)	0.0010*** (4.97)				
<i>Dist x Turn</i>			0.0072 (1.47)	0.0010 (0.36)					0.0022*** (6.51)	0.0037*** (13.75)		
<i>Dist x HighLow</i>					1.4290*** (4.18)	0.8994*** (3.34)					2.4416*** (14.12)	2.1505*** (12.54)
<i>Dist</i>	0.4188*** (10.74)	0.4935*** (10.38)	0.4055*** (12.54)	0.4970*** (13.98)	0.2420*** (5.30)	0.3991*** (8.85)	0.2567*** (12.70)	0.1879*** (11.72)	0.2409*** (14.81)	0.1587*** (10.45)	0.1292*** (7.42)	0.0719*** (4.64)
<i>Dist x Size</i>	-0.0217*** (-7.71)	-0.0180*** (-5.45)	-0.0212*** (-9.62)	-0.0183*** (-7.14)	-0.0135*** (-5.31)	-0.0142*** (-5.24)	-0.0120*** (-7.95)	-0.0075*** (-6.68)	-0.0114*** (-8.22)	-0.0063*** (-5.34)	-0.0080*** (-6.45)	-0.0036*** (-3.37)
<i>Dist x MTB</i>	0.0042*** (5.46)	0.0051*** (4.78)	0.0042*** (5.18)	0.0051*** (4.73)	0.0044*** (5.85)	0.0053*** (3.74)	0.0005 (0.78)	0.0033*** (2.59)	0.0002 (0.35)	0.0029*** (2.80)	0.0002 (0.20)	0.0030** (2.32)
<i>Dist x Prof</i>	0.1468*** (3.83)	0.0945*** (2.64)	0.1489*** (3.85)	0.0949*** (3.34)	0.1842*** (4.10)	0.1203*** (3.14)	0.2884*** (10.48)	0.0071 (0.28)	0.3053*** (12.57)	0.0393 (1.34)	0.3919*** (13.39)	0.1093*** (3.59)
<i>Dist x RD</i>	0.0423 (0.51)	0.1811* (1.69)	0.0428 (0.47)	0.1797* (1.74)	0.0646 (0.70)	0.1893* (1.69)	0.1246* (1.66)	0.0280 (0.44)	0.1547** (2.11)	0.0546 (0.88)	0.1524** (2.39)	0.0292 (0.45)
<i>Dist x RDDum</i>	0.0236*** (2.65)	-0.0025 (-0.19)	0.0229** (2.26)	-0.0024 (-0.19)	0.0203 (1.60)	-0.0041 (-0.32)	-0.0177*** (-3.92)	-0.0171*** (-3.93)	-0.0225*** (-4.81)	-0.0229*** (-5.58)	-0.0179*** (-4.88)	-0.0148*** (-3.35)
<i>Dist x Tang</i>	-0.0150 (-0.82)	-0.0075 (-0.29)	-0.0145 (-0.60)	-0.0074 (-0.36)	-0.0091 (-0.41)	-0.0013 (-0.05)	-0.0558*** (-5.60)	-0.0324*** (-3.02)	-0.0528*** (-5.25)	-0.0288*** (-2.75)	-0.0459*** (-4.18)	-0.0262*** (-2.72)
<i>Dist x Dep</i>	-0.7289*** (-5.58)	-0.2408 (-1.26)	-0.7362*** (-5.32)	-0.2437* (-1.84)	-0.8662*** (-6.33)	-0.3503* (-1.95)	0.0260 (0.30)	0.5796*** (7.35)	0.0230 (0.24)	0.5641*** (7.03)	-0.1075 (-1.15)	0.4317*** (5.03)
<i>Dist x Infl</i>	0.0051 (1.12)	-0.0314*** (-6.33)	0.0049 (1.00)	-0.0315*** (-5.78)	0.0074** (2.02)	-0.0300*** (-5.52)	0.0023*** (3.21)	0.0044*** (7.17)	0.0023*** (3.24)	0.0042*** (4.98)	0.0002 (0.29)	0.0024*** (3.85)
<i>Dist x GGDP</i>	0.0051** (2.06)	-0.0146*** (-5.61)	0.0054** (2.44)	-0.0146*** (-5.15)	0.0082*** (3.23)	-0.0125*** (-4.18)	0.0051*** (11.01)	0.0129*** (16.84)	0.0039*** (5.46)	0.0113*** (15.64)	0.0046*** (6.38)	0.0125*** (20.23)
Constant	0.0090*** (3.15)	-0.0029 (-1.00)	0.0090*** (3.36)	-0.0029 (-1.03)	0.0091*** (2.89)	-0.0027 (-0.98)	0.0156*** (11.17)	0.0181*** (10.91)	0.0157*** (9.78)	0.0184*** (10.14)	0.0162*** (9.75)	0.0188*** (9.85)
Observations	32,674	32,674	32,674	32,674	32,674	32,674	158,080	158,080	158,080	158,080	158,080	158,080
R-squared	0.0861	0.1768	0.0862	0.1768	0.0874	0.1773	0.0504	0.1385	0.0511	0.1398	0.0543	0.1406
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES

VARIABLES	Japan firms						Non-Japan firms					
	Amihud		Turn		HighLow		Amihud		Turn		HighLow	
	ΔBLEV_{t+1} (1)	ΔMLEV_{t+1} (2)	ΔBLEV_{t+1} (3)	ΔMLEV_{t+1} (4)	ΔBLEV_{t+1} (5)	ΔMLEV_{t+1} (6)	ΔBLEV_{t+1} (7)	ΔMLEV_{t+1} (8)	ΔBLEV_{t+1} (9)	ΔMLEV_{t+1} (10)	ΔBLEV_{t+1} (11)	ΔMLEV_{t+1} (12)
<i>Dist x (-Amihud)</i>	0.1433** (2.26)	0.3251*** (5.53)					0.0014*** (6.59)	0.0014*** (6.53)				
<i>Dist x Turn</i>			0.0028*** (4.98)	0.0034*** (7.17)					0.0019*** (5.56)	0.0038*** (9.53)		
<i>Dist x HighLow</i>					1.3020*** (5.25)	1.5523*** (6.37)					1.8751*** (15.22)	2.0357*** (13.72)
<i>Dist</i>	0.1688*** (7.33)	0.1645*** (7.17)	0.1332*** (6.67)	0.1039*** (4.50)	0.1058*** (5.00)	0.0716*** (3.60)	0.3831*** (20.46)	0.2953*** (14.15)	0.3395*** (19.34)	0.2389*** (12.32)	0.2244*** (11.42)	0.1281*** (6.79)
<i>Dist x Size</i>	-0.0107*** (-6.77)	-0.0106*** (-5.94)	-0.0091*** (-6.14)	-0.0074*** (-4.00)	-0.0090*** (-6.65)	-0.0072*** (-4.43)	-0.0170*** (-13.14)	-0.0101*** (-6.96)	-0.0145*** (-11.46)	-0.0071*** (-5.35)	-0.0105*** (-7.62)	-0.0035*** (-2.39)
<i>Dist x MTB</i>	0.0072*** (3.00)	0.0172*** (8.03)	0.0060** (2.01)	0.0158*** (6.05)	0.0053** (2.32)	0.0148*** (7.90)	0.0020** (3.45)	0.0026** (2.46)	0.0020*** (3.70)	0.0026*** (2.58)	0.0021*** (4.04)	0.0029*** (2.64)
<i>Dist x Prof</i>	0.4748*** (8.50)	0.1965*** (3.98)	0.5094*** (8.08)	0.2532*** (5.10)	0.5445*** (10.87)	0.2979*** (6.11)	0.2136*** (9.46)	0.0008 (0.03)	0.2283*** (10.56)	0.0276 (1.07)	0.2801*** (10.22)	0.0863*** (3.96)
<i>Dist x RD</i>	-0.0725 (-0.34)	-0.1222 (-0.81)	-0.0677 (-0.31)	-0.1453 (-0.86)	-0.0573 (-0.29)	-0.1259 (-0.89)	0.0994* (1.81)	0.1047 (1.21)	0.1400*** (3.03)	0.1570** (2.13)	0.1206** (2.24)	0.1163 (1.58)
<i>Dist x RDDum</i>	0.0124** (2.04)	0.0186*** (3.77)	0.0101* (1.75)	0.0179*** (3.52)	0.0112** (2.40)	0.0191*** (3.21)	0.0039 (0.69)	-0.0087 (-1.49)	0.0008 (0.14)	-0.0160*** (-2.72)	-0.0013 (-0.23)	-0.0138*** (-2.24)
<i>Dist x Tang</i>	-0.0551*** (-3.44)	-0.0133 (-0.97)	-0.0444** (-2.50)	-0.0054 (-0.34)	-0.0351* (-1.72)	0.0030 (0.20)	-0.0368*** (-3.90)	-0.0278** (-2.47)	-0.0403*** (-3.93)	-0.0299** (-2.38)	-0.0356*** (-3.34)	-0.0233* (-1.85)
<i>Dist x Dep</i>	-0.2157 (-1.25)	-0.1280 (-0.87)	-0.2550 (-1.40)	-0.1871 (-1.32)	-0.2923 (-1.59)	-0.2419* (-1.73)	-0.3919*** (-4.91)	0.3338*** (3.74)	-0.3697*** (-4.79)	0.3659*** (4.63)	-0.5253*** (-7.59)	0.1585* (1.68)
<i>Dist x Infl</i>	0.0023 (0.91)	0.0082*** (2.98)	0.0009 (0.44)	0.0071*** (2.65)	0.0035 (1.43)	0.0099*** (4.04)	-0.0019** (-2.35)	0.0003 (0.41)	0.0006 (0.25)	0.0006 (0.76)	-0.0021*** (-3.06)	-0.0001 (-0.10)
<i>Dist x GGDP</i>	0.0079*** (4.66)	0.0156*** (12.52)	0.0078*** (6.05)	0.0159*** (13.29)	0.0090*** (6.01)	0.0172*** (13.98)	-0.0006 (-0.90)	0.0044*** (6.18)	-0.0012* (-1.73)	0.0032*** (3.86)	0.0009 (1.43)	0.0063*** (9.29)
Constant	-0.0021* (-1.74)	0.0199*** (13.22)	-0.0020 (-1.63)	0.0205** (11.59)	-0.0018 (-1.27)	0.0205*** (12.72)	0.0188*** (12.49)	0.0090*** (4.65)	0.0189*** (14.93)	0.0092*** (4.42)	0.0192*** (10.84)	0.0096*** (6.12)
Observations	39,049	39,049	39,049	39,049	39,049	39,049	151,705	151,705	151,705	151,705	151,705	151,705
R-squared	0.0643	0.2254	0.0661	0.2265	0.0658	0.2262	0.1076	0.1082	0.0641	0.1092	0.0641	0.1092
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES

Chapter 3

Corporate sustainability performance and corporate leverage adjustments

Chapter 3 consists of one research paper entitled “The effect of corporate sustainability performance on leverage adjustments”. The paper has been published in *The British Accounting Review* (SSCI and ABDC-rank A*). The paper investigates the association between CSP and leverage SOA using a large sample of 31 countries from 2002 to 2018. Using two proxies of CSP, the paper suggests that firms with superior CSP tend to adjust faster toward their target leverage ratios. It further explores the potential underlying economic mechanisms through which CSP affects leverage adjustments addressing information asymmetry reduction, stakeholder engagements enhancement, pushing up stock prices in the stock market, and competitive advantages improvement in the product market. The positive association between CSP and leverage adjustment speed is less pronounced in countries with high-quality institutions. Findings of the paper remain statistically and quantitatively unchanged after further robustness tests and IV estimates.



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The effect of corporate sustainability performance on leverage adjustments

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ABSTRACT

We examine the impact of corporate sustainability performance (CSP) on the speed at which firms adjust their leverage ratios to the target levels for a large sample of 31 countries from 2002 to 2018. Using two proxies of CSP, we find that firms with superior CSP tend to adjust faster toward their target leverage ratios. In exploring the potential underlying economic mechanisms through which CSP affects leverage adjustments, we find that better CSP helps firms to ease information asymmetry, enhance stakeholder engagement, push up stock prices in the stock market, and improve competitive advantage in the product market. In the cross section, the positive association between CSP and leverage adjustment speed is less pronounced in countries with high-quality institutions. The results remain unchanged in robustness tests. Overall, this paper highlights the important role of CSP in shaping corporate capital structure dynamics and suggests implications for corporate strategic planning on the privately optimal levels of CSP activities.

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1. Introduction

In recent decades, non-financial performance in general, and corporate sustainability in particular, is becoming increasingly crucial and attracting substantial attention among companies and their stakeholders. Corporate sustainability performance (hereafter, CSP) identifies the extent to which a company simultaneously integrates economic growth, environmental protection, social efficiency, and governance elements into its operations, and ultimately, the influence these elements exert on the firm and society (Artiach, Lee, Nelson, & Walker, 2010). Prior literature suggests that CSP has the potential to create value for companies by increasing financial performance, that is lowering the idiosyncratic financial constraints (Cheng, Ioannou, & Serafeim, 2014), reducing a firm's risk (Sassen, Hinze, & Hardeck, 2016), and sinking the costs of capital (El Ghouli, Guedhami, Kim, & Park, 2018a, 2018b; Bae, El Ghouli, Guedhami, Kwok, & Zheng, 2019; Goss & Roberts, 2011). In this paper, we provide empirical evidence on a new mechanism through which CSP leads to corporate value creation: it increases the speed with which firms adjust their leverage toward the target capital structure and predisposes them to operate at the optimal level of leverage that balances the benefits against the costs of debt financing.

Capital structure literature documents that firms are very likely to consider target leverage ratios when they issue new capital (Graham & Harvey, 2001). Even though the dynamic trade-off theory predicts that firms have incentives to adjust to

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target leverage by reducing any deviation from those targets (Frank & Goyal, 2009), because of substantial financing frictions, (i.e. issuance costs or intermediation costs) firms may decide to deviate temporarily from their target levels. In other words, to the extent that leverage rebalancing is costly, moving toward the target can be slow (Fischer, Heinkel, & Zechner et al., 1989; Flannery & Rangan, 2006; Lemmon, Roberts, & Zender, 2008).

A separate but growing body of literature has highlighted the important role of CSP in shaping corporate information environments, equity valuation, competitive advantage, and stakeholder engagement. Prior literature suggests that CSP potentially motivates a firm's voluntary disclosure that enhances information transparency and reduces agency costs (Dhaliwal, Heitzman, & Li, 2006). Also, investors are more patiently to negative news and poor stock performance and are less responsive to mispricing signals of superior CSP firms (Cao, Titman, Zhan, & Zhang, 2020; Starks, Venkat, & Zhu, 2017). Such firms are therefore more likely to be overvalued,¹ which reduces the firm's cost of equity issuance. In addition to the information role of sustainability reporting, CSP has a non-negligible influence on the product market. Flammer (2015a, 2015b) and Cao, Liang, and Zhan (2019) suggest that CSP enhances a firm's position in the product market as a competitive advantage that improves the firm's expected future cash flow realization, resulting in a low marginal capital transaction cost (Faulkender, Flannery, Hankins, & Smith, 2012). In addition, stakeholder theory documents that CSP helps firms to build long-term relationships with suppliers, customers, and creditors, which not only helps firms to improve revenue and profit, but also enables them to capitalise on their performance advantage (Bae et al., 2019; Choi & Wang, 2009; Lins, Servaes, & Tamayo, 2017). Such firms are awarded high ratings by credit rating agencies (Attig, El Ghouli, Guedhami, & Suh, 2013; Stellner, Klein, & Zwergel, 2015). To the extent that CSP affects the information asymmetry, pushes up the stock prices, improves competitive advantage, and enhances stakeholder engagement of firms, firms with superior CSP have lower agency costs, transaction costs (Cheng et al., 2014), costs of equity capital (Breuer, Müller, Rosenbach, & Salzmann, 2018; Dhaliwal, Li, Tsang, & Yang, 2011; El Ghouli et al., 2018a, 2018b; El Ghouli, Guedhami, Kwok, & Mishra, 2011), and to some extent, costs of bank loans (Goss & Roberts, 2011). These reduced costs, in turn, could effectively lower the cost of leverage adjustments. Therefore, we expect that the CSP should influence the speed at which firms adjust toward their optimal leverage levels. In addition, we expect that the positive impact of CSP on the speed of leverage adjustment is mitigated in countries with stronger institutional arrangements. We argue that stronger institutional settings are external mechanisms to prevent agency conflicts (An, Li, & Yu, 2015; Çolak, Gungoraydinoglu, & Öztekin, 2018; Öztekin, 2015; Öztekin & Flannery, 2012). Whilst they reduce information asymmetry and distress costs and enhance financial flexibility and the accessibility to capital markets, institutional environments are not controlled by firms, and are a less costly means for firms to manage asymmetric information and enhance stakeholder engagement. Thus, strong institutional environments can substitute the role of CSP in increasing the speed at which firms adjust to their target leverage, making the positive impacts of CSP on speed of leverage adjustment less pronounced.

To examine our hypotheses, we employ a cross-country panel dataset from the Thomson Reuters and Bloomberg databases for 2869 publicly listed firms from 31 countries for the period between 2002 and 2018. Using cross-country data has two advantages. First, our sample comprises a broad sample of CSP data. Second, international data allows us to examine the impact of country-level institutional settings on the association between CSP and the speed of leverage adjustment.

The results confirm that CSP is significantly and positively associated with the speed with which firms adjust leverage toward their targets. Since previous literature suggests that CSP can lower firm risks, reduce costs of capital, improve information transparency, enhance stakeholder engagement, and generate competitive advantage (Breuer et al., 2018; Cao et al., 2019; Cho, Lee, & Pfeiffer, 2013; Choi & Wang, 2009; El Ghouli et al., 2011, 2018a, 2018b; Goss & Roberts, 2011; Sassen et al., 2016), firms with superior CSP have lower leverage adjustment costs, and thus, faster adjustment speeds. We confirm the robustness of the results by using alternative control variables, alternative econometric methods, substituting leverage and target leverage with alternative measures, and re-estimating the baseline model with different subsamples. To mitigate potential endogeneity and correlated omitted variables concerns, we use the instrument variable approach that employs the two-stage feasible efficient generalized method of moment's estimation with validity-tested instruments. Our results remain valid.

We further investigate four mechanisms through which CSP positively affects the speed of leverage adjustment and find that information asymmetry, equity mispricing, stakeholder engagement, and competitive advantage are significantly associated with this relationship in the predicted direction. In addition, we find that strong institutional settings moderate the positive impact of CSP on leverage adjustment speed. This result is consistent with the view that institutional settings are an external and less costly mechanism that firms could employ to reduce asymmetric information and enhance stakeholder engagement, thus, speeding up their leverage adjustment (An et al., 2015; Çolak et al., 2018; Öztekin, 2015; Öztekin & Flannery, 2012).

This paper makes further contribution to several strands of literature. Firstly, this paper contributes to the literature on the dynamic adjustment of capital structure. The earlier literature presumed that the speed of leverage adjustment across firms was constant (Fama & French, 2002; Flannery & Rangan, 2006; Leary & Roberts, 2005), but recent literature has provided evidence that adjustment speeds are heterogeneous and determined by various factors. In addition to the strand of research that employs the dynamic partial adjustment models of capital structure to identify the determinants of adjustment speeds (An et al., 2015; Faulkender et al., 2012; Çolak et al., 2018; Öztekin & Flannery, 2012), we introduce a new non-financial

¹ A detailed discussion of the association between mispricing and misvaluation can be found in section 2.3.

essential element, namely, corporate sustainability performance, which explains the cross-sectional variation of leverage adjustment speeds. We further explore the potential underlying economic channels and identify four mechanisms that explain the association between CSP and leverage adjustment speeds.

Secondly, this paper highlights the impact of institutional settings on capital structure. For instance, Fan, Titman, and Twite (2012) find that firms in countries with poor institutions are potentially highly leveraged. Öztekin and Flannery (2012) suggest that good institutional settings could reduce financial transaction costs, thus increasing leverage adjustment speeds. Öztekin (2015) also confirms that high-quality institutions enhance the adjustment speeds while stronger creditor protection and more effective bankruptcy procedures lead to high leverage ratios. In this paper, we use a broad range of institutional factors and find that strong institutional settings could be a less costly mechanism for firms to reduce leverage adjustment costs when compared to CSP. Strong institutional settings are a substitute for CSP, which significantly mitigates the positive impact of CSP on the speed of leverage adjustment.

Thirdly, this paper also contributes to the literature on CSP. Prior studies (Cheng et al., 2014; El Ghouli et al., 2011, 2018a, 2018b; Lee & Faff, 2009; Sassen et al., 2016) focus on the impacts of CSP on financial performance, firm risks, costs of external financing, and financial constraints but not on the capital structure. We shed light on the significance of the impact of CSP on the adjustment of capital structure. Additionally, to the extent that investments in CSP bring both benefits and costs to corporations (Bae et al., 2019; Cheng et al., 2014; Luo, Meier, & Oberholzer-Gee, 2011), our findings have important implications for corporate strategic planning on the privately optimal levels of CSP activities.

The remainder of this paper is organized as follows. Section 2 presents a literature review and develops the hypotheses. Section 3 explains our empirical design. Section 4 describes the data, sample selection and variable construction. Section 5 reports the empirical results, robustness checks and further analyses before Section 6 offers a conclusion.

2. Literature review and hypothesis development

This section summarizes the literature on CSP and the speed of leverage adjustment. It discusses a prediction on how CSP facilitates firm leverage adjustments and outlines a discussion on the possible channels of this relationship and the roles of the country's institutional strength in reshaping the leverage adjustment sensitivity to CSP.

2.1. Corporate sustainability performance

A large number of studies have investigated the impacts of CSP on firm financial performance. These studies provide contradictory results that show positive, negative, U-shape, and even inverse U-shape associations between CSP and corporate financial performance (Margolis & Walsh, 2003; Salzmann, 2013; Ye & Zhang, 2011). Nonetheless, existing meta-analysis shows unambiguous evidence that the positive relation is more likely to occur (Eccles, Ioannou, & Serafeim, 2014; Margolis, Elfenbein, & Walsh, 2010; Margolis & Walsh, 2003; Orlitzky, Schmidt, & Rynes, 2003; Van Beurden & Gössling, 2008). For example, in their review of 34 empirical studies, Van Beurden and Gössling (2008) show that there is clear evidence for a positive link between corporate social and financial performance. They also suggest that the studies yielding contrary findings use out-dated material. Servaes and Tamayo (2013) reveal that there is a positive relationship between corporate social responsibility (CSR) and firm value when customers have high awareness of firm activities. Similarly, Eccles et al. (2014) indicate that firms with superior socially and environmentally responsible practices, which are regarded as highly sustainable, have better financial performance compared to firms bereft of any explicitly sustainable practices. Flammer (2015a) examines shareholder proposals for CSR that pass or fail by a small margin of votes and finds that approved proposals lead to positive abnormal stock returns. Deng, Kang, and Low (2013) find that acquirers with superior CSR have higher merger announcement returns and better post-merger operating performance. Most recently, Albuquerque, Koskinen, and Zhang (2019) find that CSR decreases systematic risk and increases firm value and that these effects are stronger for firms with high product differentiation.

Empirical studies also investigate the importance of CSP in the product market and suggest that investing in CSP activities can be used to differentiate product strategy (Bagnoli & Watts, 2003; Siegel & Vitaliano, 2007). Specifically, Luo and Bhattacharya (2006, 2009) demonstrate that CSR increases customer loyalty, resulting in more pricing power for firms. There is also direct evidence of the ability of firms with CSR features to increase their sale capacity or product price (Ailawadi, Neslin, Luan, & Taylor, 2014; Auger, Burke, Devinney, & Louviere, 2003; De Pelsmacker, Driesen, & Rayp, 2005; Elfenbein & McManus, 2010; Hilger, Hallstein, Stevens, & Villas-Boas, 2019). Flammer (2015b) suggests an indirect link between CSR and the product differentiation strategy by revealing that US firms respond to tariff reductions that increase competition by investing more in their CSR activities.

Recently, the literature on corporate sustainability has focused on how social responsibility impacts the cost of capital of firms. Bauer, Derwall, and Hann (2009) investigate credit risk and suggest that firms with better employee relations have higher credit ratings and lower costs of debt financing. Similarly, Attig et al. (2013) indicate that firms with superior social performance tend to be awarded relatively high credit ratings that lead to low financing costs. Lee and Faff (2009) find that sustainable firms exhibit significantly lower idiosyncratic risk whereas Goss and Roberts (2011) show that firms with superior CSP enjoy between 7 and 18 basis-points discount on bank debts compared to their counterparts. In their examination of a European dataset, Stelner et al. (2015) also confirm that firms with better environmental, social, and governance performance have lower credit risks. Cheng et al. (2014) imply that firms with superior CSP are more likely to have access to

financial resources. In a similar vein, El Ghouli et al. (2011) show that firms can benefit from investments in CSR in terms of a lower cost of equity. Dhaliwal et al. (2011) document that firms with a high cost of equity are willing to invest more in CSR activities in the following year in order to enjoy a subsequent reduction in their cost of equity. Breuer et al. (2018) find that in countries with strong investor protection, the cost of equity falls when a firm invests in CSR. El Ghouli et al. (2018a, 2018b) conclude that the investment in corporate environmental responsibility reduces the firm's equity costs worldwide. Bae et al. (2019) conclude that CSR can reduce the costs of high leverage by impacting firms' interactions with customers and competitors.

In this paper, we contribute to the extant literature by examining the correlation between CSP and the speed of adjustment (SOA) of the targeted leverage level of firms. This study adds to the current research on the impacts of corporate sustainability on firm financial performance, risks, and costs of capital, and provides further evidence on the effects of corporate sustainability on a firm's capital structure decisions. In a related work, Do, Huang, and Lo (2018) examine the impact of adopting CSR on leverage SOA using the US data. Our study differentiates from theirs in two ways. The first is that by establishing the relationship between CSP and the leverage SOA, we further identify four potential underlying economic channels that link firms' CSP and SOA: asymmetric information, equity mispricing, stakeholder engagement, and competitive advantage. We also show that this association is present only for over-levered firms, not for under-levered firms. The second is that, differently from a single-country study, we include public firms from 31 countries, so our sample has a larger and more comprehensive coverage of data. By employing international data, we are able to address the impact of country-level institutions on the association between CSP and the leverage SOA.

2.2. Speed of leverage adjustment

The study by Modigliani and Miller (1958) has generated a number of theories that emphasise the importance of a firm's decisions on capital structure, due to frictions and imperfections within capital markets. The trade-off theory, which is regarded as one of the major theoretical perspectives, emphasises two types of market friction: corporate income taxes, and financial distress/bankruptcy costs. The early static trade-off models claim that firms have their own target capital structure that balances the costs and benefits of debt (Bradley, Jarrell, & Kim, 1984; Brennan & Schwartz, 1978; Kraus & Litzenger, 1973). Such theoretical models are followed by recent empirical dynamic trade-off models, and results suggest that there is a mean reversion of capital structure as firms try to reach such target levels to maximize the firm value (Hennessy & Whited, 2005; Strebulaev, 2007; Titman & Tsyplakov, 2007). Consequently, a new strand of research has attempted to examine how quickly firms adjust to their target leverage levels.

The speed that firms converge on their target leverage depends on the cost of adjusting leverage. Such adjustments commence only when the benefits of adjustment are sufficient to offset the costs of moving back to the target (Fischer, Heinkel, & Zechner, 1989; Leary & Roberts, 2005). With zero adjustment costs, trade-off theory suggests that no firms should be observed with leverage deviation from the target leverage level. At the other extreme, if adjustment costs are infinite, firms should never move back to their targets. The current literature has provided mixed evidence on the speed with which firms converge toward their target leverage ratios. Specifically, while Fama and French (2002) suggest a low adjustment speed (about 7%–18% per year), other studies estimate faster firm target leverage convergence ratios. For example, Lemmon et al. (2008) estimate the SOA of 25% for book leverage; Flannery and Rangan (2006) show an even faster SOA of about 35% per year; and Altı (2006) and Leary and Roberts (2005) suggest that firms need approximately two to four years to fill in the gap between actual and target leverage ratios.

The existing literature provides differing evidence on the definition of adjustment costs that vary the speed of leverage adjustment. Specifically, a large number of studies consider transaction costs as the main part of leverage adjustment costs (Altinkılıç & Hansen, 2000; Fischer et al., 1989; Goldstein, Ju, & Leland, 2001; Strebulaev, 2007). For instance, Strebulaev (2007) provides the estimates of underwriting and management costs whereas Altinkılıç and Hansen (2000) define adjustment costs as the security issuance costs. Faulkender et al. (2012) also argue that sunk and incremental costs affect the adjustment rates of leverage ratios. Recent empirical studies focus on the opportunity costs that vary the speed of leverage adjustment among firms. Chang, Chou, and Huang (2014) show that strong corporate governance enhances firm leverage adjustments. Elsas, Flannery, and Garfinkel (2014) investigate firms' financing of major investment activities and argue that such firms adjust to their target leverage by issuing more equity capital. Zhou, Tan, Faff, and Zhu (2016) focus on the sensitivity of the cost of equity to the leverage deviation and suggest that firms with high sensitivity adjust faster to their target leverage. Ho, Lu, and Bai (2020) find that equity liquidity has a significantly positive impact on leverage adjustments. In addition, other studies consider the mispricing of equity as an element of market timing that has significant impacts on leverage SOA. For example, Warr, Elliott, Koeter-Kant, and Öztekin (2012) conclude that equity mispricing affects the speed at which firms adjust their leverage ratio and this impact depends on the position of actual leverage relative to the target level. Corporate decisions are also shown to have significant impacts on the costs of leverage adjustments. Uysal (2011) suggests that firms move the target leverage ratio further when they plan and structure for acquisitions. Lockhart (2014) argues that the demand for liquidity and access to credit lines have significant impacts on adjustment costs conditional on the deviation of actual leverage from target levels. Dang, Dang, Moshirian, Nguyen, and Zhang (2019) suggest the impact of media coverage on leverage adjustment speed via two mechanisms: information dissemination, and monitoring. Finally, the recent literature provides evidence on the impacts of macroeconomic characters and institutional environments on leverage adjustment costs. Specifically, Cook and Tang (2010) indicate that firms that operate in good economic conditions will adjust faster than their

counterparts in poor economic conditions. *Elsas and Florysiak (2011)* show that institutional settings with high default risks and high expected bankruptcy costs will enhance leverage SOA. *Öztekin and Flannery (2012)* and *Öztekin (2015)* find that better institutional environments are related to a high speed of leverage adjustments. *Çolak et al. (2018)* examine the impact of a country's political uncertainty on the leverage adjustments. Most recently, *Faff, Huang, and Lu (2020)* show that firms located in countries with higher levels of social trust have faster leverage SOA.

2.3. Corporate sustainability performance in determining speed of leverage adjustments

A growing literature suggests that CSP may affect the cost of adjusting leverage. This suggestion is inspired by the positive role played by CSP in shaping corporate behaviours. First, CSP potentially drives firm transparency since it motivates voluntary disclosure. Previous literature illustrates that firms with better environmental, social, and governance (ESG) performance are more likely to publish their ESG reports with their sustainability strategies (*Dhaliwal et al., 2006*). Such firms want to signal their high quality by highlighting their good performance (*Clarkson, Li, Richardson, & Vasvari, 2008*). ESG reports are also more likely to be assured by third parties (such as the auditing profession or other assurance providers), thus enhancing the reliability of their reports (*Simnett, Vanstraelen, & Chua, 2009*). Prior studies also suggest that CSP can improve earnings quality. *Kim, Park, and Wier (2012)* suggest that firms with high-quality CSP are less likely to be involved in accruals and real earnings management, and more likely to have more managers with ethical concerns. Therefore, such firms are more likely to generate highly transparent and reliable financial reports. In general, firms with superior CSP have better information transparency or less information asymmetry between themselves and their investors, which diminishes the likelihood of agency costs. In turn, this shrinks leverage adjustment costs and increases the speed of leverage adjustment to their target level (*Çolak et al., 2018; Öztekin, 2015; Öztekin & Flannery, 2012*).

Also, in the stock market, it is possible that CSP could push up a firm's stock prices due to the growth of socially responsible investing. Recent studies suggest that socially responsible institutions behave more patiently to negative news and are less responsive to mispricing signals toward the high CSP firms in their portfolios when compared to their other holdings (*Cao et al., 2020; Starks et al., 2017*). *Starks et al. (2017)* show that socially responsible institutional investors are long term oriented and more patient with superior CSP firms. Such institutions do not sell the stocks even after negative news and poor stock performance. *Cao et al. (2020)* further document that socially responsible institutional investors pay less attention and underreact to mispricing signals after adjusting for investment horizon. Specifically, such investors are less likely to sell the stocks they hold when the quantitative signals imply that they are overpriced, and are less likely to buy stocks when there are underpriced signals. *Hartzmark and Sussman (2019)* also suggest that mutual funds are more likely to allocate more attention to identifying high ESG stocks and react less to quantitative signals. Consequently, high CSP firms are more likely to be overvalued. On the other hand, the recent literature has shown that equity mispricing has an impact on leverage SOA. *Warr et al. (2012)* document that, firms that have a leverage above the optimal level and should, therefore, issue equity (or retire debt), adjust faster toward their target when their shares are overvalued. The speed is much slower when stocks are undervalued. In sum, firms with high CSP levels that are more likely to be overvalued in the stock market have lower costs of leverage adjustments, and thus faster leverage SOA toward their target leverage.

Second, the literature shows that CSP has a significant role in the product market relating to a firm's stakeholder engagement and competitive advantages. Specifically, better CSP performance represents a high engagement of firms with their stakeholders through mutual belief and cooperation. *Jones (1995)* shows that firms which employ ethical contracting, and which commit to their stakeholders through mutual trust and cooperation will enjoy a competitive advantage over their counterparts that do not. This competitive advantage will reduce agency and transaction costs (such as costs of monitoring, bonding, search, and warranty). *Choi and Wang (2009)* suggest that by facilitating strong stakeholder relationships, corporate sustainability not only helps firms to improve revenue and profit, but also enables them to capitalise on their performance advantages. This, in turn, increases the likelihood of long-term oriented behaviours (*Bénabou & Tirole, 2010; Eccles et al., 2014*). Additionally, as one of the stakeholders of firms, credit rating agencies tend to award relatively high ratings to superior CSP firms (*Attig et al., 2013; Oikonomou, Brooks, & Pavelin, 2014; Stellner et al., 2015*). Such firms have lower volatility in underlying asset values, which implies a lower default risk as well as lower expected losses from default. Consequently, these firms are better placed to approach external financial sources and to more quickly adjust to their targets.

Flammer (2015b) and *Cao et al. (2019)* document that CSR enhances a firm's position in the product market as a competitive advantage, thus increasing sales growth and improving corporate performance. Adopting CSP activities is also considered as being a firm's differentiation strategy, which is particularly attractive for investors in the evaluation of uncertain investment opportunities (*Smit & Trigeorgis, 2006; Stoughton, Wong, & Yi, 2018*). *Branco and Rodrigues (2006)* argue that engaging in a CSR strategy is a form of investment, entailing initial costs for future financial benefits. Accordingly, one can expect stronger and more stable cash flow and higher profitability for firms with higher CSP in the future. Such potential changes in cash flow features may provide a low marginal transaction cost for leverage targeting (*Faulkender et al., 2012*), hence accelerating the speed of leverage adjustment of firms with high CSP.

To summarize, we argue that firms with better CSP will have lower costs of leverage adjustments through four channels: lowering information asymmetry; making equity over-valued; enhancing stakeholder engagement; and increasing competitive advantage.

Based on the discussion above, we propose the following hypotheses:

H1. Firms with better CSP adjust faster to the target leverage ratios.

H2a. Information disclosure is the channel linking CSP and the speed of leverage adjustments

H2b. Equity mispricing is the channel linking CSP and the speed of leverage adjustments

H2c. Stakeholder engagement is the channel linking CSP and the speed of leverage adjustments

H2d. Competitive advantage is the channel linking CSP and the speed of leverage adjustments

Institutional settings are generally considered as being external mechanisms to mitigate agency conflicts (An et al., 2015; Çolak et al., 2018; Öztekin, 2015; Öztekin & Flannery, 2012). Supporting this view, La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998) find that financial markets are more effective and vigorous in countries with better institutions. In such countries, investor protection and legal enforcement are strong and ensure that stakeholder rights are implemented in times of need. Öztekin and Flannery (2012) show that stronger institutions reduce information asymmetry and distress costs, and enhance access to capital markets and financial flexibility, making it easier for firms to issue either debt or equity that leads to higher adjustment speeds. Öztekin (2015) also confirms that high quality institutions form legal frameworks that facilitate more effective contracting, which enables economic transactions. Çolak et al. (2018) suggest that strong institutional settings reduce the uncertainty of financial markets. Nonetheless, institutional settings are established beyond the control of firms and represent a less costly means for firms to reduce information asymmetry and enhance stakeholder engagement. Taken together, strong institutional environments can substitute the role of CSP in increasing the speed at which firms adjust to target leverage, making the positive impacts of CSP on leverage speed of adjustment attenuated.

The following hypothesis supports these arguments:

H3. A country's institutional strength attenuates the positive impacts of CSP on the speed of leverage adjustments.

3. Empirical design

This paper investigates how CSP affects the speed at which firms adjust to their target leverage ratios. We argue that it would be cheaper for firms with sustainability compliant to obtain debt and equity capital, which would enable firms to adjust more quickly to their target leverage. Based on the existing literature, we model a firm's target leverage as a function of the firm's time-varying characteristics and the industrial elements (An et al., 2015; Devos, Rahman, & Tsang, 2017; Flannery & Rangan, 2006; Hovakimian, Opler, & Titman, 2001; Huang & Ritter, 2009; Warr et al., 2012). These components include firm financial characteristics and the industry leverage ratio. Definitions of the variables are provided in Appendix A. We consider the following equation:

$$L_{i,j,t+1}^* = \beta X_{i,j,t} \quad (1)$$

where β is the coefficient vector and $X_{i,j,t}$ is a set of firm-level characteristics and industry leverage ratio.

Relying on the costs and benefits of rebalancing their leverage ratio, firms assess how rapidly they converge to the target leverage ($L_{i,j,t+1}^*$) from their current positions ($L_{i,j,t}$). We estimate the standard partial adjustment model of capital structure:

$$L_{i,j,t+1} - L_{i,j,t} = \gamma_j (L_{i,j,t+1}^* - L_{i,j,t}) + \vartheta_{i,j,t+1} \quad (2)$$

Substituting Eq. (1) to Eq. (2) and rearranging them, yields:

$$L_{i,j,t+1} = (\gamma\beta)X_{i,j,t} + (1-\gamma)L_{i,j,t} + \vartheta_{i,j,t+1} \quad (3)$$

The speed of leverage adjustment (γ) allows firm i in a specific country j that diverges away from the target to adjust partially back to their target during the next period. We note that γ should be greater than zero as a firm's managers make efforts to reach the target leverage ratio, and the gap between the target and real leverage ratios should decrease over time (hereinafter called "the distance from target" and estimated as $Dist_{i,t} = L_{i,t+1}^* - L_{i,t}$). However, since market frictions cause costly adjustments, firms do not fully converge on their leverage, or γ being smaller than one. While the leverage adjustment speed γ in Eq. (3) is constant for all firms in a specific country, to test our hypotheses, we allow CSP to increase the firm's SOA toward its target ratio. Thus, γ varies with CSP and the control variables:

$$\gamma_{i,j,t} = \phi_{i,j,t} CSP_{i,j,t} + \rho_{i,j,t} X_{i,j,t} \quad (4)$$

where $\phi_{i,j,t}$ and $\rho_{i,j,t}$ are coefficient vectors and $X_{i,j,t}$ is a set of controls. As previous studies (An et al., 2015; Öztekin & Flannery, 2012) have suggested, a firm's accounting variables may affect both target and leverage SOA, thus we include the control variables that are used in target leverage estimation (X vector) in Eq. (4).

Substituting Eq. (4) back to Eq. (3) yields the equation for a partial adjustment model with heterogeneity in the leverage SOA:

$$L_{i,j,t+1} - L_{i,j,t} = (\phi_{i,j,t} CSP_{i,j,t} + \rho_{i,j,t} X_{i,j,t}) (\beta X_{i,j,t} - L_{i,j,t}) + \vartheta_{i,j,t+1} \quad (5)$$

This can be further simplified to yield:

$$L_{i,j,t+1} = (\phi_{i,j,t} CSP_{i,j,t} + \rho_{i,j,t} X_{i,j,t}) (Dist_{i,j,t}) + \vartheta_{i,j,t+1} \quad (6)$$

To estimate Eq. (5), following Faulkender et al. (2012) and Çolak et al. (2018), we use a two-step process. In the first step, we estimate Eq. (3) country by country using system GMM.² We also control for firm fixed effects and year fixed effects in Eq. (1) to capture the unobserved heterogeneity across time and across firms. From here, we obtain an estimate of target leverage using Eq. (1). Using this estimate of target leverage, we calculate each firm's distance from target ($Dist_{i,j,t}$) and substitute this estimated distance into Eq. (6). Following the recent literature (Dang et al., 2019; Çolak et al., 2018; Öztekin, 2015; Öztekin & Flannery, 2012), we estimate this model using pooled ordinary least squares. Since $Dist_{i,j,t}$ is generated from the first stage rather than observed, the estimation in the second stage is subject to the well-known generated regressors issue, in which the estimated standard errors may be incorrect (Pagan, 1984). We address this issue by using bootstrapped standard errors. Moreover, given that both CSP and leverage adjustments are firm-level choices, we employ firm fixed effects estimators to control for time-invariant unobserved firm-specific factors that may be correlated with the CSP variables and the leverage SOA.

Our next hypotheses (H2a - H2d) are based on the contention that information disclosure, equity mispricing, stakeholder engagement, and competitive advantage could be the channels ($CHANNEL_{i,j,t}$) linking CSP and firms' speed of leverage adjustments. To test these hypotheses, we include measures of the particular channels and their interactions with CSP in our empirical setting:

$$\gamma_{i,j,t} = \phi_{i,j,t} CSP_{i,j,t} + \mu_{i,j,t} ID_{i,j,t} + \pi_{i,j,t} CSP_{i,j,t} * CHANNEL_{i,j,t} + \rho_{i,j,t} X_{i,j,t} \quad (7)$$

Finally, to test the third hypothesis (H3), that a country's institutional strength may attenuate the positive impact of CSP on the speed of leverage adjustments, we add a country's institution variables and the interactions between such institution variables and CSP as follows:

$$\gamma_{i,j,t} = \phi_{i,j,t} CSP_{i,j,t} + \Delta_{i,j,t} IN_{i,j,t} + \Lambda_{i,j,t} CSP_{i,j,t} * IN_{i,j,t} + \rho_{i,j,t} X_{i,j,t} \quad (8)$$

4. Variables, data, and sample selection

This section defines the variable construction used in the empirical analysis, and the data sources we use to collect various firm, industry, and country characteristics, and our sample selection procedure.

4.1. Variable construction

4.1.1. Leverage measures

We measure our dependent variable, leverage, using both the book ratio (BL) and the market ratio (ML), as it is likely that several firms have book leverage rather than market leverage and vice versa (An et al., 2015; Chang et al., 2014; Cook & Tang, 2010; Flannery & Rangan, 2006; Öztekin & Flannery, 2012):

$$BL_{i,j,t} = \frac{D_{i,j,t}}{TA_{i,t,j}} \quad (9)$$

$$ML_{i,j} = \frac{D_{i,t,j}}{D_{i,t,j} + S_{i,t,j} P_{i,t,j}} \quad (10)$$

where $D_{i,t}$ is the book value of firm i 's interest-bearing debt (sum of short-term and long-term book value of interest-bearing debt) at time t , $TA_{i,t}$ denotes the book value of firm i 's assets at time t , j denotes the country, and $S_{i,t} P_{i,t}$ denotes the product of the number of common shares outstanding and the stock price per share at time t , which equals the market value of firm i 's equity at time t .

² We note that since Eq. (3) is a dynamic panel data model, using traditional pooled OLS or fixed effects (FE) estimators would lead to biased and inconsistent estimates (Baltagi, 2013). In our robustness check, we adopt previous studies (Byoun, 2008; Devos et al., 2017; Warr et al., 2012) using the cross-sectional regressions of Fama and MacBeth (1973) to estimate target leverage.

4.1.2. Corporate sustainability performance

There are several ways to measure the CSP. Specifically, [Elkington \(1997\)](#) suggests the triple bottom line approach of including the economic, environmental, and social effects of firms on both stakeholders and society (see also [Dyllick & Hockerts, 2002](#)). [Murphy and McGrath \(2016\)](#) recommend the inclusion of corporate governance performance as another aspect of CSP. In this paper, we measure CSP using ESG performance scores obtained from the Thomson Reuters ESG database. This measure is used widely both in research ([Chang et al., 2014](#); [Cheng et al., 2014](#); [Eccles et al., 2014](#); [Ioannou & Serafeim, 2012](#); [Mackenzie, Rees, & Rodionova, 2013](#); [Sassen et al., 2016](#)) and in practice ([PRI, 2019](#)).

Unlike financial reports, a firm's ESG data disclosure can be unstructured and published at any time during the year. The Thomson Reuters ESG database has standardized and simplified the ESG reported data to make it helpful for financial analysis. This database obtains more than 400 ESG metrics coming mostly from firms' public reporting such as annual reports, corporate social responsibility reports, company websites, and global media sources. From this pool of information, Thomson Reuters establishes ESG scores that measure a firm's ESG performance across three pillars (environment (E), social (S), and governance (G)) and ten topics (resource use, emissions, innovation, management, shareholders, CSR strategy, workforce, human rights, community, and product responsibility). The database also offers an overall score, which incorporates ESG controversies captured from global media sources that materially and significantly affect the companies (ESGC scores). In this paper, we use the annual ESG scores and ESGC scores for each focal company every year in our main analyses as measures of CSP. Since the values of ESG, ESGC, and the three pillars (environment (ENV), corporate governance (CGV), and social (SOC) performance) are highly skewed and show kurtosis, we use the natural logarithm to achieve more normality. Before the transformation, we add 1 to each value of ESG, ESGC, ENV, CGV, and SOC scores to retain observations with 0 ([Chan, Watson, & Woodliff, 2014](#); [Rhou, Singal, & Koh, 2016](#)).³

4.1.3. Institutional environment variables

The information on institutional environments is obtained from various sources, mostly the law and finance literature. We first draw the legal and regulatory variables using five proxies: efficiency of the judicial system (EFFJUD); rule of law (RULLAW); level of corruption (CORRUP); risk of expropriation (RISEXP); and the repudiation of contracts by the government (RISCON) (by following [La Porta et al., 1998](#)). Next, we consider the role of the financial environment comprising the following components: disclosure score index (DISCLO) ([Jin & Myers, 2006](#)); financial analyst (ANALYST) ([Bushman, Piotroski, & Smith, 2004](#)); auditing practice (AUDIT) ([Bushman et al., 2004](#)); disclosure to congress (DISCON) ([Djankov, La Porta, Lopez-de-Silanes, & Shleifer, 2010](#)); and disclosure to the public (DISPUB) ([Djankov et al., 2010](#)). We also investigate the impact of a country's corporate governance on the CSP-leverage SOA association by including six corporate governance indicators suggested by [Kaufmann, Kraay, and Mastruzzi \(2009\)](#). These indicators are accountability (VOIACC), political instability (POLSTA), government effectiveness (GOVEFF), regulation quality (REGQUA), rule of law (RULLAW2), and control of corruption (CONCOR) (by following [Kaufmann et al., 2009](#)). We also explore some other institutional factors, including English origin (ENGORI) ([La Porta et al., 1998](#)), public sector ethics (PUBETH) ([Kaufmann, 2004](#)), good government index (GOOGOV) ([Morck, Yeung, & Yu, 2000](#)), and media channels (MEDIA) ([Bushman et al., 2004](#)). These institutional variables are widely used in the literature of institutions and leverage adjustments ([An et al., 2015](#); [Çolak et al., 2018](#); [Öztekin & Flannery, 2012](#)).

4.1.4. Control variables

[Öztekin and Flannery \(2012\)](#) and [An et al. \(2015\)](#) suggest that a firm's characteristics may impact both target leverage and leverage SOA. Therefore, in this study, we control for a set of firm-level characteristics in both specifications. Specifically, we include firm size as a natural logarithm of total assets, tangibility as fixed assets as a proportion of total assets, profitability as earnings before interests and taxes as a proportion of total assets, research and development (R&D) expenses as R&D expenses as a proportion of total assets, R&D as a dummy variable that equals one if a firm reports R&D expenses and zero otherwise, depreciation expenses as depreciation expenses as proportion of total assets, market-to-book ratio as the market-to-book ratio of a firm's assets, and the industry median leverage ratio as the median debt ratio of a firm's [Fama and French \(1997\)](#) industry classification.

4.2. Data and sample

We retrieve data from several sources during our sample period of 2002–2018.⁴ First, the firm financial data for each country is obtained from Thomson Reuters Worldscope via the Datastream database. Second, in order to estimate CSP and CSP disclosure, we retrieve information on ESG factors from the Thomson Reuters ESG and Bloomberg database. Third, we collect the macro-level institutional environments from [La Porta et al. \(1998\)](#), [Morck et al. \(2000\)](#), [Djankov et al. \(2010\)](#), [Kaufmann et al. \(2009\)](#), [Bushman et al. \(2004\)](#), and [Öztekin and Flannery \(2012\)](#). We retain only firms with common securities. We also exclude firms with special features, such as warrants, trusts, funds, and non-equity stocks. Financial and utility firms are eliminated since these firms are subject to special regulations on financing policies. To reduce short panel bias, we eliminate

³ Based on the Skewness and kurtosis test for normality, we reject the hypothesis that ESG score and ESGC score are normally distributed at 1% level.

⁴ We obtain data from 2002 as this is the first year from which data on ESG scores is available in the Thomson Reuter database.

firms that do not have data for at least two consecutive years. We winsorize both the dependent and independent variables at the 1st and 99th percentiles to mitigate the potential impact of extreme values.

Our final sample consists of 19,434 firm-year observations from 31 countries over the period spanning 2002 to 2018. Panel A of Table 1 reports the number of observations in each country and summarizes the descriptive statistics of our key variables. In general, the sample coverage varies across countries. Developed countries are likely to have higher data coverage than developing countries. In addition, summary statistics of dependent and explanatory variables are similar to those in prior studies. For instance, the mean of book leverage ratio in our study is 0.227 compared to 0.21 in An et al. (2015) and 0.24 in Öztekin and Flannery (2012). With regard to CSP, we use ESG and ESGC scores that range from 0 to 100, with high scores indicating strong performance, as proxies. The mean scores in our sample are 52.655 for ESG and 46.419 for ESGC. In general, the scores are higher for developed countries and lower for developing countries, which implies that developed countries

Table 1

Descriptive statistics

This table reports the number of observations and means of firm-level variables by country and for the entire sample in Panel A and full-sample summary statistics in Panel B. The study period is from 2002 to 2018. The variable definitions are in Appendix A.

Panel A: Descriptive statistics														
COUNTRY	Obs.	ESG score	ESGC score	ENV score	CGV score	SOC score	BLEV	MLEV	SIZE	TANG	PROF	R&D	DEP	MTB
AUSTRALIA	811	47.535	42.957	42.853	52.742	47.546	0.196	0.168	13.694	0.319	0.089	0.029	0.040	3.414
AUSTRIA	100	58.060	52.404	58.570	56.663	58.772	0.262	0.355	15.776	0.344	0.119	0.006	0.053	1.723
BELGIUM	128	54.783	49.582	54.245	54.849	55.244	0.235	0.279	15.505	0.240	0.100	0.042	0.045	1.853
BRAZIL	87	57.400	46.267	55.330	55.215	61.263	0.318	0.325	16.034	0.316	0.161	0.016	0.035	3.544
CANADA	594	46.901	44.289	44.766	48.465	47.601	0.196	0.201	14.414	0.504	0.095	0.015	0.051	2.809
CHINA	340	39.309	36.175	39.772	47.637	31.709	0.258	0.303	16.311	0.303	0.098	0.015	0.028	2.919
DENMARK	213	53.928	49.005	55.671	52.200	53.742	0.176	0.128	14.543	0.235	0.169	0.078	0.047	5.680
FINLAND	279	58.995	53.510	65.629	51.898	58.739	0.234	0.237	15.132	0.238	0.139	0.027	0.043	2.645
FRANCE	599	65.513	54.851	74.094	53.083	67.975	0.233	0.284	16.611	0.203	0.117	0.031	0.046	2.173
GERMANY	720	61.086	50.497	64.643	51.556	65.867	0.216	0.273	16.148	0.253	0.122	0.034	0.045	2.285
GREECE	45	47.123	45.049	50.326	47.634	43.618	0.302	0.416	15.219	0.344	0.099	0.001	0.031	1.530
HONG KONG	358	42.831	40.224	40.877	51.597	37.169	0.192	0.186	15.170	0.267	0.111	0.021	0.030	2.886
INDONESIA	54	48.365	48.365	44.294	46.621	53.763	0.095	0.050	14.505	0.524	0.250	0.008	0.041	3.954
ISRAEL	59	47.339	40.603	44.692	54.815	43.454	0.290	0.245	15.791	0.218	0.127	0.031	0.039	4.129
ITALY	146	62.406	49.136	63.505	57.222	65.809	0.326	0.441	16.862	0.235	0.121	0.020	0.043	2.066
JAPAN	3897	53.376	49.756	59.918	51.289	48.902	0.202	0.258	15.794	0.289	0.105	0.029	0.042	1.691
MALAYSIA	88	47.450	45.638	44.282	46.161	51.592	0.264	0.189	15.156	0.422	0.146	0.001	0.041	3.996
MEXICO	15	38.065	35.765	34.335	47.171	33.813	0.326	0.259	15.770	0.468	0.154	0.002	0.045	3.509
NETHERLANDS	222	66.530	52.655	68.357	62.071	68.612	0.224	0.229	16.270	0.248	0.117	0.032	0.045	2.471
NEW ZEALAND	64	46.824	44.463	46.717	49.110	44.963	0.243	0.186	13.585	0.331	0.168	0.051	0.049	4.293
NORWAY	137	59.797	52.604	62.294	55.586	61.024	0.227	0.231	15.561	0.387	0.148	0.011	0.064	2.190
PHILIPPINES	19	37.688	36.588	44.838	30.146	37.316	0.346	0.360	15.666	0.354	0.135	0.000	0.035	2.595
SINGAPORE	64	44.227	41.768	42.517	49.544	41.295	0.210	0.231	15.356	0.193	0.100	0.027	0.028	2.154
SOUTH KOREA	612	52.739	46.428	58.027	49.914	50.101	0.259	0.351	15.911	0.350	0.109	0.018	0.042	1.789
SPAIN	112	55.415	49.498	61.501	42.510	60.675	0.337	0.263	15.188	0.234	0.119	0.049	0.044	5.027
SWEDEN	366	59.722	52.858	65.957	47.878	63.926	0.268	0.245	15.351	0.202	0.139	0.026	0.039	2.926
SWITZERLAND	494	54.887	47.057	57.137	48.308	57.657	0.182	0.147	15.171	0.216	0.119	0.054	0.040	3.772
THAILAND	11	53.108	53.108	57.558	33.489	65.708	0.233	0.282	15.086	0.388	0.152	0.020	0.037	2.463
TURKEY	87	52.392	49.652	55.919	49.256	51.707	0.314	0.318	15.448	0.350	0.149	0.005	0.040	3.093
UNITED KINGDOM	1243	56.094	49.669	56.661	53.547	57.739	0.213	0.194	14.733	0.215	0.133	0.039	0.041	3.313
UNITED STATES	7470	50.601	43.254	48.344	51.439	52.043	0.242	0.180	15.248	0.200	0.109	0.061	0.039	4.058
All countries	19,434	52.655	46.419	53.759	51.436	52.625	0.227	0.219	15.367	0.252	0.113	0.041	0.041	3.115

Panel B: Full-sample summary statistics							
	Mean	Median	SD	Min.	P25	P75	Max.
ESG score	52.655	52.275	17.814	0.000	38.810	66.790	97.890
Ln(ESG)	3.918	3.975	0.385	0.000	3.684	4.216	4.594
ESGC score	46.419	44.170	15.988	0.000	34.790	57.320	95.600
Ln(ESGC)	3.797	3.810	0.369	0.000	3.578	4.066	4.571
ENV score	53.759	53.382	22.364	0.000	35.748	72.120	99.215
CGV score	51.436	51.919	21.044	0.000	34.880	68.202	99.006
SOC score	52.625	52.810	21.950	0.000	35.427	69.752	98.939
BLEV	0.227	0.216	0.168	0.000	0.099	0.327	1.155
MLEV	0.219	0.175	0.194	0.000	0.064	0.321	0.929
SIZE	15.367	15.322	1.544	7.427	14.451	16.331	20.497
TANG	0.252	0.211	0.185	0.000	0.109	0.353	0.922
PROF	0.113	0.119	0.135	0.000	0.076	0.168	0.455
R&D	0.041	0.018	0.084	-0.004	0.004	0.049	5.548
DEP	0.041	0.037	0.025	0.000	0.025	0.051	0.199
MTB	3.115	2.170	4.071	-8.470	1.320	3.600	29.210

Table 2

Pearson correlation coefficients This

table presents the correlation coefficients between firm financial variables in Panel A and between CSP performance scores in Panel B for the whole sample. Stars indicate significant at the 5% level ($p < 0.05$). The variable definitions are in [Appendix A](#).

Panel A: Firm financial variables								
	BLEV	MLEV	SIZE	TANG	PROF	R&D	DEP	MTB
BLEV	1							
MLEV	0.7208*	1						
SIZE	0.2368*	0.3928*	1					
TANG	0.1690*	0.2527*	0.1534*	1				
PROF	-0.0650*	-0.1568*	0.1679*	0.1085*	1			
R&D	-0.1253*	-0.2323*	-0.2896*	-0.2491*	-0.4245*	1		
DEP	0.1085*	0.0896*	0.0186*	0.3972*	0.1531*	-0.0127	1	
MTB	0.0300*	-0.2381*	-0.1617*	-0.1284*	0.0640*	0.1962*	-0.0295*	1

Panel B: CSP performance scores					
	ESG score	ESGC score	ENV score	CGV score	SOC score
ESG score	1				
ESGC score	0.7514*	1			
ENV score	0.8586*	0.6541*	1		
CGV score	0.6943*	0.5410*	0.3663*	1	
SOC score	0.8762*	0.6340*	0.6852*	0.4059*	1

have higher sustainability performance. These statistics are consistent with [Cheng et al. \(2014\)](#), who also investigate the international market and use similar data sources. In particular, they document the same mean of the ESG score which is 52. Our average ESG score is slightly lower than that documented in [Sassen et al. \(2016\)](#), which is 61. Nonetheless, [Sassen et al. \(2016\)](#) focus on European markets that include more developed countries and we focus on international firms from 31 countries. Hence, the sample selection may contribute to these slight differences.

Panel A of [Table 2](#) reports the Pearson correlation coefficients among the financial variables of firms. Except for the high correlation between book and market leverage, there is no evidence that explanatory variables are highly correlated. The correlation matrix suggests that leverage ratios are positively associated with firm size, tangibility, depreciation, and market-to-book ratio, but are negatively linked to profitability and R&D expenditure. Panel B of [Table 2](#) shows the correlation coefficients among ESG performance scores and their elements, including environment, corporate governance, and social performance scores. It suggests that ESG and ESGC scores are highly correlated with each other and with their elements, although environment, corporate governance and social performance scores are not highly associated.

5. Empirical results

5.1. CSP and leverage adjustments

An essential premise of our study is that CSP affects the speed with which firms move toward their target leverage ratios. Our explanation for this association is the effects of CSP on the firm's capital transaction costs and agency costs. [Table 3](#) reports the results from estimating the partial adjustment model (Eq. (6)) using pooled OLS with bootstrapped standard errors (Models 1–4) and firm fixed effects clustering at the country level (Models 5–8) for book and market leverage. Our variables of interest are two CSP proxies: the natural logarithm of ESG ($\ln(ESG)$) and ESGC scores ($\ln(ESGC)$). The first row in the table suggests that the coefficients on all CSP variables are positive and significant at the 1% level. It indicates that firms with better sustainability performance are likely to move faster to their target leverage ratios.

Regarding the magnitude of the impact, a standard deviation increase of one in CSP increases the speed of adjustment by 2.4%–4.3%, compared with an average adjustment speed of 20.4%.⁵ In other words, an average firm takes about 3 years to adjust half of the deviation between actual and target leverage. This duration decreases to about 2.4 years with superior CSP.⁶ In general, the results support our first hypothesis that CSP encourages the speed of leverage adjustment. Firms with better CSP are charged lower transaction costs in issuing financial capital and have lower asymmetric information that leads to lower agency costs. Consequently, such firms have a higher speed of adjustment.

⁵ To compute the economic significance of corporate sustainability performance on speed of leverage adjustment, we take the product of the coefficients and sample standard deviation of the measures of corporate sustainability performance ([An et al., 2015](#); [Faulkender et al., 2012](#); [Çolak et al., 2018](#)).

⁶ The half-life time is calculated as $\ln(0.5)/\ln(1-0.204)$, where 0.204 is the sample mean of adjustment speeds. Because corporate sustainability performance increases the adjustment speeds by 2.4%–4.3%, the lower bound of half-life time reduces to $\ln(0.5)/\ln(1-0.247)$.

Table 3

CSP and leverage speed of adjustments – baseline regression results This

table reports the regression results for the effect of CSP, proxied by natural logarithm of ESG and ESGC scores, on the leverage speed of adjustment using following model:

$$\Delta L_{i,t+1} = (\phi_{i,t} CSP_{i,t} + \rho_{i,t} X_{i,t}) (Dist_{i,t}) + \theta_{i,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,t+1}$). $Dist_{i,t}$ is the difference between the target leverage ratio and the actual leverage ratio. $CSP_{i,t}$ is proxied by the natural logarithm of ESG and ESGC scores. Control variables (vector $X_{i,t}$) including firm characteristics and industry median leverage ratio ($INDLEV$). Results of pooled OLS regression with bootstrapped standard errors. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	Ln(ESG)		Ln(ESGC)	
	ΔBL_{t-1} (1)	ΔML_{t-1} (2)	ΔBL_{t-1} (3)	ΔML_{t-1} (4)
CSP*Dist	0.0804*** (4.3434)	0.0687*** (6.2832)	0.0720*** (4.1892)	0.0592*** (4.7991)
SIZE*Dist	-0.0114*** (-2.8138)	-0.0052* (-1.8914)	-0.0081*** (-2.7249)	-0.0020 (-1.0388)
TANG*Dist	0.0230 (0.5126)	0.0620* (1.6619)	0.0197 (0.6570)	0.0572 (1.6085)
PROP*Dist	0.0185 (0.4006)	-0.0266 (-0.5497)	0.0233 (0.3080)	-0.0243 (-0.4962)
RD*Dist	0.1003 (0.8388)	0.0287 (0.2516)	0.1115 (0.9071)	0.0400 (0.3644)
RDDUM*Dist	-0.0174 (-0.8711)	-0.0299 (-1.5871)	-0.0230 (-1.1259)	-0.0345 (-1.5170)
DEP*Dist	-0.8405*** (-3.3076)	-0.4991*** (-2.8331)	-0.8245*** (-6.0033)	-0.4674** (-2.5140)
MTB*Dist	0.0022 (1.4910)	-0.0017 (-1.4486)	0.0021* (1.9023)	-0.0016 (-1.4844)
INDLEV*Dist	-0.0875 (-1.2749)	-0.1006*** (-2.7928)	-0.1059 (-1.2748)	-0.1073*** (-3.0978)
Constant	-0.0006 (-0.0533)	-0.0227 (-0.9458)	-0.0011 (-0.0738)	-0.0236 (-1.0763)
Observations	18,471	18,471	18,471	18,471
R-squared	0.0815	0.2370	0.0819	0.2370
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES

5.2. Channels linking CSP and leverage adjustments

In this section, we examine four possible mechanisms: information disclosure, equity mispricing, stakeholder engagement, and competitive advantage that potentially link a firm's sustainability performance and leverage SOA, as predicted by H2a, H2b, H2c, and H2d, respectively.

5.2.1. Information disclosure

As proposed by H2a, the presence of adverse selection and information costs can significantly escalate the costs of leverage adjustment, thus reducing the speed with which firms adjust back to their target leverage. Nonetheless, if CSP facilitates the speed of leverage adjustment by increasing a firm's information disclosure, then its impacts on leverage adjustment should be stronger for firms with less information disclosure and vice versa. We use two measures to proxy for ESG information disclosure ($ESGDIS_{i,t}$). The first measure is ESG disclosure score developed by Bloomberg ($ESGDIS_BB$) that is collected from company-sourced filings, such as corporate social responsibility reports, annual reports, the company website, and a proprietary Bloomberg survey that requests corporate data directly.⁷ We also employ the ESG disclosure score provided by Thomson Reuters ESG database ($ESGDIS_DS$) that measures whether or not a company has disclosed an information item in any given year as another proxy for ESG information disclosure.

Table 4 presents the results for Eq. (7) for $ESGDIS_BB$ measures in models (1)–(4) and $ESGDIS_DS$ in models (5)–(8). The coefficients of CSP in all models are positive and statistically significant at the 1% level, implying that the positive relationship between CSP and leverage SOA remains after controlling for ESG information disclosure. More importantly, the coefficients on the interaction terms $ESGDIS * CSP * Dist$ are negative and highly statistically significant at the 1% level, indicating that the positive association between CSP and leverage SOA is attenuated for firms that disclose more ESG information. The results

⁷ Bloomberg rates a firm's ESG disclosure on three dimensions: social, environmental, and governance. ESG disclosure scores indicate the rating that Bloomberg's analysts give to the degree of transparency and accountability of a firm's reporting on the ESG strategies, performance, and related activities. The comprehensive score of ESG disclosure is calculated from 120 indicators, spanning from 0.1 (minimum disclosure) to 100. We collected all the data available from the Bloomberg (the earliest data available is from 2007) and match with our sample using the International Securities Identification Number (ISIN) and ticker symbol (TICKER). The mean of Bloomberg's ESG disclosure score of firms in our sample is 30.508, with the lowest score of 1.240 and highest score of 76.033.

Table 4
CSP and leverage speed of adjustments: ESG information Disclosure as possible channels This table reports the regression results for the following model:

$\Delta L_{i,t+1} = (\phi_{i,t} CSP_{i,t} + \mu_{i,t} ID_{i,t} + \pi_{i,t} CSP_{i,t} * ID_{i,t} + \beta_{i,t} X_{i,t}) (Dist_{i,t}) + \theta_{i,t+1}$
The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,t+1}$). $Dist_{i,t}$ is the difference between the target leverage ratio and the actual leverage ratio. $CSP_{i,t}$ is proxied by the natural logarithm of ESG and ESGC scores. $ESGDIS_{i,t}$ is the firm's ESG information disclosure, which is measured by the ESG disclosure score developed by Bloomberg (ESGDIS_BB) in Model (1)–(4) and by Thomson Reuter ESG database (ESGDIS_DS) in Model (5)–(8). Control variables (vector $X_{i,t}$) including firm characteristics and industry median leverage ratio (INDLEV). The coefficients of control variables are not reported in the interests of brevity. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	ESGDIS_BB				ESGDIS_DS			
	Ln(ESG)		Ln(ESGC)		Ln(ESG)		Ln(ESGC)	
	ΔBL_{t+1} (1)	ΔML_{t+1} (2)	ΔBL_{t+1} (3)	ΔML_{t+1} (4)	ΔBL_{t+1} (5)	ΔML_{t+1} (6)	ΔBL_{t+1} (7)	ΔML_{t+1} (8)
CSP*Dist	0.1252*** (3.3055)	0.1298*** (5.1696)	0.1252*** (3.3055)	0.1298*** (5.1696)	0.1287*** (4.9014)	0.1448*** (6.0281)	0.1410*** (5.1810)	0.1664*** (6.5971)
ESGDIS*CSP*Dist	-0.0258*** (-3.8410)	-0.0293*** (-5.8844)	-0.0258*** (-3.8410)	-0.0293*** (-5.8844)	-0.0186*** (-3.6234)	-0.0264*** (-6.1836)	-0.0233*** (-4.2130)	-0.0325*** (-5.8059)
ESGDIS *Dist	0.0893*** (4.6925)	0.0949*** (4.2548)	0.0893*** (4.6925)	0.0949*** (4.2548)	0.0776*** (4.3057)	0.0994*** (6.3489)	0.0746*** (4.2760)	0.1009*** (5.6434)
Controls*Dist	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.0045 (0.2891)	-0.0180*** (-3.3917)	0.0045 (0.2891)	-0.0180*** (-3.3917)	-0.0178* (-1.7361)	-0.0116** (-2.0860)	-0.0119*** (-2.6792)	-0.0115*** (-2.6921)
Observations	10,256	10,256	10,256	10,256	15,141	15,141	15,141	15,141
R-squared	0.0810	0.2318	0.0810	0.2318	0.0894	0.2371	0.0840	0.2371
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES

support the hypothesis H2a. In addition, consistent with previous studies, the coefficients of information disclosure ($ESGDIS_{i,t}$) are all positive and statistically significant, implying that firms with better information disclosure adjust faster to target leverage levels (Öztekin, 2015; Öztekin & Flannery, 2012).

5.2.2. Equity mispricing

We argue that high CSP firms are more likely to be overvalued, which reduces their costs of leverage adjustment, thus increasing the speed of their adjustment toward their target leverage. Hence, if the positive effect of CSP on leverage SOA is driven by the equity overvaluation, this effect should be weaker (stronger) for firms that are over- (under-)valued in the market (H2b). To estimate equity mispricing, we use the equity value as determined by the residual income model scaled by the market price. This approach, suggested by Rhodes-Kropf, Robinson, and Viswanathan (2005), deconstructs the book-to-market ratio into two components: the ratio of value to market price that is a measure of mispricing; and the ratio of book value to value that is a measure of growth opportunities. They find that the value to market price ratio better captures mispricing than book-to-market ratio.⁸ In this paper, we follow Warr et al. (2012) who use the residual income model to estimate the firm's equity value. The residual income model is estimated by adding the discounted expected earnings in excess of the expected return on book value to the book value of equity:

$$V_0 = B_0 + \sum_{t=1}^n \frac{(E_t - r \times B_{t-1})}{(1+r)^t} + \frac{TV}{(1+r)^n \times r} \tag{11}$$

where V_0 is the value of the firm's equity at time 0, B_0 is the book value at time 0, r is the cost of equity, E_t is the expected future earnings for year t at time 0, TV is the terminal value that is calculated as:

$$TV = \frac{(E_t - r \times B_{t-1}) + (E_{t+1} - r \times B_t)}{2} \tag{12}$$

where r is the cost of equity that is measured using Fama and French's (1997) one-factor model with the short-term T-bill as a proxy for the risk-free rate of interest. Time 0 is the beginning of the fiscal year, and n equals two years.

The value of the firm's equity, V_0 , is compared to the market value of the stock, P_0 , to determine the misvaluation:

⁸ Market-to-book ratio is frequently used as a measure of equity valuation in early capital structure studies. However, this ratio performs rather poorly (Lee, Myers, & Swaminathan, 1999; Warr et al., 2012). For instant, Flannery and Rangan (2006) find little impact of market-to-book on adjustment rates, whereas Hovakimian (2006) argues that any association between market-to-book and capital structure is due to growth opportunities, not market timing. Lee et al. (1999) show that market-to-book ratios predict only about 0.33% of the variation in real stock returns, and they conclude that market-to-book is a weak measure of mispricing. In an unreported table, nevertheless, we also achieve consistent results when we use book-to-market ratio as the proxy for equity valuation.

$$VP_0 = \frac{V_0}{P_0} \tag{13}$$

Following Warr et al. (2012), we use the median VP as the watershed for over- and under-valuation. Specifically, the VP of less than the median implies over-valuation, while a VP greater than the median implies under-valuation. We use the dummy variable that equals one if the firm's equity is overvalued and zero otherwise.

Panel A of Table 5 presents the results. The coefficients of CSP*Dist are positive and statistically significant at the 1% level, consistent with our main finding. The coefficients of the interaction term OveVal*Dist are also positive and highly statistically significant, indicating that firms with high CSP are more likely to be over-valued in the market which helps them to move faster to their target leverage than their counterparties. This result is consistent with Warr et al. (2012). More importantly, the coefficients of the triple interaction term OveVal*CSP*Dist are negative and highly significant in all models (1–4). This implies that the positive impact of CSP on leverage SOA is weaker for overvalued firms that have lower costs of equity adjustment. This result supports our hypothesis H2b.

The preceding argument shows that CSP can push up a firm's stock price, make the firm's equity overvalued in the market, and thus reduce the overall cost of the firm's equity. Recent studies also document the negative association between CSP and the cost of equity. El Ghoul et al. (2011) show that firms can benefit from investment in CSR in terms of a lower cost of equity. Dhaliwal et al. (2011) document that firms with a high cost of equity are willing to invest more in CSR activities in the

Table 5

CSP and leverage speed of adjustments: equity mispricing as a possible channel and over- and under-levered firms Panel

A of this table reports the regression results for the following model:

$$\Delta L_{i,t+1} = (\phi_{i,t} CSP_{i,t} + \beta_{i,t} OveVal_{i,t} + \pi_{i,t} CSP_{i,t} * OveVal_{i,t} + \rho_{i,t} X_{i,t}) (Dist_{i,t}) + \theta_{i,t+1}$$

Panel B of this table reports the regression results for the effect of CSP on the leverage speed of adjustment of following model:

$$\Delta L_{i,t+1} = (\phi_{i,t} CSP_{i,t} + \omega_{i,t} Under_{i,t} + \alpha_{i,t} CSP_{i,t} * Under_{i,t} + \rho_{i,t} X_{i,t}) (Dist_{i,t}) + \theta_{i,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,t+1}$). $Dist_{i,t}$ is the difference between the target leverage ratio and the actual leverage ratio. $CSP_{i,t}$ is proxied by the natural logarithm of ESG and ESGC scores. $OveVal_{i,t}$ is dummy variable that equals one if firms are overvalued and zero otherwise. $Under_{i,t}$ is the dummy variable that takes value of one if a firm is under levered and zero otherwise. Control variables (vector $X_{i,t}$) including firm characteristics and industry median leverage ratio ($INDLEV$). The coefficients of control variables are not reported in the interests of brevity. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

Panel A. Equity mispricing as a possible channel				
VARIABLES	Ln(ESG)		Ln(ESGC)	
	ΔBL_{t+1} (1)	ΔML_{t+1} (2)	ΔBL_{t+1} (3)	ΔML_{t+1} (4)
CSP*Dist	0.0859*** (10.6324)	0.0817*** (5.0908)	0.0791*** (4.8846)	0.0747*** (6.1581)
Oveval*CSP*Dist	-0.0368*** (-2.6414)	-0.0821*** (-3.7067)	-0.0439** (-2.5581)	-0.0900*** (-4.0724)
Oveval*Dist	0.1377** (2.5180)	0.3242*** (3.6759)	0.1607** (2.4203)	0.3437*** (3.9441)
Controls*Dist	YES	YES	YES	YES
Constant	-0.0016 (-0.1158)	-0.0282 (-1.0158)	-0.0021 (-0.1479)	-0.0285 (-1.2902)
Observations	18,471	18,471	18,471	18,471
R-squared	0.0819	0.2382	0.0824	0.2383
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
Panel B. Over- and under-levered firms				
VARIABLES	Ln(ESG)		Ln(ESGC)	
	ΔBL_{t+1} (1)	ΔML_{t+1} (2)	ΔBL_{t+1} (3)	ΔML_{t+1} (4)
CSP*Dist	0.0967*** (5.1045)	0.1066*** (9.1228)	0.0894*** (6.0434)	0.0981*** (7.2467)
Under* CSP*Dist	-0.0016*** (-5.1123)	-0.0020*** (-7.8958)	-0.0016*** (-3.0113)	-0.0022*** (-5.9829)
Under*Dist	0.0379* (1.9084)	-0.0974*** (-6.9432)	0.0292 (1.1845)	-0.1012*** (-4.7751)
Controls*Dist	YES	YES	YES	YES
Constant	-0.0005 (-0.0329)	0.0015 (0.0607)	-0.0001 (-0.0051)	0.0020 (0.0843)
Observations	18,471	18,471	18,471	18,471
R-squared	0.0838	0.2497	0.0838	0.2497
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES

following year in order to enjoy a subsequent reduction in their cost of equity. Breuer et al. (2018) find that in countries with strong investor protection, the cost of equity falls when a firm invests in CSR. El Ghoul et al. (2018a, 2018b) conclude that investment in corporate environmental responsibility reduces the firm's equity costs worldwide. However, the impact of CSP in reducing the firm's cost of debt financing is not clear. For instance, Goss and Roberts (2011) show that the economic impact of CSP on bank loan cost is rather small, implying that banks do not recognize the value enhancing or the risk reducing effect of CSP. If this is the case, we could expect the impact of CSP on leverage SOA to be asymmetric between over-levered and under-levered firms.

We examine the impact of CSP on leverage SOA for over-levered and under-levered firms by including interaction terms between CSP and a dummy variable that takes value of one if firm is under-levered and zero otherwise (*Under*). The results, which are presented in Panel B of Table 5, support our argument. Specifically, the coefficients of the interaction terms $CSP \times Dist$ are positive and highly significant whereas the triple interaction terms $Under \times CSP \times Dist$ are significantly negative at the 1% level across models (1)–(4). This indicates that the positive relationship between CSP and leverage SOA is significantly stronger for over-levered firms than for under-levered firms. This can be explained for over-levered firms, as high CSP helping to reduce a firm's cost of equity which helps to accelerate the speed of the firm's leverage adjustments. However, as banks do not recognize the value-enhancing or the risk-reducing impact of high CSP, under-levered firms that need to issue debt or retire equity to adjust to the target would move more slowly to their target due to high investments in CSP.

5.2.3. Stakeholder engagement

The hypothesis *H2c* posits that better sustainability performance represents the high engagement of firms with their stakeholders through mutual belief and cooperation that reduces agency costs and transaction costs, thereby decreasing leverage adjustment costs and enhancing the speed of leverage adjustment. To the extent that CSP helps to facilitate dynamic leverage adjustments through this mechanism, the impact of CSP on leverage SOA should be stronger for firms that engage poorly with their stakeholders and conversely, weaker for firms that engage better with their stakeholders. To establish a proxy for stakeholder engagement, we use the scores obtained from the Thomson Reuters ESG database that capture the degree to which a focal company explains the formal processes in place for engagement with its stakeholders. The higher the score, the stronger the firm's stakeholder engagement.

Panel A of Table 6 displays the evidence to explore this mechanism. Across the models, we continue to find that CSP has positive and significant impacts on leverage SOA, even when controlling for the impacts of stakeholder engagement as shown by the coefficients of CSP proxies in the models. We also find that the coefficients of the interactions between CSP proxies and stakeholder engagement are negative and statistically significant at the 1% level in all models. These results imply that the positive effects of CSP on leverage SOA are less pronounced for firms that engage highly with their stakeholders. This finding supports *H2c*.

We argue that strong CSP helps firms to build long term relationships with their stakeholders such as suppliers, customers, and creditors through mutual belief and corporation. For instance, Lins et al. (2017) suggest that high CSR firms build social capital through their CSR activities, which help them to perform better during the crisis. Bae et al. (2019) show that CSR impacts the interaction between firms and their customers and competitors such that it reduces the cost of high leverage. In this sub-section, we study the heterogeneity of social capital of the different countries and examine whether the association between CSP and leverage SOA is different.

Putnam (2000) shows that a firm's social trust is more valuable in a country with higher social capital. Lins et al. (2017) further argue that in countries where people have a lower social trust, a firm's sustainable activities are less likely to be considered by their stakeholders as trust-enhancing activities; they instead may be viewed as window dressing and less genuine. In a related study, using a large international sample of 65 countries, Faff et al. (2020) show that country-level social trust has a positive effect on corporate leverage SOA. Following the logic, higher country-level social capital can enhance agents' social trust, then improve their stakeholder engagement, thus strengthening the association between CSP and leverage SOA.

As an alternative argument, a country's social capital is set beyond the agents. Relying on a country's social trust to enhance stakeholder engagement is a less costly choice for firms to reduce leverage adjustment costs and speed up their SOAs. Thus, firms operating in countries with better (worse) social trust become less (more) reliant on cheaper macro-level tools to build long term relationships with their stakeholders than investing in sustainable activities to enhance stakeholder engagement to save on their investment costs. Consequently, the positive association between CSP and leverage SOA is attenuated in countries with higher social capital.

We use the OECD social cohesion indicator that was originally derived from the survey administered in 2018 (OECD, 2019) as a proxy for country-level social trust. A cohesive society is one where citizens have confidence in public institutions, which is strongly related to societal trust. In the survey, respondents were asked to answer the binary questions: "Do you have confidence in each of the following: in the national government, in financial institutions or banks, in the judicial system and courts, in the local police force, in the military". A high score of social trust denotes that people in a specific country generally trust their public institutions. Indeed, this measure has been most widely used in prior studies that examine the country-level social trust (Kang & Kim, 2019; Qu & Yang, 2015; Rao, Pearce, & Xin, 2005).

We augment our baseline model with country-level social trust (*SOCTRU*) and its interactions with CSP measures ($ESP \times SOCTRU$). The results are reported in Panel B of Table 6. We continue to find that ESP has positive and significant effects on leverage SOA in all models. The coefficients in *SOCTRU* are also positive and significant at the 1% level, consistent with Faff

Table 6
CSP and leverage speed of adjustments: stakeholder engagement as a possible channel and the role of a country's social trust Panel A of this table reports the regression results for the following model:

$$\Delta L_{i,t+1} = (\phi_{i,t} CSP_{i,t} + \alpha_{i,t} SE_{i,t} + \alpha_{i,t} CSP_{i,t} * SE_{i,t} + \beta_{i,t} X_{i,t}) (Dist_{i,t}) + \theta_{i,t+1}$$

Panel B of this table reports the regression results for the following model:

$$\Delta L_{i,t+1} = (\phi_{i,t} CSP_{i,t} + \mu_{i,t} SOCTRU_{i,t} + \pi_{i,t} CSP_{i,t} * SOCTRU_{i,t} + \beta_{i,t} X_{i,t}) (Dist_{i,t}) + \theta_{i,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,t+1}$). $Dist_{i,t}$ is the difference between the target leverage ratio and the actual leverage ratio. $CSP_{i,t}$ is proxied by the natural logarithm of ESG and ESGC scores. $SE_{i,t}$ is the stakeholder engagement, which captures the degree to which a focal company explains the formal processes in place for engagement with its stakeholders. $SOCTRU_{i,t}$ is the country's social trust score. Control variables (vector $X_{i,t}$) including firm characteristics and industry median leverage ratio ($INDLEV$). The coefficients of control variables are not reported in the interests of brevity. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

Panel A. Stakeholder engagement as a possible channel				
VARIABLES	Ln(ESG)		Ln(ESGC)	
	ΔBL_{t-1} (1)	ΔML_{t-1} (2)	ΔBL_{t-1} (3)	ΔML_{t-1} (4)
CSP*Dist	0.0990*** (5.7220)	0.1167*** (7.1685)	0.0896*** (5.8581)	0.1149*** (5.8513)
SE*CSP*Dist	-0.0142*** (-4.4912)	-0.0266*** (-5.8627)	-0.0140*** (-2.6637)	-0.0312*** (-5.5412)
SE*Dist	0.0570*** (4.3369)	0.1072*** (5.1399)	0.0573** (2.3716)	0.1254*** (4.6550)
Controls*Dist	YES	YES	YES	YES
Constant	-0.0041 (-0.6442)	-0.0269 (-1.3550)	-0.0041 (-0.2990)	-0.0275 (-1.1137)
Observations	15,981	15,981	15,981	15,981
R-squared	0.0794	0.2352	0.0794	0.2354
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
Panel B. The role of a country's social trust				
VARIABLES	Ln(ESG)		Ln(ESGC)	
	ΔBL_{t-1} (1)	ΔML_{t-1} (2)	ΔBL_{t-1} (3)	ΔML_{t-1} (4)
CSP*Dist	0.1073*** (5.3672)	0.1214*** (6.1152)	0.0981*** (5.1039)	0.1144*** (7.5726)
SOCTRU*Dist	0.0073*** (3.7545)	0.0110*** (7.6285)	0.0073*** (3.6491)	0.0119*** (8.4455)
CSP*SOCTRU*Dist	-0.0017*** (-3.2095)	-0.0025*** (-7.2099)	-0.0017*** (-3.6387)	-0.0028*** (-7.0581)
Controls*Dist	YES	YES	YES	YES
Constant	0.0209 (0.4050)	0.0230 (0.2799)	0.0215 (0.6463)	0.0239 (0.3565)
Observations	17,679	17,679	17,679	17,679
R-squared	0.0867	0.2469	0.0866	0.2468
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES

et al. (2020) that firms in high social trust countries have faster leverage adjustment. More importantly, the coefficients on the interaction term ($ESP*SOCTRU*Dist$) are negative and significant across models, implying that the effect of CSP on leverage SOA is attenuated in countries with higher social trust. This result is consistent with our second argument about the role of country-level social trust in shaping the association between CSP and leverage SOA.

5.2.4. Competitive advantage

The previous literature shows that CSP enhances a firm's position in the product market as a competitive advantage that results in an expectation of stronger and more stable cash flows and higher profitability in the future (Cao et al., 2019; Flammer, 2015b). We hypothesize the competitive advantage, as proxied by the expected future cash flow realization, to be another possible channel that links a firm's CSP and leverage SOA (H2d). We expect that the impacts of CSP performance on leverage SOA would be stronger for firms with low expected future cash flow realization and vice versa.

Following Daske, Hail, Leuz, and Verdi (2008), Doidge, Karolyi, and Stulz (2004), Jiao (2011), Lang, Lins, and Miller (2004), and Cahan, De Villiers, Jeter, Naiker, and Van Staden (2016), we use Tobin's Q to measure the market's assessment of a firm's long-term expected value. Tobin's Q includes the market's assessment of a firm's future cash flows and the riskiness of those cash flows. The results, shown in Panel A of Table 7, are consistent with our predication. Specifically, the coefficients on $CSP*Dist$ and $TobinQ*Dist$ are positive and highly statically significant, showing that a firm's CSP and future expected cash flows have positive impacts on leverage SOA, consistent with our main finding and the previous literature (Faulkender et al.,

Table 7

CSP and leverage speed of adjustments: competitive advantage as a possible channel and effect of product market competition Panel

A of this table reports the regression results for the following model:

$$\Delta L_{i,t+1} = (\phi_{i,t} CSP_{i,t} + \mu_{i,t} TobinQ_{i,t} + \pi_{i,t} CSP_{i,t} * TobinQ_{i,t} + \rho_{i,t} X_{i,t}) (Dist_{i,t}) + \delta_{i,t+1}$$

Panel B of this table reports the regression results for the following model:

$$\Delta L_{i,t+1} = (\phi_{i,t} CSP_{i,t} + \mu_{i,t} Concentrate_{i,t} + \pi_{i,t} CSP_{i,t} * Concentrate_{i,t} + \rho_{i,t} X_{i,t}) (Dist_{i,t}) + \delta_{i,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,t+1}$). $Dist_{i,t}$ is the difference between the target leverage ratio and the actual leverage ratio. $CSP_{i,t}$ is proxied by the natural logarithm of ESG and ESGC scores. $TobinQ_{i,t}$ measures the market's assessment of a firm's future cash flow. $Concentrate_{i,t}$ is a dummy variable that takes value of one if a firm operates in concentrated industry and zero otherwise. Control variables (vector $X_{i,t}$) including firm characteristics and industry median leverage ratio ($INDLEV$). The coefficients of control variables are not reported in the interests of brevity. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

Panel A. Competitive advantage as a possible channel				
VARIABLES	Ln(ESG)		Ln(ESGC)	
	ΔBL_{t-1} (1)	ΔML_{t-1} (2)	ΔBL_{t-1} (3)	ΔML_{t-1} (4)
CSP*Dist	0.1032*** (6.6680)	0.1260*** (7.5865)	0.0829*** (9.0089)	0.1149*** (6.9598)
TobinQ*CSP*Dist	-0.0191*** (-2.9536)	-0.0379*** (-4.9043)	-0.0121*** (-3.3899)	-0.0408*** (-5.0244)
TobinQ*Dist	0.0777*** (3.1987)	0.1332*** (4.5334)	0.0515*** (4.0112)	0.1410*** (4.4387)
Controls*Dist	YES	YES	YES	YES
Constant	-0.0144 (-1.1769)	-0.0413*** (-3.5672)	-0.0147 (-0.9765)	-0.0424*** (-3.5594)
Observations	15,203	15,203	15,203	15,203
R-squared	0.0879	0.2415	0.0869	0.2416
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES

Panel B. The effect of product market competition				
VARIABLES	Ln(ESG)		Ln(ESGC)	
	ΔBL_{t-1} (1)	ΔML_{t-1} (2)	ΔBL_{t-1} (3)	ΔML_{t-1} (4)
CSP*Dist	0.1057*** (4.3914)	0.0986*** (6.1198)	0.0921*** (5.6257)	0.0880*** (6.6597)
CSP*Concentrate*Dist	-0.0758*** (-3.2669)	-0.0908*** (-4.4412)	-0.0688*** (-2.8020)	-0.0965*** (-4.5024)
Concentrate*Dist	0.2943*** (3.2573)	0.3510*** (4.4149)	0.2590*** (2.8549)	0.3606*** (4.4368)
Controls*Dist	YES	YES	YES	YES
Constant	-0.0034 (-0.3206)	-0.0286* (-1.7745)	-0.0033 (-0.2324)	-0.0291 (-1.4598)
Observations	18,471	18,471	18,471	18,471
R-squared	0.0834	0.2391	0.0834	0.2393
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES

2012). More importantly, the coefficients of *TobinQ*CSP*Dist* are negative and highly significant across models, indicating that the impact of CSP performance on leverage SOA is weaker for firms with higher market assessment of future cash flows. The result supports our hypothesis *H2d*.

In addition, as mentioned above, market competition can be seen as an incentive for firms to enhance the CSP, thus, improving the firm's general performance (Cao et al., 2019). In other words, firms in highly competitive industries have more incentives to enhance their CSP to distinguish them from their low CSP competitors, thus increasing their SOA. In line with this view, we expect the link between CSP and leverage SOA to be stronger for a highly competitive industry.

We use the Herfindahl-Hirschman (HH) index as a proxy for market competition. The dummy variable (*Concentrate*) takes the value of one if firms operate in a concentrated industry (HH index is above the median of the index) and zero if firms operating in competitive industries (HH index is below the median of the index).⁹ We estimate the regression that includes the triple interaction *CSP*Concentrate*Dist* to measure the impact of CSP on leverage SOA for each of the subsamples. The results, presented in Panel B Table 7, support our argument. Specifically, the coefficients on the interaction terms *CSP*Dist* are positive and highly significant across models, indicating the positive link between CSP and leverage SOA, consistent with our baseline results. Interestingly, the coefficients on triple interaction terms *CSP*Concentrate*Dist* are negative and highly

⁹ HH index is measured as the sum of squared market shares in a given industry based on the four-digit SIC code. A HH index that is higher than median of the index implies concentrated industries; a HH index that is lower than median of the index implies competitive industries.

Table 8a

Robustness tests: Alternative measures of leverage and target leverage This table reports the robustness checks using partial active leverage adjustment as alternative measure of leverage (Model (1)–(2) and using Fama-McBeth method to estimate target leverage (Model (3)–(6) for following regressions:

$$\Delta L_{i,j,t+1} = (\phi_{i,j,t} CSP_{i,j,t} + \rho_{i,j,t} X_{i,j,t}) (Dist_{i,j,t}) + \vartheta_{i,j,t+1}$$

The dependent variable is the change in leverage ratio ($\Delta L_{i,j,t+1}$). $Dist_{i,j,t}$ is the difference between the target leverage ratio and the actual leverage ratio. $CSP_{i,j,t}$ is proxied by the natural logarithm of ESG and ESGC scores. Control variables (vector $X_{i,j,t}$) including firm characteristics and industry median leverage ratio ($INDLEV$). The coefficients of control variables are not reported in the interests of brevity. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	Alternative leverage measure: AL		Alternative target leverage measure: Fama-McBeth method			
			Ln(ESG)		Ln(ESGC)	
	Ln(ESG) (1)	Ln(ESGC) (2)	ΔBL_{t-1} (3)	ΔML_{t-1} (4)	ΔBL_{t-1} (5)	ΔML_{t-1} (6)
CSP*Dist	0.308*** (5.171)	0.247*** (6.264)	0.0804*** (4.690)	0.0720*** (5.008)	0.0687*** (5.926)	0.0592*** (4.349)
Controls*Dist	YES	YES	YES	YES	YES	YES
Constant	-0.0338* (-1.949)	-0.0417** (-2.125)	-0.0006 (-0.0505)	-0.0011 (-0.0793)	-0.0227 (-1.113)	-0.0236 (-1.254)
Observations	17,758	17,758	18,471	18,471	18,471	18,471
R-squared	0.701	0.696	0.081	0.082	0.237	0.237
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES

significant at the 1% level, indicating that market competition helps low CSP firms in highly competitive industries to have more incentive to maximize their CSP, leading to an increase in their leverage SOA. This supplementary analysis for the impact of market competition provides additional support for our main findings.

5.3. Robustness tests

In this section, we investigate the robustness of our baseline results by using alternative and additional measures of leverage and target leverage ratio, alternative econometric method, and addressing the endogeneity issue.¹⁰

5.3.1. Alternative measures of leverage and target leverage ratios

We test the robustness of the baseline results using an alternative measure of leverage ratio. As suggested by Faulkender et al. (2012), the change in leverage ratio includes both passive and active adjustments, with the former being a mechanical adjustment and the latter involving firms actually visiting the capital markets. Since only active adjustments involve transaction costs, Faulkender et al. (2012) argue that studies on firm leverage adjustments should only focus on the active component. In this section, we measure leverage ratio focusing on the active component of the adjustment:

$$L_{i,j,t}^p = \frac{D_{i,j,t}}{TA_{i,j,t} + NI_{i,j,t+1}} \tag{14}$$

where $NI_{i,j,t+1}$ is the net income during the year ending at time $t+1$. Leverage at $t+1$ would be $L_{i,j,t}^p$ if the firm engages in no net capital market activities.

Our baseline regression (Eq. (6)) then becomes the following partial active adjustment model:

$$L_{i,j,t+1} - L_{i,j,t}^p = \alpha_0 + \gamma(L_{i,t+1}^* - L_{i,j,t}^p) + \vartheta_{i,j,t+1} \tag{15}$$

The left-hand side of Eq. (15) thus equals the firm's active adjustment toward its target leverage ratio.

The results of this robustness check are presented in Models (1) and (2) of Table 8a. We find that the coefficients of both CSP measures are positive and statistically significant at the 1% level, indicating that our main finding is robust if the alternative leverage ratio only captures active adjustments. The sign and significance of control variables are consistent with the baseline results presented in Table 3.

Following previous studies (Byoun, 2008; Devos et al., 2017; Warr et al., 2012), we measure target leverage ratio using the cross-sectional regressions of Fama and MacBeth (1973) to estimate target leverage. The results are reported in Models (3) to

¹⁰ We also check the robustness of our baseline results by using alternative and additional control variables and subsample of countries with different institutional characteristics. The results support our main hypothesis. Due to the space limitation, all the results will be available upon request.

Table 8b

CSP and leverage speed of adjustments – Alternative econometric method This table reports the regression results for the effect of CSP, proxied by natural logarithm of ESG and ESGC scores, on the leverage speed of adjustment using of firm fixed effects regression with clustered standard error at the country level:

$$\Delta L_{i,t+1} = (\phi_{i,t} CSP_{i,t} + \theta_{i,t} X_{i,t}) (Dist_{i,t}) + \eta_{i,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,t+1}$). $Dist_{i,t}$ is the difference between the target leverage ratio and the actual leverage ratio. $CSP_{i,t}$ is proxied by the natural logarithm of ESG and ESGC scores. Control variables (vector $X_{i,t}$) including firm size (*SIZE*), tangibility (*TANG*), profitability (*PROF*), R&D expenses (*RD*), R&D dummy (*RDDUM*), depreciation expenses (*DEP*), market-to-book ratio (*MTB*), and industry median leverage ratio (*INDLEV*). The coefficients of control variables are not reported in the interests of brevity. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	Ln(ESG)		Ln(ESGC)	
	$\Delta BL_{i,t+1}$ (1)	$\Delta ML_{i,t+1}$ (2)	$\Delta BL_{i,t+1}$ (3)	$\Delta ML_{i,t+1}$ (4)
CSP*Dist	0.1129*** (3.6072)	0.0790*** (3.3278)	0.0973*** (4.9756)	0.0659*** (3.0256)
Controls*Dist	YES	YES	YES	YES
Constant	-0.0100*** (-3.4834)	-0.0197*** (-3.6139)	-0.0099*** (-3.3060)	-0.0196*** (-3.5060)
Observations	18,471	18,471	18,471	18,471
R-squared	0.1775	0.3714	0.1779	0.3715
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

(6) of Table 8a. Again, the coefficients on CSP measures are positive and statistically significant, implying that our baseline finding is not sensitive to the method of estimating the target leverage ratios.

5.3.2. Alternative econometric method

Next, given that both CSP and leverage SOA are firm-level choices, we estimate our models with firm-fixed effects to control for time-invariant unobserved firm-specific factors that may be associated with CSP and leverage adjustments (An et al., 2015). Because there could be a correlation in error terms within the same country, we also cluster standard error at the country level as robustness. We still find qualitatively consistent results as presented in Table 8b. Specifically, models (1)–(4) of Table 8b show that firms with stronger CSP have significantly faster speed of leverage adjustment.

5.3.3. Endogeneity issue

One potential threat to our analysis of the effect of CSP on leverage adjustments is that our CSP variables may not be exogenous. In fact, firms do not randomly choose their CSP. It may be determined by unobserved variables that also affect the leverage adjustment speed. The literature has shown that CSP can be a signal of good performance or the so-called “doing well by doing good” argument (e.g., Dowell, Hart, & Yeung, 2000; Krüger, 2015; Orlitzky et al., 2003; Renneboog, Ter Horst, & Zhang, 2008.; Renneboog, Ter Horst, & Zhang, 2011). Specifically, Cheng, Hong, and Shue (2013) suggest that spending on CSP activities generates a halo impact on a firm's performance and increases a firm's profit. Accordingly, firms with better financial performance will invest more in CSP and could have superior leverage adjustment speeds. This endogeneity of CSP can lead to biased and inconsistent estimates.

We address this concern using an instrumental variable approach. Specifically, we use macroeconomic variables that affect firm performance and availability of fund including GDP growth rate and money supply growth rate as instruments for CSP variables. It is argued that firms from countries with high GDP and money supply growth have higher investment in CSP than companies from low GDP and money supply growth. We also perform several tests to assess the instruments' validity and relevance.

We re-estimate Eq. (6) using the two-stage least squares regression technique. The results of the IV regressions are reported in Table 8c. We regress CSP proxies including $Ln(ESG)$ and $Ln(ESGC)$ on the instrument variables ($GGDP$ and GMS) and the controls. Specifically, the results from the first stage as reported in Table 8c show a positive and significant coefficient at the 1% level for $GGDP$ and GMS , implying that countries with high GDP growth rate and money supply growth rate have higher CSP, which is consistent with our argument (Models 1, 3, 5, & 7). In the second stage, we estimate the SOA model using the fitted values of CSP measures as explanatory variables (Models 2, 4, 6, & 8). Importantly, we continue to find a significantly positive association at the 1% level between CSP and the SOA. The p values of Wald tests are lower than 1% level indicating that CSP variables are endogenous. The p values of Sargan J statistics are higher than 0.1 demonstrating that the overidentification restriction is satisfied. The p values of the F-statistics on the first-stage instruments are all significant at 1% level, which passes the weak instrument test. In sum, these results reinforce the confidence in our analysis, confirming the previously documented positive relation between corporate sustainability variables and leverage SOA.¹¹

¹¹ We also use the legal origin and country average CSP excluding the industry in which the focal firm operates as instruments for CSP variables (Cheng et al., 2014; Liang & Renneboog, 2017). The results also confirm positive relation between corporate sustainability variables and leverage SOA.

Table 8c

Instrumental variable approach This

Table reports the first-stage and second-stage regression from our IV regressions. In the first stage, we regress the CSP variables ($\ln(ESG)$ and $\ln(ESGC)$) interacted with $Dist$ on the instruments and the controls, where a given firm's CSP proxies are instrumented using GDP growth rate ($GGDP$) and money supply growth rate (GMS). $CSP_{i,t}$ is proxied by the natural logarithm of ESG and ESGC scores. Control variables including firm characteristics and industry median leverage ratio ($INDLEV$). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A. In the second stage, we regress dependent variable that is the change in book leverage ratio ($\Delta LEV_{i,t-1,t}$) on the predicted values of $\ln(ESG)*Dist$ and $\ln(ESGC)*Dist$, respectively, and the control variables. $Dist_{i,t}$ is the difference between the target leverage ratio and the actual leverage ratio. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped and reported in parenthesis. The p values of Wald tests, Sargan J statistics and first-stage F tests are reported. The variable definitions are in Appendix A.

VARIABLES	$\ln(ESG)$				$\ln(ESGC)$			
	BL		ML		BL		ML	
	First stage	Second stage	First stage	Second stage	First stage	Second stage	First stage	Second stage
	$\ln(ESG)*Dist$ (1)	ΔBLE_{t-1} (2)	$\ln(ESGC)*Dist$ (3)	ΔBLE_{t-1} (4)	$\ln(ESG)*Dist$ (5)	ΔBLE_{t-1} (6)	$\ln(ESGC)*Dist$ (7)	ΔBLE_{t-1} (8)
CSP*Dist		0.8744*** (0.1884)		1.4669*** (0.4870)		0.7300*** (0.1505)		1.0543*** (0.3087)
SIZE*Dist	0.2300*** (0.0009)	-0.1957*** (0.0436)	0.2277*** (0.0008)	-0.3233*** (0.1109)	0.2117*** (0.0010)	-0.1485*** (0.0322)	0.2095*** (0.0010)	-0.2113*** (0.0650)
TANG*Dist	0.0620*** (0.0195)	-0.0194 (0.0287)	0.0808*** (0.0180)	-0.0629 (0.0507)	0.1162*** (0.0227)	-0.0587* (0.0314)	0.1647*** (0.0212)	-0.1236** (0.0599)
PROP*Dist	0.1646*** (0.0185)	-0.1148*** (0.0405)	0.2457*** (0.0239)	-0.3842*** (0.1287)	0.1099*** (0.0216)	-0.0413 (0.0299)	0.2387*** (0.0281)	-0.2789*** (0.0854)
RD*Dist	1.5298*** (0.0337)	-1.1296*** (0.2963)	1.3981*** (0.0497)	-1.9472*** (0.6921)	1.5460*** (0.0393)	-0.9179*** (0.2413)	1.3816*** (0.0583)	-1.3600*** (0.4407)
RDDUM*Dist	0.1970*** (0.0104)	-0.1719*** (0.0402)	0.1645*** (0.0101)	-0.2663*** (0.0827)	0.2956*** (0.0122)	-0.2220*** (0.0473)	0.2783*** (0.0119)	-0.3171*** (0.0875)
DEP*Dist	1.9466*** (0.1090)	-2.3948*** (0.3919)	1.8113*** (0.1143)	-3.0396*** (0.8995)	1.9753*** (0.1272)	-2.1538*** (0.3269)	1.5547*** (0.1342)	-2.0109*** (0.5062)
MTB*Dist	0.0039*** (0.0004)	-0.0011 (0.0010)	0.0071*** (0.0006)	-0.0115*** (0.0036)	0.0053*** (0.0005)	-0.0015 (0.0010)	0.0064*** (0.0007)	-0.0082*** (0.0022)
INDLEV*Dist	-0.2728*** (0.0352)	0.1452** (0.0705)	-0.0727*** (0.0228)	0.0219 (0.0559)	-0.0348 (0.0410)	-0.0866* (0.0464)	0.0280 (0.0267)	-0.1133*** (0.0372)
GGDP*Dist	0.0023* (0.0013)		0.0042*** (0.0012)		0.0038** (0.0016)		0.0050*** (0.0014)	
GMS*Dist	0.4456*** (0.0740)		-0.1044 (0.0719)		0.5174*** (0.0864)		0.1878** (0.0843)	
Constant	0.0154 (0.0127)	-0.0039 (0.0172)	0.0133 (0.0120)	-0.0474** (0.0224)	0.0202 (0.0154)	-0.0143 (0.0176)	0.0276* (0.0141)	-0.0595*** (0.0214)
Observations	17,950	17,950	17,950	17,950	17,950	17,950	17,950	17,950
R-squared	0.9908	0.0878	0.9911	0.0631	0.9866	0.1951	0.9869	0.2002
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES
Wald test		0.0092		0.0000		0.0000		0.0000
Sargan J statistic		0.1550		0.1089		0.1267		0.1091
First-stage F test		0.0000		0.0012		0.0000		0.0000

5.4. CSP and leverage adjustments: the role of a country's institutions

Our next analysis considers various institutional factors that could potentially attenuate the positive impact of a firm's sustainability performance on its leverage SOA. Previous studies suggest that institutional environments are external mechanisms to mitigate agency conflicts, reduce asymmetric information and distress costs, and enhance accessibility to, and lessen the uncertainty of, capital markets (An et al., 2015; Çolak et al., 2018; La Porta et al., 1998; Öztekin, 2015; Öztekin & Flannery, 2012). Consequently, as proposed in H3, strong institutional environments can substitute the role of CSP in increasing the leverage SOA, making the positive impacts of CSP on adjustment speed less pronounced. To examine H3, we include institutional variables and their interaction terms with the CSP proxies (i.e., $\ln(ESG)$ and $\ln(ESGC)$) in our baseline model as shown in Eq. (8). We then substitute Eq. (8) back to partial adjustment specification (Eq. (3)) and run the estimation. The results are reported in Table 9. Consistent with our baseline findings, the coefficients of CSP proxies across models and panels are positive and significant at the 1% level, indicating that the positive effect of CSP on leverage SOA still holds when we control for institutional factors. In line with previous studies, better institutions reduce adjustment costs and increase a firm's leverage SOA (Öztekin, 2015; Öztekin & Flannery, 2012). More importantly, in all models and panels, we find significantly

Table 9

CSP and leverage speed of adjustments: the role of country's institution This table reports the regression results for the effect country's institution on CSP – leverage SOA relationship using the following model:

$$\Delta L_{i,t+1} = (\phi_{i,t} CSP_{i,t} + \Delta_{i,t} IN_{i,t} + \alpha_{i,t} CSP_{i,t} * IN_{i,t} + \beta_{i,t} X_{i,t}) (\Delta_{i,t} Dist_{i,t} + \theta_{i,t+1})$$

The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,t+1}$). $\Delta_{i,t}$ is the difference between the target leverage ratio and the actual leverage ratio. $CSP_{i,t}$ is proxied by the natural logarithm of ESG. $IN_{i,t}$ is the country's institution variables, which is measured by the legal and regulatory variables in panel A, information environment variables in Panel B, country's corporate governance variables in panel C, and other country's institutional factors in panel D. Control variables (vector $X_{i,t}$) including firm characteristics and industry median leverage ratio ($INDLEV$). The coefficients of control variables are not reported in the interests of brevity. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

Panel A. Legal and regulatory variables												
VARIABLES	LEGREG – EFFJUD		LEGREG – RULLAW		LEGREG – CORRUP		LEGREG – RISEXP		LEGREG – RISCOV			
	ΔBL_{t+1} (1)	ΔML_{t+1} (2)	ΔBL_{t+1} (3)	ΔML_{t+1} (4)	ΔBL_{t+1} (5)	ΔML_{t+1} (6)	ΔBL_{t+1} (7)	ΔML_{t+1} (8)	ΔBL_{t+1} (9)	ΔML_{t+1} (10)		
CSP*Dist	0.1305*** (5.3523)	0.1429*** (5.9848)	0.1143*** (2.8885)	0.0999*** (5.3539)	0.1125*** (5.9072)	0.1158*** (4.7981)	0.1087*** (3.8617)	0.0685** (2.2220)	0.1502*** (4.5674)	0.1845*** (6.2033)		
LEGREG *CSP*Dist	-0.0090*** (-4.0406)	-0.0121*** (-5.0003)	-0.0076** (-2.2528)	-0.0083*** (-5.1078)	-0.0082*** (-4.9608)	-0.0107*** (-4.1433)	-0.0067** (-2.1450)	-0.0047 (-1.4817)	-0.0115*** (-3.9032)	-0.0166*** (-5.9756)		
LEGREG *Dist	0.0348*** (5.4511)	0.0466*** (5.2155)	0.0352*** (3.4452)	0.0482*** (8.4630)	0.0384*** (5.0905)	0.0516*** (6.5757)	0.0349*** (4.5621)	0.0497*** (6.9452)	0.0357*** (5.1455)	0.0477*** (5.4751)		
Controls*Dist	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		
Constant	-0.0043 (-0.4559)	-0.0305** (-2.2954)	-0.0040 (-0.3633)	-0.0289 (-1.1784)	-0.0040 (-0.5227)	-0.0298 (-1.5914)	-0.0033 (-0.3185)	-0.0254 (-1.3050)	-0.0048 (-0.3329)	-0.0330 (-1.4001)		
Observations	17,935	17,935	17,935	17,935	17,935	17,935	17,935	17,935	17,935	17,935		
R-squared	0.0867	0.2409	0.0868	0.2422	0.0866	0.2412	0.0867	0.2425	0.0867	0.2414		
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		
Panel B. Information environments												
VARIABLES	FINENV – DISCLO		FINENV – ANALYST		FINENV – AUDIT		FINENV – DISCON		FINENV – DISPUB			
	ΔBL_{t+1} (1)	ΔML_{t+1} (2)	ΔBL_{t+1} (3)	ΔML_{t+1} (4)	ΔBL_{t+1} (5)	ΔML_{t+1} (6)	ΔBL_{t+1} (7)	ΔML_{t+1} (8)	ΔBL_{t+1} (9)	ΔML_{t+1} (10)		
CSP*Dist	0.1220*** (4.6733)	0.1557*** (7.9174)	0.1182*** (4.8487)	0.1216*** (7.2597)	0.1213*** (5.8525)	0.1555*** (6.7390)	0.1001*** (4.1590)	0.0973*** (5.4298)	0.1020*** (5.0248)	0.0911*** (5.8205)		
FINENV*CSP*Dist	-0.0164*** (-4.0971)	-0.0238*** (-6.7675)	-0.0029*** (-3.2517)	-0.0038*** (-7.4104)	-0.0202*** (-4.5356)	-0.0327*** (-6.9652)	-0.0865** (-2.5004)	-0.1205*** (-4.3654)	-0.0902*** (-4.1566)	-0.1118*** (-5.0513)		
FINENV*Dist	0.0670*** (3.6624)	0.0838*** (5.7927)	0.0123*** (3.7509)	0.0167*** (7.8357)	0.0885*** (5.1075)	0.1165*** (8.3373)	0.4083*** (3.0092)	0.5744*** (4.9350)	0.4146*** (4.9835)	0.5334*** (6.3023)		
Controls*Dist	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		
Constant	-0.0053 (-0.4257)	-0.0319 (-1.2441)	-0.0042 (-0.3113)	-0.0308* (-1.8036)	-0.0046 (-0.3376)	-0.0306* (-1.7265)	-0.0050 (-0.4658)	-0.0293 (-1.3248)	-0.0052 (-0.3636)	-0.0286 (-1.3814)		
Observations	17,959	17,959	17,885	17,885	17,885	17,885	18,243	18,243	18,243	18,243		
R-squared	0.0864	0.2408	0.0864	0.2405	0.0871	0.2412	0.0882	0.2435	0.0880	0.2429		
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES		
Panel C. Country's corporate governance												
VARIABLES	CORGOV – UNIACT		CORGOV – INSCPA		CORGOV – COMEFF		CORGOV – RECFIA		CORGOV – BRLAW9		CORGOV – FNNFAR	
	ΔBL_{t+1} (1)	ΔML_{t+1} (2)	ΔBL_{t+1} (3)	ΔML_{t+1} (4)	ΔBL_{t+1} (5)	ΔML_{t+1} (6)	ΔBL_{t+1} (7)	ΔML_{t+1} (8)	ΔBL_{t+1} (9)	ΔML_{t+1} (10)	ΔBL_{t+1} (11)	ΔML_{t+1} (12)
CSP*Dist	0.1012*** (4.1751)	0.1066*** (5.6325)	0.1035*** (3.2599)	0.1131*** (6.2001)	0.1038*** (3.2906)	0.1182*** (6.6604)	0.0831** (2.4271)	0.1196*** (7.2957)	0.0977*** (4.0105)	0.1196*** (7.0603)	0.1007*** (4.0452)	0.1185*** (6.4078)
CORGOV*CSP*Dist	-0.0568*** (-4.0971)	-0.0769*** (-6.7675)	-0.0735*** (-3.2517)	-0.0880*** (-7.4104)	-0.0435*** (-4.5356)	-0.0571*** (-6.9652)	-0.0372** (-2.5004)	-0.0605*** (-4.3654)	-0.0401*** (-4.1566)	-0.0598*** (-5.0513)	-0.0458*** (-5.0513)	-0.0610*** (-5.0513)

	(-2.9150)	(-4.4932)	(-2.9229)	(-4.3582)	(-2.7766)	(-4.7628)	(-2.4197)	(-4.1515)	(-3.5479)	(-4.8869)	(-3.4466)	(-4.8360)
CORGOV*Dist	0.2408***	0.3280***	0.2693***	0.3100***	0.1988***	0.2448***	0.2029***	0.2464***	0.1889***	0.2460***	0.2026***	0.2468***
	(3.0919)	(4.9839)	(2.8184)	(4.1359)	(3.1620)	(6.1067)	(3.5077)	(4.4730)	(4.6054)	(5.8976)	(3.6211)	(5.1248)
Controls*Dist	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.0005	-0.0218	-0.0009	-0.0265	-0.0018	-0.0286	-0.0043	-0.0289	-0.0016	-0.0274	-0.0019	-0.0272
	(0.0419)	(-0.9453)	(-0.0838)	(-0.9786)	(-0.1220)	(-0.8585)	(-0.2981)	(-1.1615)	(-0.1140)	(-1.3608)	(-0.1281)	(-1.3224)
Observations	15,964	15,964	15,964	15,964	15,964	15,964	15,964	15,964	15,964	15,964	15,964	15,964
R-squared	0.0847	0.2529	0.0829	0.2512	0.0851	0.2528	0.0865	0.2523	0.0851	0.2525	0.0854	0.2526
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Panel D. Other country's institutional factors

VARIABLES	OTHER – ENGORI		OTHER – PURETH		OTHER – GOOGOV		OTHER – MEDIA	
	ΔBL_{t-1} (1)	ΔML_{t-1} (2)	ΔBL_{t-1} (3)	ΔML_{t-1} (4)	ΔBL_{t-1} (5)	ΔML_{t-1} (6)	ΔBL_{t-1} (7)	ΔML_{t-1} (8)
CSP*Dist	0.0975***	0.0898***	0.1020***	0.1249***	0.1234***	0.1489***	0.0743***	0.0716***
	(5.6704)	(5.8468)	(7.5394)	(5.8231)	(5.3053)	(7.9483)	(3.9525)	(6.0549)
OTHER*CSP*Dist	-0.0713***	-0.0768***	-0.0010***	-0.0015***	-0.0043***	-0.0063***	-0.0000	-0.0000**
	(-3.9943)	(-2.9705)	(-6.4976)	(-5.0528)	(-4.0880)	(-7.4144)	(-1.2516)	(-2.5579)
OTHER*Dist	0.3187***	0.3365***	0.0048***	0.0061***	0.0177***	0.0233***	0.0001	0.0001***
	(4.6123)	(3.3055)	(8.7906)	(5.6901)	(4.1715)	(7.2154)	(1.5940)	(2.9985)
Controls*Dist	YES	YES	YES	YES	YES	YES	YES	YES
Constant	-0.0069	-0.0340	-0.0064	-0.0319*	-0.0046	-0.0309*	-0.0060	-0.0304*
	(-0.4733)	(-1.6195)	(-0.4542)	(-1.8938)	(-0.4211)	(-1.8070)	(-0.4196)	(-1.8864)
Observations	18,243	18,243	18,243	18,243	17,959	17,959	17,885	17,885
R-squared	0.0869	0.2392	0.0870	0.2406	0.0864	0.2407	0.0866	0.2388
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES

Table 10

ESG pillars and leverage speed of adjustments This table reports the regression results for the effect of ESG pillars including environment (ENV), social (SOC), and corporate governance (CGV) on the leverage speed of adjustment using the following models:

$$\Delta L_{i,t+1} = (\phi_{i,t} ESGpillar_{i,t} + \rho_{i,t} X_{i,t}) (Dist_{i,t}) + \theta_{i,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,t+1}$). $Dist_{i,t}$ is the difference between the target leverage ratio and the actual leverage ratio. $ESGpillar_{i,t}$ is proxied by the natural logarithm of environment (Model (1)–(2)), social (Model (3)–(4)), and corporate governance scores (Model (5)–(6)). Control variables (vector $X_{i,t}$) including characteristics and industry median leverage ratio ($INDLEV$). The coefficients of control variables are not reported in the interests of brevity. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	ENVIRONMENT		SOCIAL		GOVERNANCE	
	ΔBL_{t-1} (1)	ΔML_{t-1} (2)	ΔBL_{t-1} (3)	ΔML_{t-1} (4)	ΔBL_{t-1} (5)	ΔML_{t-1} (6)
$\ln(ENV)*Dist$	0.0429*** (4.0597)	0.0262*** (2.9745)				
$\ln(SOC)*Dist$			0.0576*** (5.4021)	0.0380*** (7.2508)		
$\ln(CGV)*Dist$					0.0421*** (5.9923)	0.0467*** (5.9770)
Controls*Dist	YES	YES	YES	YES	YES	YES
Constant	0.0006 (0.0812)	-0.0217 (-1.0280)	0.0001 (0.0053)	-0.0216 (-1.1915)	-0.0014 (-0.1108)	-0.0249 (-1.2918)
Observations	18,465	18,465	18,465	18,465	18,463	18,463
R-squared	0.0783	0.2348	0.0809	0.2358	0.0790	0.2366
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES

Table 11

CSP and leverage speed of adjustments: Effect of firm's corporate governance practice This table reports the regression results for the following model:

$$\Delta L_{i,t+1} = (\phi_{i,t} ENVSOC_{i,t} + \rho_{i,t} Dummy_CGV_{i,t} + \pi_{i,t} ENVSOC_{i,t} * Dummy_CGV_{i,t} + \rho_{i,t} X_{i,t}) (Dist_{i,t}) + \theta_{i,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,t+1}$). $Dist_{i,t}$ is the difference between the target leverage ratio and the actual leverage ratio. $ENVSOC_{i,t}$ is proxied by the natural logarithm of average of environment and social performance scores. $Dummy_CGV_{i,t}$ is a dummy variable that equals one if firms have strong corporate governance and zero otherwise. Control variables (vector $X_{i,t}$) including firm characteristics and industry median leverage ratio ($INDLEV$). The coefficients of control variables are not reported in the interests of brevity. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	ΔBL_{t-1} (1)	ΔML_{t-1} (2)
$ENVSOC*Dist$	0.0722*** (6.0466)	0.0693*** (5.0613)
$Dummy_CGV*Dist$	0.0055** (2.4205)	0.0086** (3.2839)
$ENVSOC*Dummy_CGV*Dist$	-0.0155*** (-2.7858)	-0.0547*** (-8.6514)
Controls*Dist	YES	YES
Constant	0.0019 (0.1617)	0.0029 (0.1158)
Observations	18,463	18,463
R-squared	0.0821	0.2481
Industry FE	YES	YES
Year FE	YES	YES
Country FE	YES	YES

negative effects of institutional factors on the relationship between CSP and leverage SOA. That is, strong institutions can be a cheaper choice for firms to substitute the roles of CSP in reducing information asymmetry and transaction costs. Consequently, in countries with better institutional settings, the positive relationship between CSP and leverage SOA is relatively weaker (H3).¹²

¹² Due to the space limitation, we only report the results of regressions that use ESG as the proxy for CSP. The results for regressions that use ESGC as the proxy for CSP will be available upon request.

Table 12

CSP and leverage speed of adjustments: financial constraints This table reports the regression results for the following model:

$$\Delta L_{i,t+1} = (\phi_{i,t} CSP_{i,t} + \mu_{i,t} FINCON_{i,t} + \pi_{i,t} CSP_{i,t} * FINCON_{i,t} + \beta_{i,t} X_{i,t}) (Dist_{i,t}) + \theta_{i,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,t+1}$). $Dist_{i,t}$ is the difference between the target leverage ratio and the actual leverage ratio. $CSP_{i,t}$ is proxied by the natural logarithm of ESG and ESGC scores. $FINCON_{i,t}$ is the financial constraints variables, which is measured by firm's cash flow (CASHFLOW) in Model (1)–(4) and KZ index (KZINDEX) in Model (5)–(8). Control variables (vector $X_{i,t}$) including firm characteristics and industry median leverage ratio (INDLEV). The coefficients of control variables are not reported in the interests of brevity. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	FINCON – CASHFLOW				FINCON – KZINDEX			
	Ln(ESG)		Ln(ESGC)		Ln(ESG)		Ln(ESGC)	
	ΔBL_{t-1} (1)	ΔML_{t-1} (2)	ΔBL_{t-1} (3)	ΔML_{t-1} (4)	ΔBL_{t-1} (5)	ΔML_{t-1} (6)	ΔBL_{t-1} (7)	ΔML_{t-1} (8)
CSP*Dist	0.1106*** (4.1634)	0.1048*** (4.6785)	0.1001*** (5.7448)	0.0935*** (6.0871)	0.1057*** (5.9201)	0.1019*** (9.7886)	0.0943*** (6.1591)	0.0906*** (8.1837)
FINCON* CSP*Dist	-0.0756*** (-3.3385)	-0.1108*** (-5.0190)	-0.0744*** (-3.7977)	-0.1067*** (-5.1926)	-0.0857*** (-4.5865)	-0.1050*** (-8.0812)	-0.0903*** (-5.1902)	-0.1030*** (-8.9039)
FINCON*Dist	0.2889*** (3.1690)	0.4138*** (4.5730)	0.2726*** (3.2737)	0.3836*** (4.8672)	0.3991*** (5.3587)	0.4636*** (8.7462)	0.4038*** (5.9911)	0.4427*** (8.8373)
Controls*Dist	YES	YES	YES	YES	YES	YES	YES	YES
Constant	-0.0004 (-0.0389)	-0.0275 (-1.6420)	-0.0015 (-0.1269)	-0.0292 (-1.3424)	0.0035 (0.2652)	-0.0151 (-0.6495)	0.0030 (0.2102)	-0.0162 (-0.5767)
Observations	16,418	16,418	16,418	16,418	18,428	18,428	18,428	18,428
R-squared	0.0926	0.2503	0.0931	0.2501	0.0893	0.2421	0.0894	0.2417
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES

5.5. Further analyses

5.5.1. ESG pillars and leverage adjustments

Next, we deconstruct our aggregate ESG measure and investigate which of its components drive the results. We separately measure environment, social, and corporate governance performance by taking the natural logarithm of EVN, SOC, and CGV scores. Table 10 presents the results with ESG components as the main explanatory variables of both book and market leverage regressions. The results on the independent variables of interest are positive and statistically significant at the 1% level in all models, with the magnitude of the impacts being very similar. This suggests that all components of ESG performance significantly encourage the leverage SOA. In other words, the overall positive impact of corporate sustainability performance on leverage SOA is driven by the three pillars: the firm's environmental, social, and corporate governance performance.

5.5.2. The effect of corporate governance on the relationship between environment and social performance and leverage SOA

In this paper, we use ESG and ESGC scores from Thomson Reuters ESG database as the proxy for CSP, the database comprises more than 400 ESG metrics. The major scores are established from three categories: environmental, social, and governance. We argue that CSP firms with better CSP will have lower costs of leverage adjustments as they have lower information asymmetry, which prompts lower agency costs. The previous analysis of the impacts of ESG pillars on leverage adjustments also shows that all components of ESG performance significantly encourage the leverage SOA. However, the literature shows that corporate governance is one of the most critical internal factors to mitigate agency problems, reduce asymmetric information, and as a result, accelerate the leverage SOA. Specifically, Chang et al. (2014) find that both over- and under-levered firms with strong corporate governance adjust faster toward their target leverage ratio. Liao, Mukherjee, and Wang (2015) find that both a higher level of financial leverage and a faster leverage SOA are associated with better corporate governance quality, which is defined by a more independent board featuring CEO–chairman separation and a greater presence of outside directors, coupled with larger institutional shareholdings. The question is: to what extent the effect of CSP on leverage SOA is driven by a firm's good corporate governance practice? We address this question by analysing the cross-sectional differences in corporate governance in determining the relationship between environmental and social performance and leverage SOA.

Table 11 presents the results with the average of ENV and SOC scores (EVNSOC) and the interaction term between EVNSOC and the corporate governance dummy variable that takes the value of one if a firm's corporate governance score is greater than the median value and zero otherwise (Dummy_CGV) as the main explanatory variables of both book and market leverage models. The results show that both EVNSOC and Dummy_CGV have significantly positive relationships with a firm's leverage SOA at the 1% level, consistent with our findings and previous studies (Chang et al. 2014; Liao et al. 2015). More importantly, the interaction term $EVNSOC * Dummy_CGV * Dist$ is negative and highly significant at the 1% level, indicating that strong firm-level corporate governance can be an alternative for firms to substitute for the roles of environmental and social performance

Table 13

CSP and leverage adjustment activities This

table reports the marginal effects from the logit regressions modelling firm's decision to access capital markets regarding to CSP levels. Panels A and B present the results for over-levered and under-levered firms, respectively. Debt issuances, debt retirements, and equity issuances are defined as a security issuance or repurchase of at least 5% of the book assets. Equity retirements are defined as a stock repurchase of at least 1.25% of the book assets. $CSP_{i,t}$ is proxied by the natural logarithm of ESG and ESGC scores. Control variables (vector $X_{i,t}$) including firm characteristics and industry median leverage ratio ($INDLEV$). The coefficients of control variables are not reported in the interests of brevity. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

Panel A. Over-levered firms								
VARIABLES	Debt Issuance		Debt Retirement		Equity Issuance		Equity Retirement	
	ESG	ESGC	ESG	ESGC	ESG	ESGC	ESG	ESGC
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CSP*Dist	0.1168 (1.4623)	0.1352** (1.9640)	-0.0683 (-0.8665)	0.0155 (0.2285)	0.4414*** (6.4169)	0.4106*** (6.9291)	0.0035 (0.2974)	0.0380 (1.5853)
Controls*Dist	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.2098 (1.0401)	0.2089 (1.0361)	0.5101** (2.5633)	0.5061** (2.5429)	0.4904*** (2.8246)	0.4888*** (2.8164)	0.5572*** (2.9536)	0.5578*** (2.9589)
Observations	8007	8007	8007	8007	8007	8007	8007	8007
R-squared	0.0964	0.0966	0.1095	0.1094	0.1371	0.1378	0.1834	0.1837
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES

Panel B. Under-levered firms								
VARIABLES	Debt Issuance		Debt Retirement		Equity Issuance		Equity Retirement	
	ESG	ESGC	ESG	ESGC	ESG	ESGC	ESG	ESGC
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CSP*Dist	0.1106 (1.3758)	0.1104 (1.6293)	0.0159 (0.6233)	0.0433 (1.2993)	0.4316*** (6.4862)	0.4431*** (7.9062)	0.0054 (0.1681)	0.1188* (1.8659)
Controls*Dist	YES	YES	YES	YES	YES	YES	YES	YES
Constant	0.4105*** (3.7246)	0.4076*** (3.6968)	0.4960*** (5.0078)	0.4694*** (4.8203)	0.0501 (0.5489)	0.0379 (0.4161)	0.5325*** (2.8193)	0.2547** (2.4573)
Observations	10,464	10,464	10,464	10,464	10,464	10,464	10,464	10,464
R-squared	0.1079	0.1079	0.1320	0.1321	0.1341	0.1358	0.2283	0.2272
Industry FE	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES

in reducing information asymmetry. Consequently, for firms with strong corporate governance, the positive impact of environmental and social performance on leverage SOA is relatively weaker.

5.5.3. CSP and leverage adjustments: the role of financial constraints

A growing literature suggests that the speed that firms adjust to their target leverage differs between financially constrained and unconstrained firms (e.g., Dang, Kim, & Shin, 2014; Faulkender et al., 2012; Korajczyk & Levy, 2003). Indeed, one might argue that firms with high levels of financial constraints may be less likely to access the external capital markets, and hence would adjust slowly to their target leverage. In contrast, firms with a low level of financial constraints may face low adjustment costs, resulting in potentially quicker adjustment (Korajczyk & Levy, 2003). However, Dang, Kim, and Shin (2012) and Dang et al. (2014) show that more constrained firms move faster to their target leverage when compared to less constrained firms. The reason is that firms with more constraints rely heavily on external sources to offset their financing deficits; therefore, their costs of leverage adjustment are shared with the transaction costs of accessing external capital markets, resulting in a faster adjustment speed. Faulkender et al. (2012) demonstrate that financial constraints significantly impact leverage SOA in a highly asymmetric fashion. Specifically, firms that are highly financially constrained move much faster to their target compared to their unconstrained counterparties when they are over-levered, but more slowly when they are under-levered. Hong, Kubik, and Scheinkman (2012) suggest that firms that are highly financially constrained may have lower investments in sustainability activities that are considered as a luxury, and have lower scores on CSP, even though CSP may significantly relieve the firm's financial constraints (Chan, Chou, & Lo, 2017; Dhaliwal et al., 2011).¹³ Taken together, firms that face more financial constraints prefer to take the opportunity of offsetting their deficit to choose an appropriate debt-equity

¹³ For example, Goss and Roberts (2011) find that companies which perform better in social responsibility can achieve lower bank call rates and longer loan terms. Chan et al. (2017) using the KZ index and Altman's Z-score as the measurement of financial constraints, conclude that a firm's engagement in CSR is negatively associated with financial constraints.

mix rather than investing in expensive CSP activities to adjust toward their target leverage. In other words, the positive effect of CSP on the leverage SOA is likely to be mitigated when firms are highly financially constrained.

To better gauge the impact of a firm's financial constraints on the association between CSP and leverage SOA, we use the interaction terms of CSP and the proxies of financial constraints. We use two main measures of financial constraints, the cash flow deficit (Faulkender et al., 2012) and the Kaplan-Zingales index (Kaplan & Zingales, 1997), supplemented by the "text-based" analysis adopted by Hoberg and Maksimovic (2015) and Bodnaruk, Loughran, and McDonald (2015).¹⁴ Table 12 reports the results for both proxies of CSP measures (i.e., $\ln(\text{ESG})$ and $\ln(\text{ESGC})$). We find that the coefficients of the interaction terms $\text{CSP} \times \text{Dist}$ are positive and highly significant. This indicates a consistently positive relationship between CSP and leverage SOA as in our baseline results. More importantly, the coefficients of the interaction terms between financial constraint proxies and CSP proxies are negative and statistically significant. This implies that the positive association between CSP and leverage adjustment speed is less pronounced for firms with a higher degree of financial constraints. This result is consistent with Dang et al. (2012, 2014), and Faulkender et al. (2012) suggesting that firms with more financial constraints are more likely to change their debt and equity mix to one that lowers the cost of leverage adjustment rather than participating in expensive CSP activities to move back to their target leverage.¹⁵

5.5.4. CSP and leverage adjustment activities

In this section, we explore whether a firm's CSP level facilitates leverage adjustment activities. Recent literature suggests that external capital market access, including debt issuance, debt retirement, equity issuance, and equity repurchase, is relevant for a firm's leverage rebalancing (Dang et al., 2019; Çolak et al., 2018; Öztekin & Flannery, 2012). To the extent that a firm's CSP can reduce the cost of equity but not certainly the cost of debt, it should enhance the firm's ability to access equity capital markets through these external adjustment mechanisms.

To examine this argument, we follow Çolak et al. (2018) and Dang et al. (2019) and estimate a series of logit models of a debt/equity issuance/retirement on CSP proxies including ESG and ESGC and the controls that are used in the baseline regression (Eq. (4)) for over-levered and under-levered firms. Following the recent research (Dang et al., 2019; Çolak et al., 2018; Öztekin & Flannery, 2012), we define capital market access as a debt issuance, debt retirement or an equity issuance of at least 5% of the total book assets. An equity retirement is defined as a stock repurchase of at least 1.25% of the book assets.

Panels A and B of Table 13 report the regression results for securities issuance and retirement for over-levered and under-levered firms, respectively. We find that for both over-levered firms and under-levered firms, CSP has a significant and positive impact on a firm's equity issuance but not on debt issuance, debt retirement, or equity retirement. These results suggest that for over-levered firms that need to increase equity to adjust back to the leverage target, superior CSP reduces the firm's cost of equity, thus facilitating the equity issuance (El Ghouli et al., 2011; Breuer et al., 2018; Ghoul, Guedhami, Kim, and Park, 2018). Nonetheless, differently from over-levered firms, under-levered firms need to increase the debt to move toward their target leverage levels. Therefore, even though superior CSP reduces the cost of equity issuance of under-levered firms, it has no impact on the debt transactions of such firms. This is consistent with Goss and Roberts (2011) who argue that CSP activities have very limited effects on bank loan costs and in line with our previous finding that CSP only has significant impacts on leverage SOA of over-levered firms but not for under-levered firms.

6. Conclusion

In this study, we have examined the relationship between corporate sustainability performance and the speed of corporate leverage adjustments. Using a large sample of firms across 31 countries, we have demonstrated that firms with superior sustainability performance are faster in adjusting their leverage ratios toward their targets. On average, a firm takes approximately 3 years to adjust half of the deviation between the actual and the target leverage. This duration decreases to 2.4 years with firms that show a high degree of sustainability. Such effect derives from all three pillars of CSP, namely, environmental, social, and corporate governance performance.

We have further investigated four channels that link CSP and leverage SOA. CSP not only drives a firm's voluntary CSP information disclosure and earnings quality but also reflects the firm's ethical concerns, and motivates transparency, and the reliability of financial reports, which, in turn, reduces information asymmetry, thereby lowering adjustment costs and increasing adjustment speeds. In addition, socially responsible institutions behave more patiently towards negative news and are less responsive to mispricing signals from the high CSP firms, making high CSP firms more likely to be overvalued. This, in turn, reduces costs of equity capital and accelerates the firm's leverage SOA. CSP also enhances engagement with the firm's stakeholders through mutual trust and cooperation, which helps firms to enjoy reductions in agency costs and transaction costs. Finally, CSP enhances a firm's position in the product market as a competitive advantage that results in an expectation

¹⁴ Most studies on financial constraints use accounting variables to measure financial constraint in a firm. However, these measures are influenced by firm operations and other fundamentals. We also use the text-based analysis to identify financial constraints. The results of such tests are consistent with our findings that use accounting-based financial constraint measures. Due to the space limitation, the results of this test will be available upon request.

¹⁵ We also test the impact of financial constraints on the positive association between CSP and leverage SOA for over-levered and under-levered firms separately. The results show that for over-levered firms, the positive impact of CSP on leverage SOA is attenuated for financially constrained firms, whereas the association between CSP and leverage SOA is insignificant for over-levered firms. These results are consistent with Faulkender et al. (2012) and our previous findings.

of stronger and more stable cash flows and higher profitability in the future, lowering the marginal transaction costs. Hence, firms with superior sustainability performance adjust faster toward their targets. In addition, our further analyses have highlighted the role of financial constraints on a firm's capital structure policy, that is, financial constraints offset the positive impact of CSP on leverage SOA. Taken together, in this paper, we contribute to the capital structure literature by identifying a new factor which has a significant impact on corporate leverage adjustments and exploring the potential underlying economic mechanisms to explain the relationship identified.

We also contribute to the literature on the effects of institutional settings/environments on corporate financing policies. Our results show that all the institutional factors (including a country's enforcement mechanisms, information environments, corporate governance, English origin, public sector ethics, goodness of government, and media channels) play important roles in moderating the positive impact of CSP on leverage SOA.

Our study has important implications at both organisational and national levels. Executives who wish to increase the speed of leverage adjustment to enhance a firm's value need to give greater consideration to, and invest more in, their sustainable activities. The changes in the speed at which firms adjust back to their target levels which have been demonstrated in this study are large enough to be economically meaningful. However, to the extent that sustainable activities are costly, including financial costs and opportunity costs, these need to be traded off against the benefits of increasing leverage SOA. From a policy perspective, our findings speak to the importance of CSP investments in a firm's financing performance. Governments and authorities should consider using regulations to encourage firms to improve their environmental, social, and corporate governance performance, as well as create good quality institutional settings. Our findings are consistent with previous literature that highlights the role of private politics in shaping corporate behaviour (Baron, 2009; Baron & Diermeier, 2007).

Appendix A. Variable definitions

Variables	Acronym	Description	Data source
Book leverage	BLEV	Book value of total debt divided by book value of total assets.	Worldscope
Market leverage	MLEV	Book value of total debt divided by the sum of market value of equity and the book value of total debt	Worldscope
Active leverage	ALEV	Book value of total debt divided by the sum book value of total assets and the total net income	Worldscope
ESG score	ESG	ESG score that measures firm's ESG performance across three pillars (environment (E), social (S), and governance (G)) and ten topics (resource use, emissions, innovation, management, shareholders, CSR strategy, workforce, human rights, community, and product responsibility)	Thomson Reuters ESG database
ESG combined score	ESGC	ESG combined score, which incorporates ESG controversies captured from global media sources that materially and significantly affect the companies.	Thomson Reuters ESG database
Environment	ENV	Environmental pillar that examines factors including resource usage and reduction; emissions and emissions reductions; environmental activism and initiative and product or process innovation.	Thomson Reuters ESG database
Social	SOC	Social pillar that examines factors including employment quality, health and safety issues, training, diversity, human rights, community involvement and product responsibility.	Thomson Reuters ESG database
Corporate governance	CGV	Corporate governance pillar that examines factors including board structure, compensation policy, board functions, financial and operational transparency, shareholder rights and vision and strategy.	Thomson Reuters ESG database
Target Distance	Dist	Difference between target and observed leverage ratio	Self-calculated
Firm size	SIZE	Natural logarithm of book value of total assets	Worldscope
Tangibility	TANG	Net property, plant and equipment dividend by book value of assets	Worldscope
Growth opportunity	MTB	Ratio of book value of assets less book value of equity plus market value of equity to book value of assets	Worldscope
Profitability	PROF	Earning before interests, taxes, depreciation and amortization divided by book value of assets	Worldscope
Depreciation	DEP	Depreciation and amortization divided by book value of assets	Worldscope
Research and development	RD	Research and development expenses divided by book value of assets	Worldscope
Research and development dummy	RDDUM	Dummy variable that equals one if research and development expenses are not reported and zero otherwise	Worldscope
ESG disclosure	ESGDIS_BB ESGDIS_DS	Score that is collected from company-sourced filings, such as corporate social responsibility reports, annual reports, the company website, and a proprietary Bloomberg survey that requests corporate data directly Measures the degree to which a focal company discloses ESG information in a given year. The score ranges from zero to 100. The higher the score, the stronger the firm's ESG disclosure.	Bloomberg Thomson Reuters ESG database

(continued)

Variables	Acronym	Description	Data source
Stakeholder engagement	SE	Measures the degree to which a focal company explains the formal processes in place for engagement with its stakeholders. The higher the score, the stronger the firm's stakeholder engagement.	Thomson Reuters ESG database
Book Equity	B	Book value of equity	Worldscope
Income before extraordinary items	E	Net Income before Extraordinary Items/Preferred Dividends	Worldscope
Cost of equity	R	Measured using Pama and French's (1997) one-factor model with the short-term T-bill as a proxy for the risk-free rate of interest	Self-calculated
Cash flow deficit	CASHFLOW	A dummy that equals one if the firm has a cash flow deficit and zero otherwise	Worldscope
KZ index	KZINDEX	The index that consists of a linear combination of five accounting ratios: cash flow to total assets, the market to book ratio, debt to total assets, dividends to total assets, and cash holding to total assets.	Self-calculated following Baker, Stein, and Wurgler (2003)
Under-target leverage	UNDER	A dummy that equals one if firm is under-levered relative to target leverage and zero otherwise.	Self-calculated
Industry median of leverage	INDMED	The median leverage ratio of an industry to which a firm belongs.	Self-calculated
GDP growth rate	GGDP	Annual GDP growth rate.	World Development Indicator
Money supply growth rate	GMS	Annual money supply (M2) growth rate.	Datastream
Social trust	SOCTRU	Measure where citizens have confidence in public institutions, which is strongly related to societal trust.	OECD
Efficiency of judicial system	EFFJUD	Measures the efficiency and integrity of the country's legal environment. The index is scaled from zero to 10; lower scores, indicate lower efficiency levels.	La Porta et al. (1998)
Rule of law	RULLAW	Measures the law and order tradition in the country. The index is scaled from zero to 10, with lower scores for less tradition for law and order.	La Porta et al. (1998)
Level of corruption	CORRUP	Measures the corruption level of the government in the country. The index is scale from zero to 10, with lower scores for lower level of corruption.	La Porta et al. (1998)
Risk of expropriation	RISEXP	Measures the risk of "outright confiscation" or "forced nationalization". The index is scaled from zero to 10, with lower scores for higher risks.	La Porta et al. (1998)
Repudiation of contracts by government	RISCON	Measures the "risk of a modification in a contract taking the form of a repudiation, postponement, or scaling down" due to "budget cutbacks, indigenization pressure, a change in government, or a change in government economic and social priorities". The index is scaled from zero to 10, with lower scores for higher risks.	La Porta et al. (1998)
Comprises disclosure score index	DISCLO	Measures the level of financial disclosure and availability of information to investors.	Jin and Myers (2006)
Financial analyst Auditing practice	ANALYST AUDIT	Number of analysts following the largest 30 companies in each country in 1996. Variable indicating the percentage of firms in the country audited by the Big 5 accounting firms. AUDIT equals 1, 2, 3, or 4 if the percentage ranges between (0, 25%), (25%, 50%), (50%, 75%), and (75%, 100%), respectively.	Bushman et al. (2004) Bushman et al. (2004)
Disclosure to congress	DISCON	Measures the ratio of all source items contained in the country's blank disclosure form available to congress over all source items potentially disclosed in the artificial "universal" form.	Djankov et al. (2010)
Disclosure to public	DISPUB	Measures the ratio of all source items contained in the country's disclosure form available to the public over all source items potentially disclosed in the artificial "universal" form.	Djankov et al. (2010)
Voice and Accountability	VOIACC	Measures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.	Kaufmann et al. (2009)
Political Stability and Absence of Violence Government effectiveness	POLSTA GOVEFF	Measures perceptions of the likelihood that the government will be destabilized or overthrown by Measures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.	Kaufmann et al. (2009) Kaufmann et al. (2009)
Regulation quality	REGQUA	Measures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	Kaufmann et al. (2009)
Rule of law	RULLAW2	Measures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	Kaufmann et al. (2009)
Control of corruption	CONCOR	Measures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.	Kaufmann et al. (2009)
English origin	ENGORI	Dummy variable equal to unity if the firm operates under English law, and zero otherwise.	La Porta et al. (1998)
Public sector ethics	PUBETH	Measures the percentage of firms in the country giving satisfactory ratings to the questions on honesty of politicians, government favouritism in procurement,	Kaufmann (2004)

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Variables	Acronym	Description	Data source
Good government index	GOOGOV	diversion of public funds, trust in postal office, and the average bribe frequencies for permits, utilities, and taxes.	Morck et al. (2000)
Media channel	MEDIA	Measures how well the country protects private property rights.	Bushman et al. (2004)
		Average rank of the countries' media development (print and television) between 1993 and 1995.	Bushman et al. (2004)

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Chapter 4

Employment protection laws and corporate leverage adjustments

Chapter 4 consists of one submitted research paper entitled “OECD labour protection and dynamic leverage adjustments.” The paper has been submitted for review and publication and is currently under the first-round review by *Management Science* (SSCI and ABDC-rank A*). This paper investigates the link between employment protection laws (EPLs) and leverage speed of adjustments. Using data of 19 OECD countries, the paper suggests that the stringency of EPLs negatively and significantly affect leverage SOA. The effect remains valid after a series of tests for endogeneity and robustness checks. Further analysis suggests that the negative impact of EPLs on leverage adjustments is more pronounced in countries with effective legal enforcement.

OECD Labour Protection and Dynamic Leverage Adjustments

Abstract

This paper examines the impact of employment protection laws (EPLs) on the speed of corporate leverage adjustments. By exploiting within-country changes in EPLs across 19 OECD founding countries/members, we find that an increase in the stringency of EPLs significantly decreases leverage adjustment speeds. This association is consistent with the view that stringent EPLs raise firms' costs of adjustment on target leverage. Our result survives several tests addressing the endogeneity concern and is robust to a battery of robustness checks. We further demonstrate that the response of leverage adjustment to changes in EPLs is more pronounced in countries with effective legal enforcement. Generally, our results are consistent with the dynamic trade-off theory of capital structure.

Keywords: Employment protection laws, legal enforcement, leverage adjustment, dynamic trade-off theory.

JEL Code: G3, K31, O16

1. Introduction

As one of the most dominant views of capital structure, the traditional trade-off theory argues that firms have optimal leverage ratios that balance the benefits (i.e. tax shield) and the costs (i.e. financial distress or bankruptcy costs) of debts (Bradley, Jarrell, & Kim, 1984; Brennan & Schwartz, 1978). Subsequently, the empirical studies indicate that in the dynamic framework, firms have an incentive to adjust back to their optimal capital structure (Hennessy & Whited, 2005; Titman & Tsyplakov, 2007). However, this convergence encounters considerable costs as financing frictions that reduce the leverage's speed of adjustment (SOA). Accordingly, researchers have devoted substantial effort to understanding the elements that impact firms' leverage adjustment speed. Many of the prior studies focus mainly on the importance of firm-level factors on leverage adjustments such as cash flows (Faulkender, Flannery, Hankins, & Smith, 2012), corporate governance (Chang, Chou, & Huang, 2014), crash risk (An, Li, & Yu, 2015), debt covenants (Devos, Rahman, & Tsang, 2017), and news media coverage (Dang, Dang, Moshirian, Nguyen, & Zhang, 2019). Some recent literature has examined the impacts of country-level determinants such as macroeconomic conditions (Cook & Tang, 2010), institutional arrangements (Öztekin & Flannery, 2012), and political uncertainty (Çolak, Gungoraydinoglu, & Öztekin, 2018). To date, however, the literature has largely ignored the importance of the legal framework related to an important nonfinancial stakeholder, namely employees, in determining leverage adjustments. Given that labour is a key factor of production that affects corporate performance, and that the ability to adopt labour regulations is essential for many aspects of firms' operation such as innovation (Acharya, Baghai, & Subramanian, 2013, 2014), costs of financing (Alimov, 2015; Chen, Kacperczyk, & Ortiz-Molina, 2011), capital structure (Simintzi, Vig, & Volpin, 2015), cash holding (Cui, John, Pang, & Wu, 2018; Karpuz, Kim, & Ozkan, 2020), an analysis of firms' leverage adjustments in conjunction with employment protection laws (EPLs) is an essential gap in the literature needing to be filled.

To explore how changes in labour regulations impact firms' leverage SOA, we develop two competing hypotheses based on the growing literature that examines the essential roles of labour market mechanisms on firms' financing decisions. On the one hand, the stringency of labour regulations limits the flexibility to adjust the workforce, and thus, increases labour adjustment costs and reduces operating flexibility of corporations. As such, rigid labour laws may distort investment and production decisions, and negatively impact corporate performance and growth (Autor, Kerr, & Kugler, 2007; Hirsch, 1991). Consequently, strict EPLs associate with greater distress risks and higher costs of external capital (Alimov, 2015; Chen et al., 2011; Cui, John, Pang, & Wu, 2018). Previous literature also suggests that firms are likely to reserve the information asymmetry when their employees have more protection (Belkhir, Ben-Nasr, & Boubaker, 2016; Hilary, 2006; Scott, 1994). This, in turn, increases firms' agency costs and costs of leverage adjustment. Therefore, we hypothesize that strong EPLs promote firms' leverage adjustment costs and reduce leverage SOA.

On the other hand, one can argue that the strong labour regulation may protect creditors' wealth by deterring firms from taking high-risk investments and making corporate takeovers (Pagano & Volpin, 2005; Warga & Welch, 1993). Additionally, firms' productivity and innovation can be improved in an environment with stricter EPLs through worker training, selection, hiring, and retention (Acharya et al., 2013, 2014; Belot, Boone, & Van Ours, 2007; Poschke, 2009). Countries with stringent EPLs usually have more friendly political environments for workers that may help large firms in occasions of financial distress. In sum, stringent employment protections can lower firms' financial risks, and thus, lower the cost of external financing so enabling firms to adjust more quickly toward their target leverage.

To test these opposing hypotheses, we use the EPL index developed by the Organization for Economic Cooperation and Development (OECD) for its 19 member countries over the 1985-

2007 period. As our empirical analysis implies a dynamic capital structure model, we follow the recent literature to adopt a two-step regression method (Çolak et al., 2018; Dang et al., 2019). Specifically, in the first step, we measure the optimal capital structure and calculate the distance from such optimal level. In the second step, we estimate the partial adjustment model and explore whether the stringency of EPLs has significant impacts on leverage SOA.

Our baseline results show that when labour protection becomes more stringent in a country, firms operating in that country adjust more slowly to their target leverage ratios. Economically, a one-standard-deviation increase in EPL index decreases leverage SOA by 1.2 - 2.8 percent, compared with an average adjustment speed of 20.5 percent. Our results are robust when using alternative measures of EPLs including the proxies developed by Botero, Djankov, Porta, Lopez-de-Silanes, and Shleifer (2004), Allard (2005), and Aleksynska and Schindler (2011). They are also insensitive to an alternative measure of leverage that reflects the active component of leverage adjustments. The robustness of our results is also confirmed by using alternative subsamples of countries that include and remove United Kingdom and Japan, as well as for multinational and non-multinational firms' subsamples. Generally, our evidence lends strong support to our first hypothesis that the stringency of labour regulations lowers firms' leverage SOA.

We use three strategies to address the endogeneity concerns. First, we employ an instrumental variable approach using legal origin as an instrument for labour protection (Botero et al., 2004). The results also show that when a country's labour laws become more stringent, firms adjust more slowly to their target leverage. Next, to explore the causal relationship between the stringency of labour regulations and leverage SOA, we follow Rajan and Zingales (1998) to examine the different effects of labour regulation's stringency across industries with different labour adjustment characteristics. The hypothesis is that if EPLs indeed have a negative impact

on leverage SOA, then this association should be more pronounced in industries that require a naturally higher labour turnover. The results are consistent with our expectation. Finally, to further alleviate the potential omitted-variable concern, we control for additional variables to capture potential confounding impacts that may be biasing our results. Generally, while we cannot completely exclude endogeneity, these results jointly indicate that our main finding is unlikely to be driven by this potential issue.

We next examine the impact of the effectiveness of a country's legal enforcement on the association between legal regulations and leverage SOA. Since labour laws have weak compliance and are not fully enforced in countries with weak legal systems (Rutkowski & Scarpetta, 2005), the leverage SOA may be less sensitive to changes in labour laws in such countries. Using five proxies for the quality of enforcement suggested by La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1998), we find that in countries where laws are well enforced, the negative impact of labour regulation's stringency on leverage SOA is more pronounced.

We then extend our analysis in several ways to provide further empirical support. We first examine the relative importance of each of the components of the overall EPL index for firms' leverage adjustment. Our results show that an increase in the stringency of labour regulation afforded to temporary workers tends to lower firms' leverage SOA while the impact of EPL index for regular workers on leverage SOA is relatively weaker. Further investigations indicate that stronger labour protection decreases the leverage SOA more severely for firms with greater financial constraints, as they find it harder to access the external capital markets.

Our study contributes to a growing literature that explores the impacts of labour market mechanisms on various corporate decisions, such as investment activities (Acharya et al., 2013, 2014; Dessaint, Golubov, & Volpin, 2017), governance (Atanassov & Kim, 2009), financing (Agrawal & Matsa, 2013; Chen et al., 2011; Devos & Rahman, 2018; Matsa, 2010; Simintzi et

al., 2015), and liquidity management (Cui, John, Pang, & Wu, 2018; Karpuz et al., 2020). Specifically, our study provides novel cross-country empirical evidence on the negative and significant role played by a country's labour protection in determining firms' optimal capital structure decisions. Given the important influences of a country's policies related to workforce on economic agents, our empirical study provides valuable intuitions on policy implications for the corporate sector.

Further, our study adds to the dynamic capital structure literature. The recent literature has investigated various determinants of leverage SOA. At the firm level, the speed that firms converge toward their target leverage is affected by cash flow elements (Faulkender et al., 2012), crash risks (An et al., 2015), debt governance (Devos et al., 2017), news media coverage (Dang et al., 2019), and equity liquidity (Ho, Lu, & Bai, 2020). At the macro- and country level, the determinants of leverage SOA include the macroeconomic conditions (Cook & Tang, 2010), institutional features (Öztekin & Flannery, 2012), and political uncertainty (Çolak et al., 2018). Adding to this large body of research, we find that labour protection laws are a new and important factor that firms take into account in determining the leverage adjustments.

The rest of the paper proceeds as follows. Section 2 describes a brief review of related literature and develops main hypotheses. Section 3 presents variable constructions, data and sample, as well as discusses the empirical models and summary statistics. Section 4 reports the results. Section 5 provides further analyses and Section 6 concludes the paper.

2. Relationship between employment protection laws and leverage adjustments

This section summarizes the literature on dynamic leverage adjustments, discusses a prediction on how the stringency of EPLs reduces the speed at which firms adjust toward their target levels, and outlines the roles of the country's institutions in reshaping the leverage adjustment sensitivity to EPLs.

2.1. Dynamic leverage adjustments

From the prominent study by Modigliani and Miller (1958), a large body of research has attempted to examine one of the major perspectives of capital structure, the trade-off theory. The early static trade-off models claim that firms identify their own target leverage ratios that balance the costs (for example: financial distress and bankruptcy costs) and benefits (for example: corporate income tax savings) of debt (Bradley et al., 1984; Fischer, Heinkel, & Zechner, 1989; Strebulaev, 2007). Recent empirical dynamic trade-off models follow such theoretical research and propose that in the long run, firms try to reach their target leverage levels to maximize the firm value (Byoun, 2008; Flannery & Rangan, 2006; Titman & Tsyplov, 2007).

A recent stream of research has attempted to examine how quickly firms re-converge with their target leverage. It shows that this speed depends on the magnitude of the adjustment cost. The trade-off theory suggests that with zero adjustment costs, firms should not deviate from their target leverage levels. At the other extreme, if adjustment costs are infinite, firms should never move back to their targets. Supporting this view, Goldstein, Ju, and Leland (2001) suggest that high transaction cost reduces firms' leverage SOA. Strebulaev (2007) also shows that firms with higher underwriting and management costs have lower SOA whereas Altinkılıç and Hansen (2000) argue that firms with high security issuance costs adjust their leverage less frequently.

Recent empirical studies focus on a number of determinants of firms' speed of leverage adjustment. At the firm level, Chang et al. (2014) and Liao, Mukherjee, and Wang (2015) show that strong corporate governance improves the leverage SOA. Elsas, Flannery, and Garfinkel (2014) suggest that firms that finance more major investment activities find it easier to issue equity, and as a result, adjust faster to their target leverage. Warr, Elliott, Koeter-Kant, and

Öztekin (2012) find that equity mispricing affects the leverage SOA and this impact is conditional on the deviation of actual leverage from the target level. Uysal (2011) shows that firms that plan and structure for acquisitions adjust faster to their targets. Dang et al. (2019) suggest the impact of media coverage on leverage SOA is via two mechanisms: information dissemination and monitoring. Most recently, Ho et al. (2020) find that firms with high equity liquidity significantly promote leverage SOA. At the country level, Cook and Tang (2010) indicate that firms that operate in good economic conditions will adjust faster than firms in poor economic conditions. Elsas and Florysiak (2011) further show that institutional settings with high default risks and high-expected bankruptcy costs will boost firms' adjustment speed. Öztekin and Flannery (2012) and Öztekin (2015) show that better institutional environments enhance leverage SOA. Finally, Çolak et al. (2018) conclude that firms in countries with high political uncertainty have low leverage SOA. Nevertheless, we note that this strand of research has not studied whether and how the EPLs' stringency impacts leverage adjustments.

2.2. Employment protection laws and leverage adjustments

Based on a growing body of literature that examines the important roles of labour market mechanisms on firms' financing decisions, we develop two competing hypotheses regarding the impact of EPLs on firms' capital structure adjustment. On the one hand, we predict a positive association between labour regulations and leverage SOA. First, by limiting firms' flexibility to adjust the level of workforce, EPLs increase labour adjustment costs and reduce operating flexibility of corporations. As a result, stricter EPLs may distort firms' investment and production decisions, and adversely affect firms' performance and growth. As such, severer labour laws associate with greater distress risks, hence, higher capital transaction costs. A number of empirical studies provide evidence that supports this conjecture. Ruback and Zimmerman (1984), Abowd (1989), and Hirsch (1991) find that labour union coverage

negatively affects earnings and the market value of USA firms. Autor et al. (2007) show that the adoption of wrongful discharge protection reduces firms' productivity and technical efficiency. Berk, Stanton, and Zechner (2010) and Simintzi et al. (2015) argue that the increase in employment protection increases firms' fixed labour costs, which leads to greater costs of financial distress and a reduction in leverage. Serfling (2016) shows that due to the adoption of the good-faith expectation, firms are less likely to lay off their employees, leading to a decline in earnings, less persistence in profitability, and changes in earnings becoming more sensitive to changes in sales. As such, these firms have greater financial distress costs, higher operating leverage, and lower financial leverage. Cui, John, Pang, Wu, and Finance (2018) and Karpuz et al. (2020) suggest that strict EPLs make firing and hiring employees more difficult; this increases the fixed wage claims for the firms and leads to higher distress costs. Belkhir et al. (2016) find that stricter EPLs are likely to be increasing the conflicts between well-protected labour and creditors. Specifically, legally empowered labour can participate in disruptive labour behaviour that may increase firms' default risk. Further, in the event of default, these workers can make a reclamation of collateral by creditors and the liquidation of the corporations harder and more costly. Consequently, the capability of creditors to enforce debt contracts is potentially compromised by stringent EPLs. Similarly, Alimov (2015) shows that in countries with stringent labour regulations, banks offer loans with higher spreads and tighter non-price contract terms, thus reducing firms' ability to raise debt financing. Chen et al. (2011) find that powerful labour unions increase firms' operating leverage making labour stock adjustment more costly. These unions also frequently intervene in firms' restructurings, for instance by blocking plant closures, thereby increasing physical capital stock adjustment costs. As a result, powerful unions potentially reduce corporate operating flexibility, and thus increase firms' systematic risks and their costs of equity. Overall, the studies above suggest that stringent EPLs

reduce firms' operating flexibility, which increases firms' financial distress costs, and thus increases financing transaction costs and costs of capital.

Furthermore, stringent labour regulations can affect leverage adjustment by increasing information asymmetry. Previous literature suggests that to avoid employees extracting more resources, firms are likely to preserve the information asymmetry when their employees have a strong bargaining power. Kleiner and Bouillon (1988) find that wages and benefits for production labour significantly increase when firms provide more information on financial conditions, productivity, and relative standing on the labour market such as financial statements, production costs, sales, investments, and future strategies. Scott (1994) shows that firms are likely to constrain their information disclosure on pension plans when they face a greater likelihood of strikes. Hilary (2006) suggests that disclosing information weakens firms' position in collective bargaining. Therefore, firms with strong organized labour have an incentive to maintain high asymmetric information with outsiders. Firms which are facing organized labour have high bid-ask spreads, high probability of informed trading, low trading volume, and low analyst coverage. Most recently, Belkhir et al. (2016) argue that strong labour protection regulations negatively affect the maturity structure of debt by preserving a greater environment of information asymmetry between firm insiders and outsiders. Overall, the studies above indicate that strong EPLs can increase the level of information asymmetry between informed and uninformed market participants, which increases agency costs. In turn, this promotes firms' leverage adjustment costs and reduces leverage SOA (Çolak et al., 2018; Öztekin, 2015; Öztekin & Flannery, 2012).

Taking these arguments together, we argue that stringent EPLs can increase firms' leverage adjustment costs by decreasing operating flexibility, increasing financial distress costs, and

information asymmetry of firms. Thus, strict EPLs should impede the speed at which firms adjust toward target leverage levels. Consequently, we formulate our first hypothesis:

H1a. Stringent EPLs are associated with lower leverage SOAs.

An alternative view emphasizes that the stringent EPLs may not have a negative impact on firms' leverage SOA. Instead, stringent EPLs may even facilitate leverage adjustments. Specifically, in a stringent EPL environment, employees may be hired with an expectation of higher job security and longer term of employment, which lowers firms' credit risk for the following reasons. First, the strong labour regulation may protect creditors' wealth. For instance, with stronger negotiating positions, labour unions might deter firms from making investments that boost firms' distress risk and threaten both the unionized workers' wage premium and lenders' debt payments. Stricter labour laws could discourage corporate takeovers that place both the employees (Pagano & Volpin, 2005) and bondholders (Warga & Welch, 1993) at risk. Second, firms' productivity and innovation can be improved in an environment with stricter EPLs through worker training, selection, hiring, and retention. Belot et al. (2007) find that employees who work in great job protection environments can invest more into the firms' human capital, significantly improving firms' productivity. Poschke (2009) suggests that employment protection promotes exit of low-productivity firms and strengthens the market selection process. Acharya et al. (2013) examine country-level changes in dismissal laws in the USA, UK, France, and Germany and find that more rigorous dismissal laws enhance firms' innovation, specifically in innovation-intensive industries. In the same stream, Acharya et al. (2014) show that by reducing the employer's possibility to hinder workers after successful innovation, wrongful discharge laws foster workers' innovative efforts, foster innovation and new firm creation. Finally, Alimov (2015) shows that countries with stringent EPLs usually have more friendly political environments for workers. Therefore, large firms in such countries

are more likely to apply substantial political pressure on their governments to bail them out in events of financial distress. In general, the arguments above suggest that stringent labour laws can lower firms' financial risks and thus lower costs of external financing. As a result, strong EPLs should enable firms to adjust more quickly toward their target leverage.

We propose the following hypothesis to reflect this view:

H1b. Stringent EPLs are associated with higher leverage SOAs.

2.3. Impacts of a country's institutions

It is important to note that the association between formal labour protection laws and leverage SOA is likely to be conditional on the effectiveness of litigation in a country. Specifically, since formal laws can be observed or ignored to varying degrees, even very stringent regulations embedded in EPLs may be less effective if the country's legal systems are not well enforced. OECD (2004) shows that it is essential to distinguish EPLs from the practice that associates with the enforcement dimension; thereby, they suggest that a country's law enforcement has to be taken into account when the extent of EPLs is discussed. Rutkowski and Scarpetta (2005) also confirm that labour regulations are weak compliance and not fully enforced in countries with weak legal systems. Hence, we posit that a weak system of legal enforcement can mitigate the impact of EPLs on the speed of corporate leverage adjustment.

H2. The relationship between EPLs and leverage SOA is less pronounced among firms in countries with weak systems of legal enforcement.

3. Data and empirical design

This section defines the variable construction used in the empirical analysis, the data sources we use to collect various firm, industry, and country characteristics, and our sample selection procedure.

3.1. Variable construction

3.1.1. Leverage measures

The evidence on whether to use book value or market value of debt in calculating firm leverage ratio is not clear in capital structure studies. Fama and French (2002) find that firms' leverage ratio should be measured using book value of debt since this ratio is only impacted on by elements that are directly controlled by firms. However, Welch (2004) argues that market leverage ratio is more suitable to represent the agency problem between shareholders and creditors. In this study, we measure our dependent variable, leverage, using both the book ratio (*BL*) and the market ratio (*ML*), as it is likely that several firms have book leverage rather than market leverage and vice versa (An et al., 2015; Chang et al., 2014; Cook & Tang, 2010; Flannery & Rangan, 2006; Ho et al., 2020; Öztekin & Flannery, 2012). Specifically, book leverage is calculated as the book value of total debt divided by the book value of total assets. Market leverage is defined as the book value of total debt divided by the sum of the market value of equity and the book value of total debt.

3.1.2. Employment protection indicators

In this study, we measure the strictness of EPLs using the EPL index produced on the yearly basis by the OCED. Since the seminal paper of Lazear (1990), the EPL index developed by the OECD has been used widely in the literature as a proxy for the level of worker protection in a given country (Alimov, 2015; Karpuz et al., 2020; Levine, Lin, & Shen, 2020; Simintzi et al.,

2015). The OECD constructs this EPL index each year for all member countries by surveying a wide variety of legislations involving the length of the written notice period, amount of severance payment provisions, and the administrative requirements when a firm decides to dismiss an employee. Consequently, the OECD scores these categories for each country and combines these scores into sub-indicator EPL indices for regular workers (EPR) and temporary workers (EPT) and summary indices. The values of all indices range from zero to six, with a higher score being the more stringent legal employment protection environment. Following most recent studies (Karpuz et al., 2020; Levine et al., 2020), in the baseline regression, we measure the rigidity of a country's labour market using a summary index based on the average of the sub-indicators for regular (EPR) and temporary workers (EPT).

However, to ensure that our results are robust, we also use various alternative measures of EPLs. First, we include the EPL index developed by Allard (2005) (EPLA) that extends the OECD indicator of employment protection. This index ranges from zero to six and does not treat all law changes equally. Next, we use the collective relations law index (CRLI), social security laws index (SSLI), and employment laws index (ELI) constructed by Botero et al. (2004). The CRLI comprises collective relations' laws that protect employees through collective actions. The SSLI reflects pensions, sickness and healthcare coverage, and unemployment covering of employees. The ELI addresses the incremental cost to firms if they deviate from a rigid contract in which the conditions of employment are specified for all employees and no employee can be fired. Finally, we use unemployment coverage (UNEC) constructed by Aleksynska and Schindler (2011) that provides information on the generosity of unemployment benefits. All of these alternative measures are used in previous literature (Belkhir et al., 2016; Karpuz et al., 2020; Levine et al., 2020; Simintzi et al., 2015).

3.1.3. Institutional enforcement variables

A strong system of legal enforcement could enhance the compliance of EPLs in a country. Following the previous literature (An, Li, & Yu, 2016; Öztekin, 2015; Öztekin & Flannery, 2012), we draw the enforcement variables from La Porta et al. (1998) including five proxies: efficiency of the judicial system (EFFJUD) that measures the efficiency and integrity of the country's legal environment; rule of law (RULLAW) that represents the law and order tradition in the country; level of corruption (CORRUP) that denotes the corruption level of the government in the country; risk of expropriation (RISEXP) that indicates the risk of “outright confiscation” or “forced nationalization”; and the likelihood of contract repudiation by the government (RISCON).

3.1.4. Control variables

The previous literature in leverage adjustment (An et al., 2015; Öztekin & Flannery, 2012) suggests that firm and macroeconomic characteristics may affect both target leverage and leverage adjustment speed. In this study, we control for a set of firm-level and macroeconomic-level characteristics. Specifically, we include firm size (SIZE) measured as the natural logarithm of total assets, tangibility (TANG) as fixed assets as a proportion of total assets, profitability (PROF) as earnings before interest and taxes as a proportion of total assets, research and development (R&D) expenses (RD) as R&D expenses as a proportion of total assets, R&D dummy (RDDUM) as a dummy variable that equals one if a firm reports R&D expenses and zero otherwise, depreciation expenses (DEP) as depreciation expenses as a proportion of total assets, market-to-book ratio (MTB) as the market-to-book ratio of a firm's assets, the industry median leverage ratio (INDMED) as the median debt ratio of a firm's Fama and French (1997) industry classification, a country's inflation rate (INFL), and the country's annual GDP growth rate (GGDP).

3.2. Data and sample

We obtain data from various sources during our sample period of 1985 to 2007¹². First, the firm financial data for each country is obtained from Thomson Reuters Worldscope via the Datastream database. Second, in order to estimate the stringency of EPLs, we retrieve data on labour protection from OECD database (Botero et al. (2004); Allard (2005); and Aleksynska and Schindler (2011)). Third, we collect the inflation rate and GDP growth rate from the World Development Indicators, and data on macro-level institutional environments from La Porta et al. (1998). We retain only firms with common securities. We also exclude firms with special features, such as warrants, trusts, funds, and non-equity stocks. Financial and utility firms are eliminated since these firms are subject to special regulations on financing policies. To reduce short panel bias, we eliminate firms that do not have data for at least two consecutive years. We winsorize both the dependent and independent variables at the 1st and 99th percentiles to mitigate the potential impact of extreme values. Our final sample consists of 85,467 firm-year observations from 19 European countries over the period from 1985 to 2007.¹³

3.3. Main regression specification

This study examines the impact of the stringency of EPLs on leverage adjustment. Prior literature in capital structure dynamics suggests that a firm's target leverage is a function of the firm's time-varying characteristics, industrial elements, and macro-level variables (An et al., 2015; Dang et al., 2019; Öztekin & Flannery, 2012). We model a firm's target leverage as follows:

¹² The OECD's EPL index is available from 1985 to 2013. We stop in 2007 to avoid the severe structural shock that the global financial crisis and the European sovereign debt crisis represent to both financial leverage and employment regulations (Dessaint et al., 2017; Karpuz et al., 2020; Simintzi et al., 2015).

¹³ Basically, the countries included in our sample are the founding countries of the OECD. There are four countries that are excluded because of the data availability: Iceland, Luxemburg, Portugal, and Turkey. US is also excluded as the EPL index of this country does not vary during the analysed period while the number of observations of this country is similar to that of the rest of our sample.

$$L_{i,j,t+1}^* = \beta X_{i,j,t} \quad (1)$$

where β is the coefficient vector and $X_{i,j,t}$ is a set of variables including firm size, tangibility, profitability, research and development (R&D) expenses, an R&D dummy, depreciation expenses, market-to-book ratio, the industry median leverage ratio, inflation rate, and GDP growth rate.

Depending on the benefits and costs of rebalancing their leverage ratio, firms evaluate the speed that they adjust toward the target leverage ($L_{i,j,t+1}^*$) from their current positions ($L_{i,j,t}$):

$$L_{i,j,t+1} - L_{i,j,t} = \Lambda_j (L_{i,j,t+1}^* - L_{i,j,t}) + \pi_{i,j,t+1} \quad (2)$$

Substituting Eq. (1) to Eq. (2) and rearranging them, yields:

$$L_{i,j,t+1} = (\Lambda \beta) X_{i,j,t} + (1 - \Lambda) L_{i,j,t} + \pi_{i,j,t+1} \quad (3)$$

The speed of leverage adjustment (Λ) allows firm i in a specific country j that diverges from the target to adjust partially back to their target during the next period. Such adjustment speed, Λ , should range from zero to one as firms make efforts to reach the target leverage ratio. However, market frictions cause costly adjustments. Therefore, the gap between the target and real leverage ratios should decrease over time (hereafter called “the distance from target” and estimated as $Dist_{i,t} = L_{i,t+1}^* - L_{i,t}$). While the leverage adjustment speed Λ in Eq. (3) is constant for all firms in a specific country, to test our hypotheses we allow the stringency of EPLs to affect the firm’s SOA toward its target ratio. Thus, Λ varies with the stringency of EPLs and control variables:

$$\Lambda_{i,j,t} = \gamma EPL_{j,t} + \varphi X_{i,j,t} \quad (4)$$

where γ and φ are coefficient vectors and $X_{i,j,t}$ is the same set of controls as in Eq. (1).

Substituting Eq. (4) back to Eq. (3) yields the equation for a partial adjustment model with heterogeneity in the leverage SOA:

$$L_{i,j,t+1} - L_{i,j,t} = (\gamma EPL_{j,t} + \varphi X_{i,j,t})(\beta X_{i,j,t} - L_{i,j,t}) + \pi_{i,j,t+1} \quad (5)$$

This can be further simplified to yield:

$$\Delta L_{i,j,t+1} = (\gamma EPL_{j,t} + \varphi X_{i,j,t}) (Dist_{i,j,t}) + \pi_{i,j,t+1} \quad (6)$$

which can be written as

$$\Delta L_{i,j,t+1} = \gamma (EPL_{j,t} * Dist_{i,j,t}) + \varphi (X_{i,j,t} * Dist_{i,j,t}) + \pi_{i,j,t+1} \quad (7)$$

The impact of the strictness of EPLs on leverage SOA is captured by the coefficient (γ) on the interaction term between EPLs and the distance from target. Following previous studies (Dang et al., 2019; Faulkender et al., 2012), we adopt a two-stage procedure to estimate Eq. (7). In the first stage, we estimate Eq. (3) country by country, controlling for firm fixed effects and year fixed effects to capture the unobserved heterogeneity across time and across firms, using system GMM to obtain an estimate of target leverage using Eq. (1) and each firm's distance from target ($Dist_{i,t}$). In the second stage, we estimate this model using pooled ordinary least squares (pooled OLS). We note that because the distance from target, $Dist_{i,j,t}$, is generated from the first stage rather than observed, the estimation in the second stage is subject to the well-known generated regressors issue, in which the estimated standard errors may be incorrect (Pagan, 1984). Therefore, we estimate this model using bootstrapped standard errors. We also control for country and year fixed effects to ensure that the results reflect average within-country changes in leverage adjustment speed when a country changes the stringency of its labour regulations.

3.4. Summary statistics

Figure 1 plots the evolution of the EPR (dotted line) and EPT (solid line) index scores for each country in our sample. It shows that the stringency of EPR and EPT index differs not just across countries but also within country for the majority of countries. Austria, Belgium, Denmark, Greece, and Netherlands reduced the strictness of labour protection. Finland, Germany, Italy, Japan, and Norway are examples of countries that restructured their regulation more than once. Canada and Switzerland are countries that did not amend their EPLs.

Table 1 reports the number of observations and summarizes the descriptive statistics of our key variables for each country and for the whole sample. In general, the sample coverage varies across countries. The summary statistics of dependent and explanatory variables are similar to those in prior studies. For instance, the mean of book leverage in our study is 0.216 compared to 0.223 in Dang et al. (2019) and 0.24 in Öztekin and Flannery (2012). With regards to EPL index, the mean score in our sample is 1.60, with the most stringent labour regulation being in Greece (3.42), followed by Italy (3.16), and Spain (3.01). An average firm in the sample has total assets (book value) of \$170 million, an asset tangibility ratio of 0.32, a profitability ratio of 0.07, an R&D ratio of 0.013, and a depreciation ratio of 0.04.¹⁴

¹⁴ An unreported correlation table shows that there is no evidence that explanatory variables are highly correlated. In other words, multicollinearity is not an issue in our study.

Figure 1. Time variation in the stringency of employment protection for workers with temporary (solid line) and regular (dotted line) contracts. The study period is from 1985 to 2007.

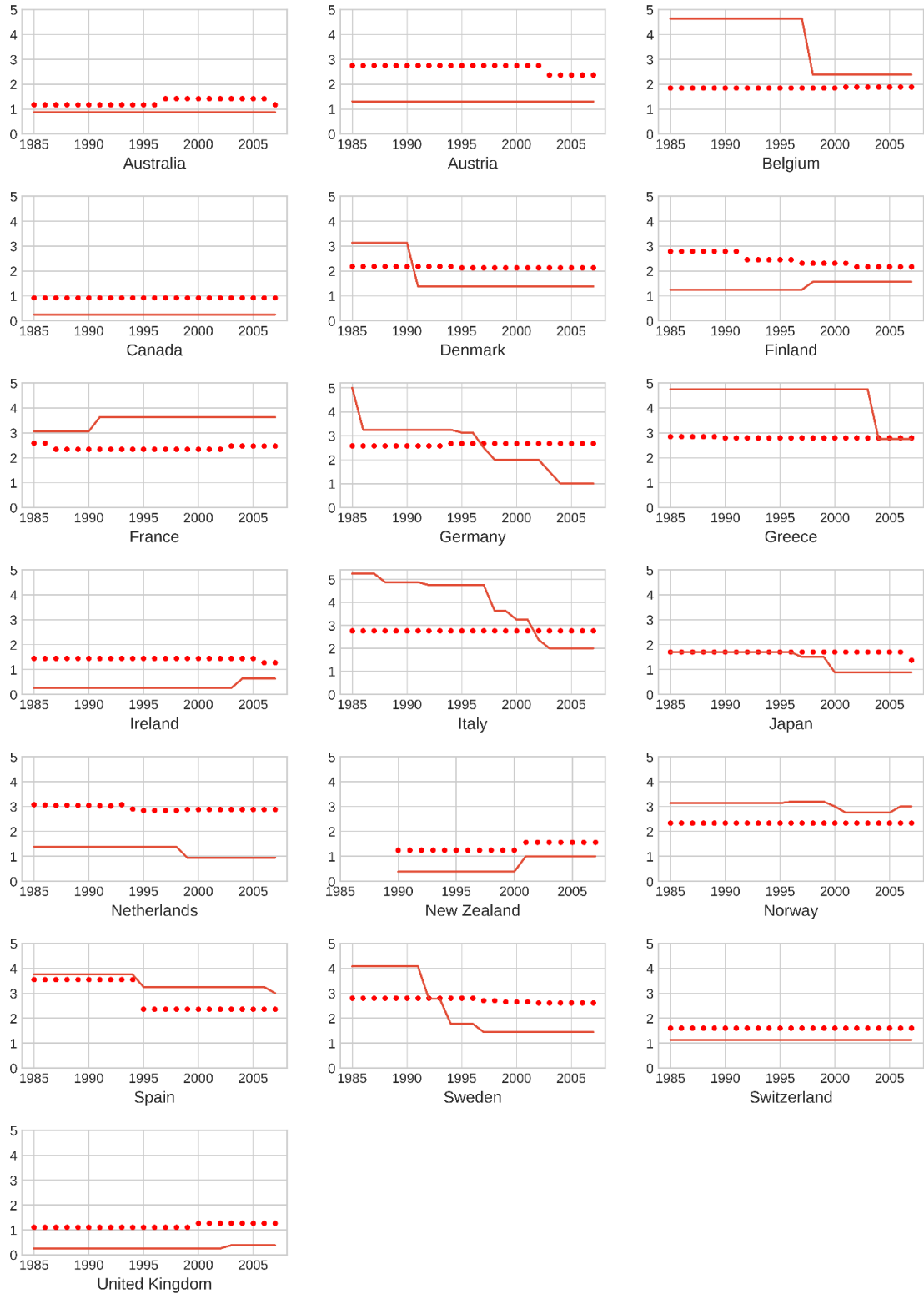


Table 1. Descriptive statistics

This table reports the means of firm-level and country-level variables by country and for the whole sample. The sample period is 1985-2007. The variable definitions are in Appendix A.

No.	Country	No. Obs.	BLEV	MLEV	EPT	EPR	EPL	SIZE	TANG	PROF	RD	RDDUM	DEP	MTB	INDMED	INFL	GGDP
1	Australia	8,803	0.1584	0.1644	0.8800	1.3520	1.1118	10.5471	0.3411	-0.0424	0.0116	0.1732	0.0439	2.5450	0.1401	0.0309	0.0343
2	Austria	936	0.2328	0.3207	1.3100	2.6599	1.9861	12.2819	0.3060	0.1005	0.0077	0.2553	0.0521	2.0792	0.2275	0.0211	0.0258
3	Belgium	1,067	0.2358	0.3131	3.1666	1.8690	2.5147	12.4729	0.2636	0.1229	0.0070	0.1509	0.0541	2.1188	0.2077	0.0204	0.0249
4	Canada	7,054	0.2064	0.2472	0.2500	0.9200	0.5853	11.8185	0.4748	0.0559	0.0171	0.1854	0.0556	2.2179	0.1714	0.0241	0.0358
5	Denmark	1,539	0.2614	0.3344	1.5494	2.1433	1.8460	11.7478	0.3436	0.1112	0.0161	0.1969	0.0497	2.1498	0.2339	0.0224	0.0216
6	Finland	1,328	0.2581	0.3311	1.4820	2.2922	1.8873	12.3232	0.3089	0.1351	0.0208	0.4699	0.0555	2.3913	0.2205	0.0173	0.0333
7	France	7,840	0.2259	0.2927	3.5787	2.3861	2.9804	12.1965	0.1994	0.1057	0.0099	0.1853	0.0530	2.2740	0.2065	0.0187	0.0221
8	Germany	3,375	0.1837	0.2397	1.9813	2.6652	2.3227	11.9116	0.2189	0.0621	0.0240	0.3022	0.0598	2.5299	0.1717	0.0184	0.0174
9	Greece	2,721	0.2552	0.2922	4.0289	2.8002	3.4154	11.4449	0.3251	0.1085	0.0018	0.2076	0.0370	2.7947	0.2276	0.0471	0.0362
10	Ireland	754	0.2284	0.2723	0.3130	1.4271	0.8680	11.8093	0.3484	0.0765	0.0068	0.2626	0.0348	2.1530	0.2128	0.0317	0.0601
11	Italy	2,648	0.2537	0.3244	3.5543	2.7600	3.1573	13.1898	0.2615	0.0980	0.0062	0.2224	0.0480	1.9301	0.2288	0.0346	0.0166
12	Japan	19,123	0.2482	0.3209	1.1779	1.6740	1.4252	12.9953	0.3007	0.0736	0.0121	0.5062	0.0295	1.9828	0.2150	0.0022	0.0149
13	Netherlands	2,422	0.2262	0.2737	1.1925	2.9225	2.0565	12.6313	0.3127	0.1408	0.0077	0.1581	0.0559	2.6133	0.2082	0.0217	0.0296
14	New Zealand	863	0.2287	0.2174	0.7596	1.4359	1.0756	11.1893	0.4071	0.1048	0.0067	0.1530	0.0489	2.6087	0.2337	0.0244	0.0336
15	Norway	1,780	0.3088	0.3627	2.9984	2.3300	2.6650	11.9914	0.3698	0.0823	0.0130	0.2017	0.0539	2.3297	0.2556	0.0231	0.0284
16	Spain	1,426	0.2268	0.2901	3.3627	2.6596	3.0098	13.1797	0.3718	0.1161	0.0024	0.0736	0.0423	2.1955	0.2257	0.0370	0.0329
17	Sweden	2,743	0.2032	0.2924	1.8090	2.6761	2.2415	11.8495	0.2440	0.0573	0.0190	0.2920	0.0505	2.8041	0.1980	0.0210	0.0284
18	Switzerland	2,495	0.2495	0.3598	1.1300	1.6000	1.3601	12.9053	0.3497	0.1071	0.0197	0.4020	0.0496	2.2143	0.2110	0.0155	0.0198
19	United Kingdom	16,550	0.1777	0.1962	0.2855	1.1683	0.7253	11.4503	0.3257	0.0619	0.0169	0.2859	0.0450	2.7793	0.1779	0.0293	0.0279
	All sample	85,467	0.2162	0.2660	1.4338	1.4338	1.6037	12.0439	0.3157	0.0684	0.0133	0.2946	0.0446	2.3686	0.1957	0.0209	0.0254

4. Results

4.1. Employment protection laws and leverage adjustments

4.1.1. Baseline results

Table 2 reports the baseline regression results for Eq. (7). Our independent variable of interest is the interaction between the EPL index and the distance from target ($EPL*Dist$). In columns (1)-(2), we estimate Eq. (7) using pooled OLS with bootstrapped standard errors that controls for country and year fixed effects. The estimates indicate that increases in the stringency of a country's employment regulations are associated with decreases in firms' leverage SOA: the coefficients on the interaction term between the EPL index and the distance from target ($EPL*Dist$) are negative and statistically significant at the 1 percent level. This finding implies that stricter employment regulations appear to increase firms' transaction costs and costs of capital, thus leading to a slower speed of firms' adjustment to target leverage ratios. This result support hypothesis H1a.

One possible caution to these results is that the stringency of labour protection and firms' leverage SOA may vary not only with the country and firm determinants but also with industry-specific variables such as the nature of technology employed in the industry. To control for unobservable industry variables, we include industry fixed effects in addition to country and year fixed effects in columns (3)-(4). The industries are defined at the two-digit SIC level. Consistent with the previous results, we find that the coefficients on the interaction term between the EPL index and the distance from target ($EPL*Dist$) are negative and statistically significant at the 1 percent level for both book and market leverage regressions, which indicates the negative effects of the stringency of EPLs on firms' speed of leverage adjustment.

Table 2. EPL and leverage speed of adjustments – core results

This table reports the regression results for the effect of EPL on the leverage speed of adjustment using following model:

$$\Delta L_{i,j,t+1} = (\varphi_{i,j,t}EPL_{j,t} + \rho_{i,j,t}X_{i,j,t}) (Dist_{i,j,t}) + \vartheta_{i,j,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,j,t+1}$). $Dist_{i,t,j}$ is the different between the target leverage ratio and the actual leverage ratio. $EPL_{j,t}$ is EPL index measured by OECD. Control variables (vector $X_{i,j,t}$) including firm size ($SIZE$), tangibility ($TANG$), profitability ($PROF$), R&D expenses (RD), R&D dummy ($RDDUM$), depreciation expenses (DEP), market-to-book ratio (MTB), industry median leverage ratio ($INDLEV$), inflation rate ($INFL$), and GDP growth rate ($GGDP$). Results of pooled OLS regression with bootstrapped standard errors, year, and country fixed effects are included in Models (1) to (2); industry, year, and country fixed effects are included in Models (3) to (4). Results of firm fixed effects regression with clustered standard error at the country level with industry/year fixed effects are reported in Models (5)-(6). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	Pooled OLS with bootstrapped SE				Firm Fixed Effects	
	ΔBL_{t+1} (1)	ΔML_{t+1} (2)	ΔBL_{t+1} (3)	ΔML_{t+1} (4)	ΔBL_{t+1} (5)	ΔML_{t+1} (6)
<i>EPL*Dist</i>	-0.0220*** (-4.2817)	-0.0127*** (-5.0620)	-0.0237*** (-3.0168)	-0.0136* (-1.6766)	-0.0312** (-2.0586)	-0.0139* (-1.7825)
<i>SIZE*Dist</i>	0.0046*** (10.1569)	0.0023*** (3.1985)	0.0048*** (5.0645)	0.0023** (2.2713)	0.0109*** (6.0148)	0.0021** (2.4004)
<i>TANG*Dist</i>	-0.0554*** (-5.7348)	-0.0056 (-0.3119)	-0.0521*** (-4.5868)	-0.0029 (-0.2117)	-0.0682*** (-2.7024)	0.0026 (0.1505)
<i>PROF*Dist</i>	-0.0017 (-0.0711)	-0.0137 (-0.7533)	-0.0009 (-0.0791)	-0.0138 (-0.8607)	0.0283 (0.4906)	-0.0142 (-0.6435)
<i>RD*Dist</i>	0.0363 (0.4082)	-0.2521*** (-4.2311)	0.0446 (0.4213)	-0.2586** (-2.2547)	0.0766 (0.6006)	-0.2546*** (-2.9343)
<i>RDDUM*Dist</i>	-0.0073*** (-2.6063)	0.0153 (1.6103)	-0.0101*** (-3.9802)	0.0144*** (2.8275)	-0.0131** (-2.5671)	0.0151* (1.7051)
<i>DEP*Dist</i>	0.4349*** (7.0134)	0.2308*** (2.7462)	0.4257*** (2.7416)	0.2227* (1.7688)	0.4869*** (3.2411)	0.2016 (1.4008)
<i>MTB*Dist</i>	0.0000 (0.0097)	-0.0015*** (-2.8080)	0.0001 (0.1176)	-0.0016*** (-7.7491)	-0.0007 (-0.5205)	-0.0014* (-1.8275)
<i>INDLEV*Dist</i>	-0.0870*** (-7.3401)	-0.0028 (-0.2149)	-0.0868** (-2.4128)	-0.0049 (-0.1824)	-0.1022* (-1.8380)	-0.0192 (-0.6837)
<i>INFL*Dist</i>	1.8728*** (12.3150)	1.0361*** (6.8856)	1.9168*** (14.3162)	1.0672*** (5.6012)	2.1672*** (4.8021)	1.1360*** (6.6198)
<i>GGDP*Dist</i>	3.0623*** (33.1058)	2.6539*** (14.6024)	3.1031*** (24.6727)	2.7056*** (10.3792)	3.4405*** (9.4220)	2.6816*** (13.3193)
<i>Constant</i>	-0.0034 (-0.9494)	-0.0261*** (-5.3608)	-0.0004 (-0.1084)	-0.0258** (-2.2014)	0.0238 (0.4830)	0.0034 (0.0695)
Observations	74,700	74,700	74,468	74,468	74,468	74,468
R-squared	0.0868	0.0749	0.0893	0.0767	0.0874	0.0792
Firm FE	NO	NO	NO	NO	YES	YES
Industry FE	NO	NO	YES	YES		
Year FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES

Next, given that leverage adjustments are firm-level choices, we employ firm fixed effects estimators to control for time-invariant unobserved firm-specific factors that may be correlated with the leverage SOA. We cluster the standard errors at the country level as the labour regulations vary at the country level. Consistently, the coefficients on the interaction term between the EPL index and the distance from target ($EPL*Dist$) as reported in columns (5)-(6) are negative and statistically significant at the 1 percent level, representing a negative association between the stringency of a country's labour regulations and firms' leverage SOA.

Regarding the economic effects, a one-standard-deviation increase in EPL index decreases leverage adjustments by 1.2 - 2.8 percent, compared with an average adjustment speed of 20.5 percent¹⁵. In other words, an average firm takes about 3 years to adjust half of the deviation between the actual and target leverage. This duration increases to about 3.6 years with stringent labour protection¹⁶. In general, the results lend strong support to our hypothesis H1a that the stringency of labour regulation causes delays in firms' desired leverage adjustment.

4.1.2. Robustness of results

In this section, we investigate the robustness of our baseline results by using alternative measures of the stringency of labour regulation, alternative measures of leverage, and alternative subsamples of countries and firms.

4.1.2.1. Alternative measures of EPLs

Following previous studies, we consider alternative measures of EPLs to check the robustness of our results (Karpuz et al., 2020; Levine et al., 2020; Simintzi et al., 2015). Table 3 reports

¹⁵ To compute the economic significance of the association between the stringency of labour regulations and leverage SOA, we take the product of the coefficients and sample standard deviation of the EPL index (An et al., 2015; Çolak et al., 2018; Faulkender et al., 2012).

¹⁶ The half-life time is calculated as $\ln(0.5)/\ln(1-0.204)$, where 0.205 is the sample mean of adjustment speeds. Because the stringency of labour regulations decreases the adjustment speeds by 1.2 to 2.8 percent, the half-life time reduces to $\ln(0.5)/\ln(1-0.177)$.

the results. First, in columns (1)-(2), we use the EPL index developed by Allard (2005) (EPLA) that extends the OECD indicator of employment protection by also considering the smaller changes in the law. The coefficients on the interaction term between EPLA index and the distance from target are negative and statistically significant at the 1 percent level, indicating that stricter labour regulation is negatively associated with firms' leverage SOA. Next, we replicate our baseline regression using three proxies of labour regulations' stringency suggested by Botero et al. (2004): collective relations law index (CRLI), social security laws index (SSLI), and employment laws index (ELI). Results, which are reported in columns (3)-(8), consistently indicate the negative impact of all three aspects of labour laws' strictness on leverage adjustment. Finally, columns (9)-(10) estimate the same specification using unemployment coverage (UNEC) constructed by Aleksynska and Schindler (2011) as a proxy for EPLs. Again, the results show that an increase in generosity of unemployment benefits reduces the speed that firms converge to target leverage levels.

Table 3. EPL and leverage speed of adjustments – Alternative measures of EPL

This table reports the regression results for the effect of alternative measures of EPL on the leverage speed of adjustment using following model:

$$\Delta L_{i,j,t+1} = (\varphi_{i,j,t}EPL_{j,t} + \rho_{i,j,t}X_{i,j,t}) (Dist_{i,t,j}) + \vartheta_{i,j,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,j,t+1}$). $Dist_{i,t,j}$ is the different between the target leverage ratio and the actual leverage ratio. $EPL_{j,t}$ is EPL index measured by Allard (2005) (*EPLA*), collective relations law index (*CRLI*), social security law index (*SSLI*), employment laws index (*ELI*), and unemployment coverage (*UNCE*). Control variables (vector $X_{i,j,t}$) including firm size (*SIZE*), tangibility (*TANG*), profitability (*PROF*), R&D expenses (*RD*), R&D dummy (*RDDUM*), depreciation expenses (*DEP*), market-to-book ratio (*MTB*), industry median leverage ratio (*INDLEV*), inflation rate (*INFL*), and GDP growth rate (*GGDP*). Year and country fixed effects are included in all models. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	EPL = EPLA		EPL = CRLI		EPL = SSLI		EPL = ELI		EPL = UNEC	
	ΔBL_{t+1}	ΔML_{t+1}	ΔBL_{t+1}	ΔML_{t+1}	ΔBL_{t+1}	ΔML_{t+1}	ΔBL_{t+1}	ΔML_{t+1}	ΔBL_{t+1}	ΔML_{t+1}
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>EPL*Dist</i>	-0.0166*** (-2.8772)	-0.0231*** (-3.1612)	-0.0548*** (-7.5977)	-0.0264*** (-4.4436)	-0.0751*** (-3.2110)	-0.0326** (-2.3124)	-0.0148*** (-2.8562)	-0.0071** (-2.2195)	-0.0031 (-0.6069)	-0.0260*** (-5.0545)
<i>SIZE*Dist</i>	0.0024*** (2.8214)	-0.0001 (-0.1798)	0.0022*** (3.2846)	0.0010 (0.9119)	0.0015 (1.3732)	0.0008 (0.8586)	0.0023*** (2.9162)	0.0011 (1.6423)	0.0027*** (2.9577)	-0.0010 (-1.3969)
<i>TANG*Dist</i>	-0.0376*** (-3.1057)	0.0175 (1.0525)	-0.0610*** (-3.8757)	-0.0073 (-0.8699)	-0.0446** (-2.1519)	-0.0001 (-0.0079)	-0.0502*** (-2.9465)	-0.0026 (-0.1532)	-0.0496** (-2.3352)	0.0029 (0.1813)
<i>PROF*Dist</i>	0.0169 (0.4456)	-0.0373** (-2.0923)	0.0052 (0.1897)	-0.0107 (-0.7887)	0.0016 (0.0514)	-0.0130 (-1.0062)	0.0031 (0.0813)	-0.0122 (-0.9339)	0.0275 (0.8848)	-0.0150 (-0.7661)
<i>RD*Dist</i>	0.1320 (1.2271)	-0.0923 (-0.7763)	-0.0333 (-0.3030)	-0.2808*** (-3.0136)	0.0497 (1.0634)	-0.2473*** (-6.4771)	0.0537 (0.4633)	-0.2464*** (-4.5365)	-0.0145 (-0.1019)	-0.1912** (-2.0245)
<i>RDDUM*Dist</i>	-0.0171** (-2.1980)	-0.0049 (-0.5164)	-0.0027 (-0.4753)	0.0175*** (3.6221)	-0.0070 (-1.2140)	0.0158*** (4.2801)	-0.0085 (-1.1341)	0.0151** (2.1418)	-0.0123*** (-3.3263)	0.0055 (0.8829)
<i>DEP*Dist</i>	0.4931*** (4.7330)	0.2125* (1.6820)	0.3745*** (4.3214)	0.1924*** (2.9711)	0.4100*** (3.6763)	0.2211*** (2.7509)	0.4319*** (3.8831)	0.2330* (1.7363)	0.4869*** (3.7640)	0.2975*** (3.1991)
<i>MTB*Dist</i>	-0.0003 (-0.3197)	-0.0016*** (-3.0316)	0.0000 (0.0263)	-0.0015*** (-2.5998)	-0.0002 (-0.1900)	-0.0016** (-2.5155)	-0.0002 (-0.1627)	-0.0017*** (-8.6769)	0.0003 (0.3176)	-0.0014** (-2.0436)
<i>INDLEV*Dist</i>	-0.0188 (-0.5579)	0.0373* (1.7325)	-0.0888*** (-3.6890)	-0.0035 (-0.1325)	-0.0971*** (-5.6664)	-0.0072 (-0.4099)	-0.0950*** (-4.9617)	-0.0062 (-0.3379)	-0.0714*** (-3.9995)	-0.0000 (-0.0007)
<i>INFL*Dist</i>	1.7242*** (9.6275)	1.2970*** (5.8617)	1.2828*** (8.0007)	0.7420*** (7.2688)	1.9569*** (9.8103)	1.0587*** (5.8617)	2.0038*** (11.9443)	1.0885*** (6.5607)	1.7385*** (19.4289)	0.9306*** (5.4962)
<i>GGDP*Dist</i>	3.0618*** (15.0624)	2.4742*** (10.0656)	2.6098*** (17.3419)	2.4551*** (17.2156)	3.2047*** (16.9928)	2.7115*** (12.4911)	3.1836*** (24.6651)	2.7083*** (18.6756)	3.2798*** (32.8728)	2.9689*** (17.2781)
<i>Constant</i>	-0.0029 (-0.8000)	-0.0335*** (-10.5233)	-0.0030 (-1.1006)	-0.0259*** (-6.0510)	-0.0031 (-1.1033)	-0.0260*** (-5.1034)	-0.0032 (-1.0252)	-0.0260*** (-4.8944)	-0.0020 (-0.8695)	-0.0281*** (-7.6303)
Observations	51,527	51,527	74,702	74,702	74,702	74,702	74,702	74,702	59,879	59,879
R-squared	0.0789	0.0587	0.0884	0.0751	0.0866	0.0748	0.0866	0.0748	0.0859	0.0763
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

4.1.2.2. Alternative measures of leverage

We further use an alternative measure of leverage ratio to test the robustness of the baseline finding. Faulkender et al. (2012) indicate that the change in leverage ratio includes both passive and active adjustments, with the former being a mechanical adjustment and the latter involving firms actually visiting the capital markets. Since transaction costs only associate with active adjustments, Faulkender et al. (2012) suggest that studies on dynamic capital structure should only focus on the active component. Consequently, we measure leverage ratio concentrating on the active adjustment:

$$L_{i,j,t}^p = \frac{D_{i,j,t}}{TA_{i,j,t} + NI_{i,j,t+1}}$$

where $NI_{i,j,t+1}$ is the net income during the year ending at time $t+1$. Leverage at $t+1$ would be $L_{i,j,t}^p$ if the firm engages in no net capital market activities.

Our Eq. (2) then becomes the following partial active adjustment model:

$$L_{i,j,t+1} - L_{i,j,t}^p = \Lambda_j (L_{i,j,t+1}^* - L_{i,j,t}^p) + \pi_{i,j,t+1} \quad (8)$$

The left-hand side of Eq. (8) equals the firm's active leverage adjustment.

Table 4 reports the results of this robustness check. We find that the coefficients of the interaction between EPL index and the distance from target are negative and statistically significant at the 1 percent and 5 percent levels for all specifications (columns (1)-(6)), indicating that our main finding is robust if the alternative leverage ratio only captures active adjustments.

Table 4. EPL and leverage speed of adjustments – Alternative measures of leverage

This table reports the robustness checks using partial active leverage adjustment as alternative measure of leverage for following regressions:

$$\Delta L_{i,j,t+1} = (\varphi_{i,j,t}EPL_{j,t} + \rho_{i,j,t}X_{i,j,t}) (Dist_{i,j,t}) + \vartheta_{i,j,t+1}$$

The dependent variable is the change in leverage ratio ($\Delta L_{i,j,t+1}$). $Dist_{i,j,t}$ is the different between the target leverage ratio and the actual leverage ratio. $EPL_{j,t}$ is EPL index measured by OECD. Control variables (vector $X_{i,j,t}$) including firm size ($SIZE$), tangibility ($TANG$), profitability ($PROF$), R&D expenses (RD), R&D dummy ($RDDUM$), depreciation expenses (DEP), market-to-book ratio (MTB), industry median leverage ratio ($INDLEV$), inflation rate ($INFL$), and GDP growth rate ($GGDP$). Results of pooled OLS regression with bootstrapped standard errors, year, and country fixed effects are included in Models (1) to (2); industry, year, and country fixed effects are included in Models (3) to (4). Results of firm fixed effects regression with clustered standard error at the country level with industry/year fixed effects are reported in Models (5)-(6). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	Pooled OLS with bootstrapped SE		Firm Fixed Effects
	(1)	(2)	(3)
<i>EPL*Dist</i>	-0.0234*** (-3.4570)	-0.0257** (-2.5287)	-0.0303*** (-4.7181)
<i>SIZE*Dist</i>	-0.0070*** (-10.0684)	-0.0069*** (-9.4276)	-0.0080*** (-10.4058)
<i>TANG*Dist</i>	-0.0156*** (-4.6727)	-0.0134*** (-6.9210)	-0.0112* (-1.7540)
<i>PROF*Dist</i>	-0.0724*** (-6.2189)	-0.0715*** (-11.5085)	-0.0576*** (-8.1973)
<i>RD*Dist</i>	0.0278 (0.4758)	0.0375 (0.5778)	0.0855** (2.0564)
<i>RDDUM*Dist</i>	-0.0058*** (-2.6924)	-0.0075*** (-6.1433)	-0.0119*** (-4.0336)
<i>DEP*Dist</i>	0.3207*** (5.7839)	0.3159*** (7.9133)	0.4037*** (11.9962)
<i>MTB*Dist</i>	-0.0004 (-0.9054)	-0.0004 (-0.8762)	-0.0006** (-2.2198)
<i>INDLEV*Dist</i>	-0.0305*** (-3.0221)	-0.0301*** (-2.5992)	-0.0307*** (-2.7499)
<i>INFL*Dist</i>	1.7514*** (16.8046)	1.7887*** (12.2525)	2.1691*** (26.3241)
<i>GGDP*Dist</i>	1.2630*** (9.4505)	1.2882*** (10.8055)	1.5596*** (19.3433)
<i>Constant</i>	-0.0031 (-0.7805)	-0.0008 (-0.1998)	0.0287 (0.5022)
Observations	64,233	64,084	64,084
R-squared	0.0881	0.0904	0.0899
Firm FE	NO	NO	YES
Industry FE	NO	YES	
Year FE	YES	YES	YES
Country FE	YES	YES	YES

4.1.2.3. Alternative subsamples

Our sample covers firms from 19 countries. Due to the heterogeneity of the sample, the negative association between EPLs and leverage SOA may not remain valid across all countries. Thus, we first examine the robustness of our results in different subsamples of countries. As United Kingdom and Japan are the majority of the sample, we examine whether the baseline findings are driven by labour laws and firms' behaviour in these countries. Panel A of Table 5 shows that the significantly negative relationship between EPLs and leverage SOA remains unchanged in both subsamples: United Kingdom and Japan firms only, or when all observations from these two countries are removed.

Further, we test our baseline results separately for multinational and non-multinational firms. Since multinational firms relate to significant foreign operations and foreign labour forces, these firms are less likely affected by changes in their home country's labour laws. This, thus, introduces a noise into our baseline regression. Following previous studies (Gungoraydinoglu, Çolak, & Öztekin, 2017; Karpuz et al., 2020), we consider firms as multinational if they report foreign operating income or foreign income tax in the past five consecutive years. The results are presented in Panel B of Table 5. We find that multinational firms' leverage SOA is only weakly affected by changes in the stringency of their home country's employee regulations. In contrast, this association is highly significant for non-multinational firms.

Table 5. EPL and leverage speed of adjustments – Alternative subsamples

This table reports the robustness checks using different subsamples including U.K and Japan only and non-U.K and non-Japan in Panel A, and multinational firms and non-multinational firms in Panel B for following regression:

$$\Delta L_{i,j,t+1} = (\varphi_{i,j,t}EPL_{j,t} + \rho_{i,j,t}X_{i,j,t}) (Dist_{i,j,t}) + \vartheta_{i,j,t+1}$$

The dependent variable is the change in leverage ratio ($\Delta L_{i,j,t+1}$). $Dist_{i,j,t}$ is the different between the target leverage ratio and the actual leverage ratio. $EPL_{j,t}$ is EPL index measured by OECD. Control variables (vector $X_{i,j,t}$) including firm size ($SIZE$), tangibility ($TANG$), profitability ($PROF$), R&D expenses (RD), R&D dummy ($RDDUM$), depreciation expenses (DEP), market-to-book ratio (MTB), industry median leverage ratio ($INDLEV$), inflation rate ($INFL$), and GDP growth rate ($GGDP$). Year and country fixed effects are included in all models. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	Panel A				Panel B			
	UK and Japan only		Non UK and Japan		Multinational firms		Non-multinational firms	
	ΔBL_{t+1} (1)	ΔML_{t+1} (2)	ΔBL_{t+1} (3)	ΔML_{t+1} (4)	ΔBL_{t+1} (5)	ΔML_{t+1} (6)	ΔBL_{t+1} (7)	ΔML_{t+1} (8)
<i>EPL*Dist</i>	-0.1268*** (-9.7618)	-0.0725*** (-12.6597)	-0.0211*** (-3.1667)	-0.0169*** (-3.1356)	-0.0390** (-2.0218)	-0.0089 (-1.1675)	-0.0200*** (-3.5647)	-0.0146*** (-7.9773)
<i>SIZE*Dist</i>	0.0059*** (3.7806)	0.0028** (2.2595)	0.0076*** (6.2298)	0.0041*** (4.9340)	0.0043*** (6.2492)	0.0019 (1.5358)	0.0050*** (3.2804)	0.0024** (2.0487)
<i>TANG*Dist</i>	-0.0933*** (-11.1283)	-0.0125 (-0.4122)	-0.0277** (-2.0520)	-0.0022 (-0.1310)	-0.0406** (-2.0998)	-0.0003 (-0.0113)	-0.0608*** (-4.5779)	-0.0028 (-0.1783)
<i>PROF*Dist</i>	0.0159 (0.3151)	-0.0280*** (-3.1709)	-0.0253* (-1.7411)	-0.0084 (-0.4640)	-0.0236 (-0.3921)	-0.0399 (-1.1125)	0.0167 (0.3319)	0.0085 (0.3124)
<i>RD*Dist</i>	-0.1231 (-0.7740)	-0.4067*** (-4.6137)	0.1069 (0.8136)	-0.1007 (-1.3958)	-0.0137 (-0.0760)	-0.1603*** (-5.2019)	0.0897 (0.5098)	-0.2941*** (-3.7983)
<i>RDDUM*Dist</i>	0.0096* (1.8358)	0.0343*** (2.7215)	-0.0126 (-1.3481)	-0.0052 (-0.7332)	0.0020 (0.6263)	0.0115* (1.7892)	-0.0115* (-1.6516)	0.0192*** (3.6528)
<i>DEP*Dist</i>	0.2703*** (6.6946)	0.1924 (1.0597)	0.3973*** (3.8573)	0.1455*** (3.7836)	0.1563 (0.7703)	0.1312 (0.9712)	0.5516*** (3.3809)	0.2616* (1.7855)
<i>MTB*Dist</i>	0.0019 (1.0851)	-0.0011** (-1.9945)	-0.0011 (-1.1204)	-0.0016 (-1.1787)	0.0022 (1.2249)	0.0001 (0.1415)	-0.0013 (-0.9550)	-0.0025*** (-13.8049)
<i>INDLEV*Dist</i>	-0.0314 (-0.9297)	-0.0183 (-1.0799)	-0.1181** (-2.2071)	0.0015 (0.0650)	-0.1435*** (-10.2821)	-0.0562* (-1.9260)	-0.0555 (-1.2127)	0.0275* (1.7634)
<i>INFL*Dist</i>	0.6401*** (4.1865)	0.1079 (0.4061)	1.4720*** (5.8400)	1.0208*** (3.2938)	2.1922*** (6.5137)	1.0328*** (7.0640)	1.6446*** (17.8684)	1.0096*** (9.8736)
<i>GGDP*Dist</i>	2.6874*** (12.5502)	2.6886*** (25.4192)	2.6105*** (10.7928)	2.4017*** (7.7211)	3.1961*** (24.7404)	3.0957*** (9.5168)	2.9445*** (14.2940)	2.4324*** (11.7917)
<i>Constant</i>	-0.0053** (-2.3801)	-0.0053 (-0.7391)	-0.0045 (-0.6478)	-0.0499*** (-15.6818)	0.0063 (0.8874)	-0.0006 (-0.1225)	-0.0031 (-0.7905)	-0.0294*** (-5.0100)
Observations	31,536	31,536	43,164	43,164	29,415	29,415	45,285	45,285
R-squared	0.0852	0.1049	0.0928	0.0763	0.0883	0.0782	0.0889	0.0796
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES

4.2. Endogeneity issues

Even though we include an intensive set of control variables in addition to industry, country, and year fixed effects in our baseline regressions in Table 2, there still may be concerns about endogeneity. Specifically, the impacts of a country's EPLs on firms' leverage SOA may occur because of other reforms that applied at the same time as the changes in labour laws. Consequently, the change in leverage SOA may not be determined by the change in EPLs but by unobserved variables. This endogeneity of labour regulations can lead to biased and inconsistent estimates. We address this issue using an instrumental variable (IV) approach, the methodology in Rajan and Zingales (1998) and controlling for additional variables.

4.2.1. IV approach

In this session, we address the concern that the effect of EPLs on leverage adjustments may be endogenous by using IV method. Specifically, Botero et al. (2004) find that legal origin is the most important determinant of a country's labour regulation that is exogenous to firms' financial decisions. Botero et al. (2004) argue that civil countries regulate labour markets more extensively than common law countries, whereas common law countries have a less generous social security system and depend more on markets to provide insurance.

Table 6. Instrumental variable

This table reports the first-stage and second-stage regression from our IV regressions. In the first stage, we regress the EPL index interacted with *Dist* on the instruments and the controls, where a given EPL index are instrumented using country's legal origin. $EPL_{j,t}$ is proxied by EPL index measured by OECD. Control variables (vector $X_{i,j,t}$) including firm size (*SIZE*), tangibility (*TANG*), profitability (*PROF*), R&D expenses (*RD*), R&D dummy (*RDDUM*), depreciation expenses (*DEP*), market-to-book ratio (*MTB*), industry median leverage ratio (*INDLEV*), inflation rate (*INFL*), and GDP growth rate (*GGDP*). In the second stage, we regress dependent variable that is the change in book and market leverage ratio ($\Delta LEV_{i,t+1,j}$) on the predicted values of $EPL*Dist$ and the control variables. $Dist_{i,t,j}$ is the different between the target leverage ratio and the actual leverage ratio. Year and country fixed effects are in all models. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped and reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	BL		ML	
	$EPL*Dist$ (1)	ΔBL_{t+1} (2)	$EPL*Dist$ (3)	ΔML_{t+1} (4)
$EPL*Dist$		-0.0635*** (0.0047)		-0.0284*** (0.0060)
$Common*Dist$	-0.9922*** (0.0025)		-0.9831*** (0.0025)	
$StockCap*Dist$				
$SIZE*Dist$	0.0334*** (0.0003)	0.0062*** (0.0005)	0.0306*** (0.0002)	0.0028*** (0.0006)
$TANG*Dist$	-0.1841*** (0.0045)	-0.0753*** (0.0085)	-0.1464*** (0.0044)	-0.0124 (0.0108)
$PROF*Dist$	-0.1238*** (0.0057)	0.0036 (0.0105)	-0.1136*** (0.0056)	-0.0122 (0.0133)
$RD*Dist$	0.4722*** (0.0343)	0.0254 (0.0633)	0.2573*** (0.0339)	-0.2554*** (0.0814)
$RDDUM*Dist$	-0.1131*** (0.0028)	-0.0105** (0.0051)	-0.0934*** (0.0027)	0.0143** (0.0065)
$DEP*Dist$	1.0308*** (0.0242)	0.4703*** (0.0448)	1.2178*** (0.0250)	0.2436*** (0.0602)
$MTB*Dist$	-0.0001 (0.0002)	0.0001 (0.0004)	-0.0019*** (0.0002)	-0.0015*** (0.0005)
$INDLEV*Dist$	0.1302*** (0.0089)	-0.0701*** (0.0165)	0.0854*** (0.0063)	0.0025 (0.0152)
$INFL*Dist$	9.8040*** (0.0617)	1.9087*** (0.1060)	9.5899*** (0.0594)	1.0531*** (0.1331)
$GGDP*Dist$	3.8158*** (0.0654)	2.8662*** (0.1160)	4.1273*** (0.0633)	2.6040*** (0.1467)
<i>Constant</i>	0.0045*** (0.0008)	0.0060*** (0.0014)	-0.0057*** (0.0008)	0.0072*** (0.0019)
Observations	74,700	74,700	74,700	74,700
R-squared	0.7896	0.0854	0.8015	0.0748
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
IV F-stat		155402		157580
Durbin p-value		0.0000		0.0000

We use a dummy variable, which is equal to one for firms from common law countries, and zero otherwise (*COMMON*). Table 6 presents the results of the IV regressions. Columns (1) and (3) report the results of first-stage regressions that use *EPL*Dist* as the dependent variable. Consistent with our prediction, the coefficients on the interaction between common law dummy variable and the distance to target (*COMMON*Dist*) are negative and statistically significant at the 1 percent level, indicating that countries with common law legal origin have less labour protection than civil law countries. In the second stage regressions (columns (2) and (4)), using the fitted values of *EPL*Dist* from the first stage as explanatory variables to estimate our baseline regression, we continue to find a negative and significant association between EPLs and leverage SOA.

We also check the validity of the instruments by reporting first-stage F-statistics of the test of the null hypothesis that the instrument can be excluded from the first-stage regressions. The F-statistics is above 50, that recommends a strong rejection of the null hypothesis. The p-value of Durbin tests is 0.000, indicating that EPLs is endogenous. In sum, these results reinforce the confidence of our analysis, confirming the previously documented negative association between the stringency of labour regulations and leverage SOA.¹⁷

4.2.2. Cross-sectional heterogeneity

We next exploit the causal relation between the stringency of labour regulations and leverage SOA by examining the different effects of labour regulation rigidity across industries with different labour adjustment characteristics. The expectation is that if EPLs indeed have a negative impact on leverage SOA, then increases in employment protection should have a

¹⁷ In an unreported table, following Alimov (2015), we use a highly correlated variable with legal origin, that is the development of a country's stock market as an alternative instrument. The results are consistent with our expectation. Specifically, we find that countries with great stock market development tend to have less labour protection. The IV estimate on EPL also suggests a negative and significant association between EPL and leverage SOA.

relatively stronger effect on leverage SOA of firms in industries that require a naturally higher propensity to adjust their labour force (higher labour turnover for their operations).

To conduct the test, we construct a proxy for the industry's labour turnover rates using the US Census Bureau's Quarterly Workforce Indicator (QWI) data¹⁸. Alimov (2015) suggests that using US industry data to construct this measure is appropriate as most industries in the US and OECD countries share commonality in structure and technologies. Following Abowd and Vilhuber (2011), we measure the industry-level labour turnover rate as:

$$LabourTurnover = \frac{HirA + Sep}{0.5(Emp + EmpEnd)}$$

where HirA is hires, Sep is separation, Emp is beginning-of-period employment, and EmpEnd is end-of-period employment.

Although previous studies (Alimov, 2015; Simintzi et al., 2015) exploit labour turnover measures from Davis, Haltiwanger, and Schuh (1996), using the QWI data has some advantages. Specifically, as the QWI data fully covers short duration jobs, it provides a more comprehensive coverage of labour turnover (Davis & Haltiwanger, 2014). Furthermore, while Davis et al. (1996) capture only 20 manufacturing industries based on two-digit SIC, the QWI data captures the labour turnover of over 200 industries based on four-digit SIC.¹⁹

¹⁸ Because the QWI data use North American Industry Classification System (NAICS) as the industry classification, we measure the industry mean rates for each four-digit NAICS and match them to their three-digit SIC equivalents.

¹⁹ Our results hold when we use industry-level labour turnover measure from Davis et al. (1996).

Table 7. Industry labour turnover effects

This table reports the regression results for the following model:

$$\Delta L_{i,j,t+1} = (\varphi_{i,j,t}EPL_{j,t} + \pi_{i,j,t}EPL_{j,t} * LabourTurnOver_{i,j,t} + \mu_{i,j,t}LabourTurnOver_{i,j,t} + \rho_{i,t,j}X_{i,j,t}) (Dist_{i,j,t}) + \vartheta_{i,j,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,j,t+1}$). $Dist_{i,j,t}$ is the different between the target leverage ratio and the actual leverage ratio. $EPL_{j,t}$ is EPL index measured by OECD. Labour Turnover rates (LabourTurnOver) are calculated using the Quarterly Workforce Indicators (QWI) data from U.S. Census Bureau. Control variables (vector $X_{i,j,t}$) including firm size ($SIZE$), tangibility ($TANG$), profitability ($PROF$), R&D expenses (RD), R&D dummy ($RDDUM$), depreciation expenses (DEP), market-to-book ratio (MTB), industry median leverage ratio ($INDLEV$), inflation rate ($INFL$), and GDP growth rate ($GGDP$). Year and country fixed effects are included in all models. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	ΔBL_{t+1} (1)	ΔML_{t+1} (2)
<i>EPL*Dist</i>	-0.0174*** (-2.9237)	0.0068 (0.8344)
<i>EPL*LabourTurnover*Dist</i>	-0.0210** (-2.0056)	-0.0415*** (-4.1771)
<i>LabourTurnover*Dist</i>	0.0158 (1.6003)	0.0146** (2.5127)
<i>SIZE*Dist</i>	0.0044*** (8.1843)	0.0018** (2.4985)
<i>TANG*Dist</i>	-0.0514*** (-4.6424)	-0.0014 (-0.1029)
<i>PROF*Dist</i>	0.0100 (0.3687)	-0.0141 (-0.8602)
<i>RD*Dist</i>	0.0244 (0.1706)	-0.2720*** (-3.7997)
<i>RDDUM*Dist</i>	-0.0082 (-1.0636)	0.0149** (2.2934)
<i>DEP*Dist</i>	0.4547*** (5.6919)	0.2435** (2.5058)
<i>MTB*Dist</i>	0.0002 (0.2289)	-0.0013*** (-2.9818)
<i>INDLEV*Dist</i>	-0.1207*** (-4.2646)	-0.0249* (-1.8285)
<i>INFL*Dist</i>	1.9591*** (23.7883)	0.9058*** (3.8392)
<i>GGDP*Dist</i>	3.0798*** (27.7377)	2.8369*** (14.0487)
<i>Constant</i>	0.0141*** (4.9343)	-0.0083* (-1.7463)
Observations	69,248	69,248
R-squared	0.0851	0.0757
Year FE	YES	YES
Country FE	YES	YES

Table 7 reports the results that include the triple interaction term among EPL index, labour turnover, and the distance from target ($EPL*LabourTurnover*Dist$). The results show that the estimated coefficients on the triple interaction term ($EPL*LabourTurnover*Dist$) are negative and statistically significant in columns (1)-(2). This indicates that the association between the stringency of labour regulation and leverage SOA is significantly stronger in industries which more frequently adjust their labour force. We note that the coefficients on the interaction term between EPL index and the distance from target ($EPL*Dist$) are still negative and statistically significant for book leverage but lose their significance for market leverage. These results imply that, in response to an increase in the strictness of a country's labour laws, only firms in industries that have higher rate of labour turnover tend to have higher costs of accessing external financing sources and thus delay their adjustment to target leverage.

4.2.3. Omitted variables

To further alleviate the potential endogeneity concern, in this section, we consider several possible omitted variables that may be correlated with employment regulations and leverage SOA. Specifically, we control for additional variables to capture potential confounding impacts that may be biasing our results.

Table 8. EPL and leverage speed of adjustments – Omitted variables

This table reports the regression results for the effect of EPL on the leverage speed of adjustment, controlling for potential omitted variables for following regression:

$$\Delta L_{i,j,t+1} = (\varphi_{i,j,t}EPL_{j,t} + \rho_{i,j,t}X_{i,j,t}) (Dist_{i,j,t}) + \vartheta_{i,j,t+1}$$

The dependent variable is the change in leverage ratio ($\Delta L_{i,j,t+1}$). $Dist_{i,j,t}$ is the different between the target leverage ratio and the actual leverage ratio. $EPL_{j,t}$ is EPL index measured by OECD. Column (1)-(2) controls for government spending on labour, column (3)-(4) controls for the overall unionization rate, and column (5)-(6) controls for political orientation of the country's ruling party. Column (7)-(8) controls for all three political variables. Other control variables (vector $X_{i,j,t}$) including firm size ($SIZE$), tangibility ($TANG$), profitability ($PROF$), R&D expenses (RD), R&D dummy ($RDDUM$), depreciation expenses (DEP), market-to-book ratio (MTB), industry median leverage ratio ($INDLEV$), inflation rate ($INFL$), and GDP growth rate ($GGDP$). Year and country fixed effects are in all models. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	ΔBL_{t+1} (1)	ΔML_{t+1} (2)	ΔBL_{t+1} (3)	ΔML_{t+1} (4)	ΔBL_{t+1} (5)	ΔML_{t+1} (6)	ΔBL_{t+1} (7)	ΔML_{t+1} (8)
<i>EPL*Dist</i>	-0.0235*** (-3.1219)	-0.0162*** (-3.6942)	-0.0234*** (-3.0638)	-0.0168*** (-3.8197)	-0.0255** (-2.2342)	-0.0195* (-1.7359)	-0.1175*** (-5.0308)	-0.0576*** (-2.8119)
<i>SIZE*Dist</i>	0.0042*** (8.6793)	0.0022** (2.0067)	-0.0012*** (-3.8038)	-0.0010 (-0.5800)	-0.0016 (-1.1289)	-0.0013 (-0.9086)	-0.0136*** (-14.4123)	-0.0056*** (-5.3499)
<i>TANG*Dist</i>	-0.0513*** (-3.2154)	-0.0062 (-0.4997)	-0.0542*** (-3.2490)	-0.0080 (-0.6481)	-0.0566*** (-3.1093)	-0.0115 (-0.9042)	-0.0429* (-1.7769)	-0.0048 (-0.2670)
<i>PROF*Dist</i>	0.0070 (0.4433)	-0.0121 (-0.7063)	0.0263 (1.6168)	-0.0028 (-0.1598)	0.0279 (1.1150)	-0.0034 (-0.2919)	0.0675*** (3.3104)	0.0243 (0.5496)
<i>RD*Dist</i>	0.0308 (0.2530)	-0.2805*** (-4.1024)	0.0475 (0.4000)	-0.2782*** (-3.8787)	0.0317 (0.2601)	-0.3187*** (-5.1855)	-0.0562 (-0.9504)	-0.5232*** (-4.0706)
<i>RDDUM*Dist</i>	-0.0063 (-1.0587)	0.0165** (2.1240)	-0.0092 (-1.6235)	0.0154** (2.0274)	-0.0076* (-1.8106)	0.0181*** (4.1195)	0.0068 (1.5575)	0.0286*** (2.8600)
<i>DEP*Dist</i>	0.3755*** (5.5682)	0.2160** (2.5527)	0.3600*** (5.4456)	0.2168*** (2.5809)	0.3459*** (3.5190)	0.1930** (2.3013)	-0.0470 (-0.5864)	-0.0698 (-0.6162)
<i>MTB*Dist</i>	0.0000 (0.0073)	-0.0014* (-1.7231)	-0.0004 (-0.5132)	-0.0017* (-1.9234)	-0.0003 (-0.1920)	-0.0015** (-2.1571)	-0.0000 (-0.0771)	-0.0023** (-2.5090)
<i>INDLEV*Dist</i>	-0.0822*** (-3.5785)	0.0029 (0.2046)	-0.0849*** (-3.6688)	0.0023 (0.1688)	-0.0904*** (-4.1441)	-0.0080 (-0.5118)	-0.1603*** (-3.9597)	-0.0647** (-1.9992)
<i>INFL*Dist</i>	1.9029*** (7.8073)	1.0347*** (7.8724)	2.2135*** (8.9461)	1.2077*** (6.9437)	2.1004*** (22.9681)	0.8914*** (4.1168)	0.8746*** (2.9330)	0.3409 (1.1040)
<i>GGDP*Dist</i>	3.0063*** (12.9985)	2.6061*** (20.1484)	3.0722*** (13.5023)	2.6485*** (20.1122)	3.0385*** (23.5860)	2.6789*** (24.0712)	2.2715*** (4.7446)	1.9468*** (4.3531)
<i>CREDITOR*Dist</i>	0.0020 (0.8557)	0.0000 (0.0072)	-0.0019 (-0.7785)	-0.0022 (-0.6128)	-0.0039 (-1.3931)	-0.0042 (-1.3180)	0.0046 (1.4437)	-0.0039 (-0.8390)
<i>TAX*Dist</i>			0.0031*** (14.7031)	0.0019*** (3.4753)	0.0031*** (8.5113)	0.0017*** (3.6364)	0.0086*** (5.8410)	0.0052*** (10.3424)
<i>UNION*Dist</i>					0.0005*** (3.3249)	0.0007** (2.1850)	-0.0006 (-1.4909)	-0.0001 (-0.2495)
<i>BARGAIN*Dist</i>							0.0026*** (5.7292)	0.0015*** (7.3014)
Constant	-0.0034 (-1.1500)	-0.0222*** (-9.5100)	-0.0034 (-1.1224)	-0.0220*** (-9.5704)	-0.0036** (-2.1154)	-0.0218*** (-4.2548)	0.0093 (0.7595)	-0.0104 (-0.9830)
Observations	70,147	70,147	70,147	70,147	68,655	68,655	36,774	36,774
R-squared	0.0853	0.0737	0.0862	0.0739	0.0860	0.0745	0.1011	0.0794
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES

As suggested by Öztekin and Flannery (2012), when a country's institutional characteristics encourage debt and equity issuances, firms operating in such countries adjust more quickly toward the targets. We include credit rights index (CREDITOR) and tax shields (TAX) as additional control variables. The results presented in columns (1)-(4) of Table 8 show that while leverage SOA increases with the tax shield, creditor rights have no effect. More importantly, the coefficients on the interaction term between EPL index and the distance from target are still negative and statistically significant at the 1 percent level, implying that the negative association between EPLs and leverage SOA still remains.

Next, we consider whether EPL index is proxying for other employment indicators. We add union density (UNION) and centralized bargaining (BARGAIN) as proxies for the stringency of the labour regulations. Columns (5)-(8) show that leverage SOA increases in countries with more centralized bargaining while the impact of union density on leverage SOA is ambiguous. The impacts of creditor rights and tax shield remain, as in columns (1)-(4). Importantly, the coefficients of the interaction term between EPLs and leverage SOA are not affected by the addition of these control variables, which are still negative and statistically significant.

4.3. Impacts of a country's institutions

Our next analysis considers the impact of the effectiveness of a country's legal enforcement on the association between legal regulation and leverage SOA. Rutkowski and Scarpetta (2005) show that labour laws have weak compliance and are not fully enforced in countries with weak legal systems. We expect that a country's weak legal enforcement can mitigate the negative impact of EPLs on firms' leverage SOA.

Table 9. Employment protection and SOA: A Country's enforcement effects

This table reports the regression results for the effect country's institution on CSP – leverage SOA relationship using the following model:

$$\Delta L_{i,j,t+1} = (\varphi_{i,j,t} EPL_{j,t} + \lambda_{i,j,t} EPL_{j,t} * ENFORC_{j,t} + \Delta_{i,j,t} ENFORC_{j,t} + \rho_{i,j,t} X_{i,j,t}) (Dist_{i,j,t}) + \vartheta_{i,j,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,j,t+1}$). $Dist_{i,j,t}$ is the different between the target leverage ratio and the actual leverage ratio. $EPL_{j,t}$ is proxied by EPL index measured by OECD. $ENFORC_{j,t}$ is the country's enforcement variables, which include efficiency of judicial system (*EFFJUD*), rule of law (*RULLAW*), level of corruption (*CORRUP*), risk of expropriation (*RISEXP*), and repudiation of contracts by government (*RISCON*). Control variables (vector $X_{i,j,t}$) including firm size (*SIZE*), tangibility (*TANG*), profitability (*PROF*), R&D expenses (*RD*), R&D dummy (*RDDUM*), depreciation expenses (*DEP*), market-to-book ratio (*MTB*), industry median leverage ratio (*INDLEV*), inflation rate (*INFL*), and GDP growth rate (*GGDP*). Year and country fixed effects are included in all models. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	ENFORC = EFFJUD		ENFORC = RULLAW		ENFORC = CORRUP		ENFORC = RISEXP		ENFORC = RISCON	
	ΔBL_{t+1}	ΔML_{t+1}	ΔBL_{t+1}	ΔML_{t+1}	ΔBL_{t+1}	ΔML_{t+1}	ΔBL_{t+1}	ΔML_{t+1}	ΔBL_{t+1}	ΔML_{t+1}
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>EPL*Dist</i>	-0.0104*	-0.0026	-0.0211***	-0.0125***	-0.0048	-0.0031	-0.0172***	-0.0102**	-0.0164**	-0.0095
	(-1.6468)	(-0.4233)	(-3.1335)	(-3.1066)	(-0.9573)	(-0.7377)	(-2.8476)	(-2.4080)	(-2.4990)	(-1.2196)
<i>EPL*ENFORC*Dist</i>	-0.0464***	-0.0154***	-0.0444***	-0.0241**	-0.0318***	-0.0079	-0.0571***	-0.0312***	-0.0318***	-0.0185
	(-4.1425)	(-2.6725)	(-5.7280)	(-2.3403)	(-3.6119)	(-0.6788)	(-4.5378)	(-2.5800)	(-2.7822)	(-1.2141)
<i>ENFORC*Dist</i>	0.0256***	0.0134***	0.0294***	0.0163***	0.0301***	0.0154***	0.0289***	0.0151***	0.0254***	0.0134***
	(17.6225)	(9.5460)	(24.3204)	(5.8537)	(18.0747)	(9.7716)	(24.6246)	(6.2757)	(26.7780)	(7.8746)
<i>SIZE*Dist</i>	-0.0139***	-0.0076***	-0.0144***	-0.0083***	-0.0143***	-0.0075***	-0.0156***	-0.0083***	-0.0133***	-0.0072***
	(-16.6529)	(-9.5076)	(-11.7443)	(-4.2650)	(-9.6268)	(-10.9040)	(-12.7275)	(-4.4482)	(-12.4426)	(-4.4061)
<i>TANG*Dist</i>	-0.0517***	-0.0029	-0.0578***	-0.0057	-0.0535***	-0.0033	-0.0515***	-0.0034	-0.0492***	-0.0019
	(-10.3188)	(-0.2786)	(-6.5774)	(-0.4368)	(-6.3714)	(-0.3888)	(-6.1306)	(-0.2687)	(-5.7093)	(-0.1809)
<i>PROF*Dist</i>	0.0498	0.0097*	0.0528**	0.0137	0.0412*	0.0061	0.0487*	0.0094	0.0419	0.0063
	(1.0076)	(1.7986)	(1.9842)	(0.8609)	(1.7870)	(0.3870)	(1.8318)	(0.6317)	(1.6035)	(0.3450)
<i>RD*Dist</i>	-0.0520	-0.3046***	-0.0985	-0.3322***	-0.1454	-0.3465***	-0.0876	-0.3177***	-0.0658	-0.3056***
	(-0.3175)	(-8.5127)	(-1.1909)	(-3.5042)	(-1.4420)	(-4.1727)	(-0.9718)	(-3.4099)	(-0.7290)	(-4.1659)
<i>RDDUM*Dist</i>	-0.0041	0.0180***	0.0028	0.0218***	0.0041	0.0218***	-0.0008	0.0194***	-0.0028	0.0183**
	(-0.6426)	(3.3383)	(0.7807)	(4.0170)	(0.6179)	(3.5487)	(-0.2358)	(3.6163)	(-0.8549)	(2.4436)
<i>DEP*Dist</i>	0.2321**	0.1312*	0.1597**	0.0810	0.1425**	0.0776	0.1863***	0.1088	0.2251***	0.1298
	(2.3982)	(1.7279)	(2.2796)	(0.6708)	(2.1166)	(1.2636)	(2.7006)	(0.8804)	(3.1828)	(1.5007)
<i>MTB*Dist</i>	-0.0009	-0.0021***	-0.0008	-0.0020***	-0.0007	-0.0020***	-0.0008	-0.0020***	-0.0008	-0.0020***
	(-1.1188)	(-4.9675)	(-0.8997)	(-4.9687)	(-0.8932)	(-4.9244)	(-0.9148)	(-5.1545)	(-0.8604)	(-4.3286)
<i>INDLEV*Dist</i>	-0.1140***	-0.0109	-0.1037***	-0.0093	-0.1189***	-0.0127	-0.1151***	-0.0112	-0.1142***	-0.0105
	(-7.7852)	(-0.5888)	(-6.9834)	(-0.7113)	(-6.2984)	(-0.7164)	(-7.7881)	(-0.8840)	(-8.0775)	(-0.5120)
<i>INFL*Dist</i>	1.5517***	0.8956***	1.4869***	0.8059***	1.3676***	0.7951***	1.4984***	0.7950***	1.7257***	0.9136***
	(6.1539)	(6.4066)	(8.8619)	(6.1668)	(7.8450)	(5.5863)	(7.9837)	(6.3501)	(9.5546)	(6.7211)
<i>GGDP*Dist</i>	2.5858***	2.4248***	2.2852***	2.2472***	2.2887***	2.2809***	2.5179***	2.3727***	2.7340***	2.4787***
	(19.7077)	(56.7195)	(31.0691)	(13.4303)	(19.3273)	(10.5826)	(36.9614)	(14.9663)	(38.0668)	(25.7235)
Constant	-0.0027	-0.0253***	-0.0015	-0.0246***	-0.0012	-0.0250***	-0.0019	-0.0250***	-0.0025	-0.0253***
	(-0.6809)	(-9.6598)	(-0.4240)	(-5.4355)	(-0.4389)	(-12.2511)	(-0.5504)	(-5.5284)	(-0.6914)	(-4.9981)
Observations	74,700	74,700	74,700	74,700	74,700	74,700	74,700	74,700	74,700	74,700
R-squared	0.0917	0.0758	0.0927	0.0760	0.0923	0.0759	0.0920	0.0758	0.0909	0.0756
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

To conduct this test, we include five proxies for the quality of enforcement suggested by La Porta et al. (1998) and their interactions with EPL index to our baseline model. Table 9 reports the results. Consistent with our baseline results, EPL index has negative effects on leverage SOA. More importantly, the coefficients on the triple interaction term among EPL index, enforcement measures, and the distance from target ($EPL*ENFORCE*Dist$) are negative and statistically significant in most models (except for columns (6) and (10)). These results imply that in countries where laws are well enforced, the negative impact of labour regulation stringency on leverage SOA is more pronounced. Our analysis further shows that, consistent with prior studies (Öztekin, 2015; Öztekin & Flannery, 2012), the coefficients on the interaction term between enforcement measures and the distance from target ($ENFORC*Dist$) are positive and statistically significant at the 1 percent level, indicating that firms operating in countries with better law enforcements have faster leverage adjustment. The results support our second hypothesis (H2).

5. Further analyses

In this section, we extend our analysis in several ways to provide further support to our main results. Specifically, we examine the impacts of employment protection legislation index of regular versus temporary workers on leverage SOA, and the confounding impacts of firms' financial constraints on such associations.

5.1. Employment protection legislation index of regular versus temporary workers and leverage adjustment

As described in section 3.1.2, we measure the rigidity of a country's labour market using a summary index based on the average of the sub-indicators for regular (EPR) and temporary workers (EPT). These legal regulations serve distinct groups of workers with distinct characteristics and thus may have different impacts on leverage SOA. To examine the relative

importance of each of the components of the overall EPL index for firms' leverage adjustment, we re-estimate our baseline specification using EPL scores for temporary and regular workers separately.

The results are reported in Table 10. The coefficients on the interaction term between EPL index for temporary workers and the distance from target ($EPT*Dist$) remain negative and highly significant at the 1 percent level, which implies that an increase in the stringency of labour regulation afforded to temporary workers tends to lower firms' leverage SOA. However, the coefficients on the interaction term between EPL index for regular workers and the distance from target ($EPR*Dist$) are negative and statistically significant only for book leverage but are insignificant for market leverage. One plausible reason for such an ambiguous impact is that the use of temporary contracts costs firms more for labour turnover compared to regular contracts. As labour regulation affects firms' financing decisions by increasing firms' labour adjustment costs, the EPL index for temporary workers would affect firms' leverage adjustment more strongly than EPL index for regular workers.

Table 10. Further analyses: Employment protection legislation index of regular versus temporary workers and leverage adjustment

This table reports the regression results for the effect of EPL index for temporary and regular workers on the leverage speed of adjustment using the following models:

$$\Delta L_{i,j,t+1} = (\varphi_{i,j,t}EPL_{j,t} + \rho_{i,j,t}X_{i,j,t}) (Dist_{i,j,t}) + \vartheta_{i,j,t+1}$$

The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,j,t+1}$). $Dist_{i,j,t}$ is the different between the target leverage ratio and the actual leverage ratio. $EPL_{j,t}$ is proxied by EPL index for temporary workers (models (1)-(2)) and for regular workers (models (3)-(4)) that are measured by OECD. Control variables (vector $X_{i,j,t}$) including firm size ($SIZE$), tangibility ($TANG$), profitability ($PROF$), R&D expenses (RD), R&D dummy ($RDDUM$), depreciation expenses (DEP), market-to-book ratio (MTB), industry median leverage ratio ($INDLEV$), inflation rate ($INFL$), and GDP growth rate ($GGDP$). Year and country fixed effects are included in all models. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	EPT		EPR	
	ΔBL_{t+1} (1)	ΔML_{t+1} (2)	ΔBL_{t+1} (3)	ΔML_{t+1} (4)
<i>EPT*Dist</i>	-0.0181*** (-7.5431)	-0.0117*** (-4.7960)		
<i>EPR*Dist</i>			-0.0234*** (-5.2481)	-0.0024 (-0.4697)
<i>SIZE*Dist</i>	0.0043*** (7.8747)	0.0021*** (2.9785)	-0.0170*** (-8.4516)	-0.0097*** (-8.8891)
<i>TANG*Dist</i>	-0.0583*** (-6.5013)	-0.0078 (-0.9483)	-0.0498*** (-3.6370)	0.0010 (0.1019)
<i>PROF*Dist</i>	-0.0001 (-0.0062)	-0.0127 (-0.7929)	0.0557*** (2.8262)	0.0130 (1.5285)
<i>RD*Dist</i>	0.0256 (0.2631)	-0.2578*** (-3.3418)	-0.0843 (-1.0106)	-0.3179*** (-4.2297)
<i>RDDUM*Dist</i>	-0.0073 (-1.1667)	0.0152*** (2.5772)	0.0003 (0.0849)	0.0207*** (5.0512)
<i>DEP*Dist</i>	0.4259*** (6.0141)	0.2251*** (3.3942)	0.1735* (1.7974)	0.0891 (0.6921)
<i>MTB*Dist</i>	0.0000 (0.0170)	-0.0015*** (-3.5609)	-0.0009 (-1.2823)	-0.0021** (-2.5455)
<i>INDLEV*Dist</i>	-0.0853*** (-4.5075)	-0.0015 (-0.0838)	-0.1166*** (-3.8944)	-0.0142 (-1.4123)
<i>INFL*Dist</i>	1.8402*** (11.3651)	1.0135*** (5.9113)	1.4432*** (24.0671)	0.7666*** (3.6937)
<i>GGDP*Dist</i>	2.9870*** (24.3026)	2.6092*** (14.2448)	2.4035*** (15.3368)	2.3253*** (21.0645)
Constant	-0.0034 (-1.2257)	-0.0261*** (-12.7200)	-0.0019 (-0.5699)	-0.0247*** (-9.2435)
Observations	74,700	74,700	74,700	74,700
R-squared	0.0872	0.0750	0.0922	0.0759
Year FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES

5.2. EPLs and leverage adjustment: the impacts of financial constraints

Our argument is that more stringent labour regulations lead to higher labour adjustment costs, a greater burden of fixed wage claims going forward, and higher operating leverage. This, in turn, increases firms' asymmetric information and default risk, and thus, increases costs of leverage adjustments. This is even more of a concern for firms with greater financial constraints, as they find it harder to access the external capital markets.

We examine this argument by using various proxies of financial constraints: cash flow deficit, dividend payout, and firm size. These proxies are among the most widely used in the literature to measure a firm's ability to access external capital markets (Almeida, Campello, & Weisbach, 2004; Faulkender et al., 2012; Faulkender & Wang, 2006). To conduct the test, we include the interaction terms of EPLs and financial constraint measures into our baseline regressions (Eq. (6)). The results are reported in Table 11. We find that the coefficients of the interaction term $EPL*Dist$ are negative and highly significant, indicating a consistently negative relationship between EPLs and leverage SOA as in our baseline results. More importantly, the coefficients on the triple interaction term among EPLs, financial constraint proxies, and the distance to target ($EPL*FINCON*Dist$) are negative and statistically significant across models. This result lends support to our argument that the negative impacts of EPLs on leverage SOA are more pronounced for firms with a higher degree of financial constraints.

Table 11. Further analyses: Effects of financial constraints

This table reports the regression results for the effects of financial constraints on the association between EPL index and leverage SOA:

$\Delta L_{i,j,t+1} = (\varphi_{i,j,t}EPL_{j,t} + \Lambda_{i,j,t} EPL_{j,t} * FINCON_{j,t} + \Delta_{i,j,t}FINCON_{j,t} + \rho_{i,j,t}X_{i,j,t}) (Dist_{i,j,t}) + \vartheta_{i,j,t+1}$
 The dependent variable is the change in book and market leverage ratio ($\Delta L_{i,j,t+1}$). $Dist_{i,j,t}$ is the different between the target leverage ratio and the actual leverage ratio. $EPL_{j,t}$ is proxied by EPL index measured by OECD. $FINCON_{j,t}$ is firm's financial constraints that are proxied by firm's operating cash flow (columns (1)-(2)), dividend pay-out (columns (3)-(4)), and firm size (columns (5)-(6)). Control variables (vector $X_{i,j,t}$) including firm size ($SIZE$), tangibility ($TANG$), profitability ($PROF$), R&D expenses (RD), R&D dummy ($RDDUM$), depreciation expenses (DEP), market-to-book ratio (MTB), industry median leverage ratio ($INDLEV$), inflation rate ($INFL$), and GDP growth rate ($GGDP$). Year and country fixed effects are included in all models. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively. Standard errors are bootstrapped. T-statistics are reported in parenthesis. The variable definitions are in Appendix A.

VARIABLES	CF		DIVIDE		SMALL	
	ΔBL_{t+1} (1)	ΔML_{t+1} (2)	ΔBL_{t+1} (3)	ΔML_{t+1} (4)	ΔBL_{t+1} (6)	ΔML_{t+1} (7)
<i>EPL*Dist</i>	-0.0279** (-2.0636)	-0.1023*** (-6.6199)	-0.0167*** (-3.0276)	-0.0171*** (-5.6662)	-0.0144*** (-3.1542)	-0.0131 (-1.4455)
<i>EPL*FINCON*Dist</i>	-0.0262* (-1.7238)	-0.0440*** (-3.3557)				
<i>FINCON *Dist</i>	0.0233* (1.8636)	-0.0001 (-0.0048)				
<i>EPL*DIVIDE*Dist</i>			-0.0164*** (-2.7521)	-0.0125** (-2.5696)		
<i>DIVIDE *Dist</i>			0.1067*** (31.6564)	0.0484*** (8.1531)		
<i>EPL*SMALL*Dist</i>					-0.0105* (-1.8152)	-0.0037 (-0.3551)
<i>SMALL *Dist</i>					0.0603*** (15.7264)	0.0357*** (4.7655)
<i>SIZE*Dist</i>	0.0069*** (7.0012)	-0.0005 (-0.7788)	0.0024*** (2.8476)	0.0015 (1.2944)	0.0041*** (7.2190)	0.0020** (2.4288)
<i>TANG*Dist</i>	-0.0972*** (-3.6028)	-0.0383*** (-2.6631)	-0.0621*** (-5.5145)	-0.0028 (-0.3597)	-0.0537*** (-3.7364)	-0.0035 (-0.3610)
<i>PROF*Dist</i>	0.0136 (0.3072)	0.0199 (0.6682)	0.1002*** (4.2595)	0.0297*** (4.5216)	0.0230 (0.8167)	-0.0011 (-0.0566)
<i>RD*Dist</i>	-0.0221 (-0.1209)	-0.3964*** (-8.5744)	-0.0768 (-0.5268)	-0.3003*** (-8.7906)	-0.0411 (-0.3222)	-0.3013*** (-3.2559)
<i>RDDUM*Dist</i>	0.0051 (0.4643)	0.0079 (0.7059)	-0.0041 (-0.5206)	0.0166*** (5.3830)	-0.0036 (-0.5852)	0.0182** (2.5611)
<i>DEP*Dist</i>	0.1671 (1.1267)	0.1029 (0.5199)	0.2117** (2.0228)	0.1300 (1.1833)	0.2874*** (4.4377)	0.1395 (1.5189)
<i>MTB*Dist</i>	0.0001 (0.0535)	-0.0021*** (-2.6621)	-0.0005 (-0.7332)	-0.0021*** (-7.8856)	-0.0005 (-0.7049)	-0.0019*** (-2.6359)
<i>INDLEV*Dist</i>	-0.1549*** (-2.8088)	-0.1118*** (-5.0436)	-0.0909*** (-3.7578)	-0.0097 (-0.3694)	-0.0967*** (-4.0838)	-0.0070 (-0.4980)
<i>INFL*Dist</i>	4.5709*** (6.2903)	1.2093* (1.9376)	1.8160*** (17.2272)	0.9511*** (7.1071)	1.6005*** (13.2728)	0.8483*** (5.9576)
<i>GGDP*Dist</i>	2.0753*** (5.2777)	2.7773*** (3.5395)	2.6364*** (13.1216)	2.5073*** (12.2078)	2.6420*** (16.7642)	2.3991*** (17.1961)
Constant	0.0128*** (3.0584)	0.0225*** (8.1606)	-0.0004 (-0.1220)	-0.0243*** (-6.1315)	-0.0021 (-0.6080)	-0.0249*** (-8.9364)
Observations	25,446	25,446	73,605	73,605	74,700	74,700
R-squared	0.1061	0.0780	0.0944	0.0764	0.0898	0.0757
Year FE	YES	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES	YES

6. Conclusion

In this paper, we study whether and how changes in the stringency of EPLs in a country affects firms' leverage adjustment speed. Since recent literature suggests evidence of both positive and negative sides of the EPLs' stringency, the association between EPLs and leverage SOA is a priori ambiguous. Using intertemporal variation in the EPL index across 19 OECD countries between 1985 and 2007, we find strong empirical evidence that increases with the strictness of labour regulation reducing firms' leverage SOA. Our results are robust to alternative measures of labour regulation stringency, alternative measures of leverage, and alternative subsamples. Additionally, we address the endogeneity issues by using an IV approach, analysing cross-sectional heterogeneity, and adding additional control variables. Our findings remain valid in such analyses.

Furthermore, since previous literature shows that employment regulations are not fully enforced in countries with inefficient legal systems, we consider the impact of the effectiveness of a country's legal enforcement on the association between EPLs and leverage SOA. Using five proxies for the quality of enforcement suggested by La Porta et al. (1998), we find that in countries with effective legal enforcement, the negative impact of EPLs on corporate leverage SOA is more pronounced. We then extend our analyses in several ways to provide further empirical support. We find that the strictness of labour regulation afforded to temporary workers is also negatively associated with leverage SOA, whereas the effect of EPL index for regular workers on leverage SOA is relatively weaker. Further analysis on the impacts on financial constraints suggests that firms that find it harder to access the external capital markets have more severe decreases in leverage SOA when responding to more stringent labour protection.

Overall, our study highlights that the stringency of a country's labour protection laws is an important determinant in shaping firms' optimal capital structure decisions. Our evidence supports a negative, rather than positive, view of EPLs and thus contributes to an essential and timely debate on the pros and cons of a country's policies related to employment protection in the corporate sector, the economy, as well as the wider society.

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Appendix A. Variable definitions

Variables	Acronym	Description	Data source
A. Firm-level variable			
A.1. Leverage			
Book leverage	BLEV	Book value of total debt divided by book value of total assets	Worldscope
Market leverage	MLEV	Book value of total debt divided by the sum of market value of equity and the book value of total debt	Worldscope
Active leverage	ALEV	Book value of total debt divided by the sum book value of total assets and the total net income	Worldscope
A2. EPL variables			
EPL index by OECD	EPL	Employment protection legislation index ranging from 0 to 6	OECD
EPR index	EPR	Sub-indicator employment protection legislation index for regular workers ranging from 0 to 6	OECD
EPT index	EPT	Sub-indicator employment protection legislation index for temporary workers ranging from 0 to 6	OECD
EPL index by Allard (2005)	EPLA	Employment protection legislation index developed by Allard (2005) that extend the OECD indicator of employment protection	Allard (2005)
Collective relations law index	CRLI	This index comprises collective relation's laws that protect employees through collective action	Botero et al. (2004)
Social security laws index	SSLI	This index reflects pensions, sickness and healthcare coverage, and unemployment covering of employees	Botero et al. (2004)
Employment laws index	ELI	This index addresses the incremental cost to firms if they deviate from a rigid contract in which the conditions of employment are specified for all employees and no employee can be fired	Botero et al. (2004)

Unemployment coverage	UNEC	This index provides information on the generosity of unemployment benefits	Aleksynska and Schindler (2011)
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A3. Target leverage variables

Distance from Target	Dist	Difference between target and observed leverage ratio	Self-calculated
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A4. Other firm-level characteristics

Firm size	SIZE	Natural logarithm of book value of total assets	Worldscope
Tangibility	TANG	Net property, plant and equipment dividend by book value of assets	Worldscope
Growth opportunity	MTB	Ratio of book value of assets less book value of equity plus market value of equity to book value of assets	Worldscope
Profitability	PROF	Earning before interests, taxes, depreciation and amortization divided by book value of assets	Worldscope
Depreciation	DEP	Depreciation and amortization divided by book value of assets	Worldscope
Research and development	RD	Research and development expenses divided by book value of assets	Worldscope
Research and development dummy	RDDUM	Dummy variable that equals to one if research and development expenses are not reported and zero otherwise	Worldscope
Cash flow deficit	CASHFLOW	A dummy that equals one if the firm has a cash flow deficit and zero otherwise	Worldscope
Dividend pay-out	DIVIDE	A dummy that equals one if the firm pay dividend in a given year and zero otherwise	Worldscope

B. Industry-level variable

Industry median of leverage	INDMED	The median leverage ratio of an industry to which a firm belongs.	Self-calculated
Labour turnover rate	LaborTurnover	The frequency that a firm replaces its employees	U.S. Census Bureau's Quarterly Workforce Indicator

C. Country-level variable

GDP growth rate	GGDP	Annual GDP growth rate.	World Development Indicator
Inflation rate	INFL	Annual inflation rate	World Development Indicator
Efficiency of judicial system	EFFJUD	Measures the efficiency and integrity of the country's legal environment. The index is scaled from zero to 10; with lower scores, lower efficiency levels.	La Porta et al. (1998)
Rule of law	RULLAW	Measures the law and order tradition in the country. The index is scaled from zero to 10, with lower scores for less tradition for law and order.	La Porta et al. (1998)
Level of corruption	CORRUP	Measures the corruption level of the government in the country. The index is scale from zero to 10, with lower scores for lower level of corruption.	La Porta et al. (1998)
Risk of expropriation	RISEXP	Measures the risk of "outright confiscation" or "forced nationalization". The index is scaled from zero to 10, with lower scores for higher risks.	La Porta et al. (1998)
Repudiation of contracts by government	RISCON	Measures the "risk of a modification in a contract taking the form of a repudiation, postponement, or scaling down" due to "budget cutbacks, indigenization pressure, a change in government, or a change in government economic and social priorities". The index is scaled from zero to 10, with lower scores for higher risks.	La Porta et al. (1998)
English origin	ENGORI	Dummy variable equal to unity if the firm operates under English law, and zero otherwise.	La Porta et al. (1998)

Credit rights index	CREDITOR	A score of one is assigned when each of the following rights of secured lenders is defined in laws and regulations: First, there are restrictions, such as creditor consent or minimum dividends, for a debtor to file for reorganization. Second, secured creditors are able to seize their collateral after the reorganization petition is approved. Third, secured creditors are paid first from the proceeds of liquidating a bankrupt firm, as opposed to other creditors such as government or workers. Finally, if management does not retain administration of its property pending the resolution of the reorganization. The index ranges from zero (weak creditor rights) to four (strong creditor rights)	La Porta et al. (1998)
Tax shields	TAX	First-year effective tax rate (percent). The tax rate obtained by dividing the total corporate tax TaxpayerCo pays by its pre-tax earnings	Djankov, Hart, McLiesh, and Shleifer (2008)
Union density	UNION	the ratio of union membership divided by employment	OECD
Centralized bargaining	BARGAIN	Percentage of employees with the right to bargain	OECD

Chapter 5

Summary and Conclusion

The thesis includes three essays that investigate several determinants of the speed at which firms adjust their leverage to target ratios: liquidity – a financial firm-level factor, corporate sustainability performance – a non-financial firm-level factor, and employment protection laws – a country-level factor.

The two papers in the second chapter of this thesis examine the association between liquidity and leverage SOA using data from the UK market and international contexts, respectively. These two papers highlight the important role of equity liquidity in determining the speed at which firms move toward to the target leverage ratios, and how this association is affected by the position of actual leverage relative to target leverage, the target's stability, and country's institutional environments. The third chapter answers the question of how, and the extent to which corporate sustainability performance affects leverage SOA. The fourth chapter reveals the link between employment protection laws and speed of leverage adjustments, and how this association is conditional on the effectiveness of country's legal system.

The main findings from this thesis are:

- (i) Equity liquidity has positive and significant impact on the speed at which firms adjust back to their target leverage ratios;
- (ii) Equity liquidity only has a positive impact on the SOA of over-levered firms and this impact is moderated in countries with bankruptcy codes but has no significant impact on that of under-levered firms;

- (iii) The positive relationship between liquidity and SOA is more pronounced for firms whose current position is relatively close to their target leverage ratio and whose target ratio is relatively stable;
- (iv) The positive liquidity - leverage SOA relationship is less pronounced for firms in strong institutional environments and more pronounced for firms in weak institutional environments;
- (v) Firms with superior CSP tend to adjust faster toward their target leverage ratios.
- (vi) There are four mechanisms through which CSP positively affects the speed of leverage adjustments: information asymmetry, equity mispricing, stakeholder engagements, and competitive advantages;
- (vii) The positive association between CSP and leverage adjustment speed is less pronounced in countries with high-quality institutions;
- (viii) An increase in the stringency of EPLs significantly decreases leverage adjustment speeds; and
- (ix) The response of leverage adjustment to changes in EPLs is more pronounced in countries with effective legal enforcement.

The details of these findings are set out in Sections 5.1 to 5.3. Section 5.4 presents the contributions and implications of the thesis's findings. Section 5.5 describes the limitations of this research and suggests future research areas.

5.1. Main findings of Chapter 2

Despite the evidence that equity liquidity and the speed at which firms adjust toward their target leverage are related, and despite the theoretical prediction among them, how liquidity determines firms' leverage SOA is largely unknown to us. Chapter 2 investigates this association through two papers. The first paper, "Liquidity and dynamic leverage adjustments: Evidence from the UK", examines the impact of liquidity on the speed that firms adjust toward

their target leverage using the UK data. Though several studies have examined the capital structure choices of UK firms (Bennett & Donnelly, 1993; Bevan & Danbolt, 2002, 2004; Dang, 2013), they do not investigate the dynamic leverage adjustments. Although, there are some studies investigating leverage adjustments in the US (Devos et al., 2017; Faulkender et al., 2012; Warr et al., 2012), it is unclear whether US findings in dynamic capital structure research are sample-specific and driven by institutional characteristics of the US market. This study adds to the empirical literature on the analysis of the dynamic leverage adjustments in the UK market.

Whilst prior studies have well documented the association between liquidity and firms' static capital structure (e.g., Lipson & Mortal, 2009), there has been no prior research that investigates the crucial role of equity liquidity in determining corporate dynamic leverage adjustments. Previous literature suggests that highly liquid firms have lower financial transaction costs, which is the main part of leverage adjustment costs (Amihud & Mendelson, 1986). Additionally, high liquidity helps firms to reduce issuing costs of both equity and debt financing (Butler et al., 2005; Cheung et al., 2019; Hennessy & Whited, 2005). This paper provides evidence that firm-level liquidity impacts both capital structure (Lipson & Mortal, 2009) and leverage adjustment speed.

Further analyses show that liquidity only has a positive effect on the SOA of over-levered firms but has no significant effect on that of under-levered firms. The reason is over-levered firms are most likely to raise equity to correct the imbalance and they are even more motivated to do so if they enjoy high equity liquidity. Under-levered firms are most likely to correct the imbalance by issuing debt, which is relatively unaffected by the state of the liquidity of its equity. The paper further highlights an interactive association among liquidity, leverage deviation, target instability, and leverage SOA: the positive relationship between a firm's liquidity and leverage SOA is more pronounced for firms which deviate less from target leverage and/or have higher target stability.

The second paper presented in Chapter 2 “Liquidity and speed of leverage adjustment” examines the relationship between liquidity and leverage SOA using an international sample of 35 countries. The paper confirms that high firm-level liquidity not only reduces equity financing costs, but also improves corporate governance, which results in lower costs of leverage adjustment. This finding is consistent with the previous literature on micro-finance (Amihud & Mendelson, 1986; Chang et al., 2014; Dang et al., 2015; Liao, Mukherjee, & Wang, 2015; Lipson & Mortal, 2009; Maug, 1998; Noe, 2002).

Secondly, consistent with the previous paper, this study shows that liquidity only has a significantly positive impact on the leverage SOA of over-levered firms. For under-levered firms, however, the association is ambiguous. Especially as due to the high level of debt, the threat of bankruptcy is generally more severe for over-levered firms. In adjusting to target leverage, over-levered firms substitute equity for debt and decrease their threat of bankruptcy. This paper finds that in countries with explicit bankruptcy codes, the threat of bankruptcy of over-levered firms is less severe, which leads to the impacts of liquidity on leverage SOA for over-levered firms being moderated.

Thirdly, this paper suggests that strong institutional environments, proxied by the strength of law and order, risk of expropriation, risk of contract repudiation by government, level of corruption (La Porta et al., 1998), creditor rights enforcement (Djankov et al., 2003), and the significance of the banking sector (Demirgüç-Kunt & Maksimovic, 1996) tend to attenuate the positive association between liquidity and leverage SOA.

5.2. Main findings of Chapter 3

Chapter 3 consists of one research paper “The effect of corporate sustainability performance on leverage adjustments”. This paper investigates the association between CSP and leverage SOA,

the potential underlying economic mechanisms of this association, and the impact of a country's institutional environments on this association.

Previous literature shows that CSP has a potential to enhance firms' value by improving financial performance through lowering the idiosyncratic financial constraints (Cheng et al., 2014), reducing firms risk (Sassen et al., 2016), and sinking the costs of capital (Bae et al., 2019; El Ghoual et al., 2018; Goss & Roberts, 2011). This paper contributes to the literature by providing empirical evidence on a new mechanism through which CSP leads to corporate value creation that is increasing the speed with which firms adjust their leverage toward the target ratios and predisposes them to operate at the optimal level of leverage that balances the benefits against the costs of debt financing. To test the hypotheses, this paper employs a cross-country panel dataset from the Thomson Reuters and Bloomberg databases for 2,869 publicly listed firms from 31 countries for the period between 2002 and 2018.

The results show that CSP has a positive and significant association with the speed of leverage adjustments toward the target. Since previous literature recommends that CSP can lower firm risks, reduce costs of capital, improve information transparency, enhance stakeholder engagements, and generate competitive advantages (Breuer et al., 2018; Cao et al., 2019; Cho et al., 2013; Choi & Wang, 2009; El Ghoual et al., 2018; El Ghoual et al., 2011; Goss & Roberts, 2011; Sassen et al., 2016), firms with superior CSP have lower leverage adjustment costs, and thus, faster adjustment speeds. The robustness of the results are confirmed by using a wide range of tests: alternative control variables, substituting leverage and target leverage with alternative measures, alternative econometric method, and re-estimating the baseline model with different subsamples. To mitigate potential endogeneity and correlated omitted variables concerns, the instrument variable approach that employs the two-stage feasible efficient generalized method of moment's estimation with validity-tested instruments is applied. The main findings of the paper remain valid.

In further analysis, the paper investigates four mechanisms through which CSP positively affects the leverage SOA and finds that information asymmetry, equity mispricing, stakeholder engagements, and competitive advantages significantly determine this association. The paper also indicates that strong institutional environments attenuate the positive association between CSP and leverage SOA. This result is consistent with the view that institutional settings are an external and less costly mechanism that firms could employ to reduce asymmetric information and enhance stakeholder engagements, thus, speeding up their leverage adjustment (An et al., 2015; Çolak et al., 2018; Öztekin, 2015; Öztekin & Flannery, 2012).

5.3. Main findings of Chapter 4

Chapter 4 consists of one research paper titled “OECD labour protection and dynamic leverage adjustments”. This paper examines the crucial role of a country-level factor, EPL, in determining the speed at which firms adjust to their target ratio. Prior literature has examined the impacts of several macro-level determinants of leverage SOA such as macroeconomic conditions (Cook & Tang, 2010), institutional arrangements (Öztekin & Flannery, 2012), and political uncertainty (Çolak et al., 2018). Labour is a key factor of production that affects many aspects of corporate performance (Acharya et al., 2013, 2014; Cui et al., 2018; Karpuz et al., 2020). To date, however, the literature has largely ignored the importance of the legal framework related to employees – a nonfinancial element, in determining leverage adjustments. To test the hypotheses, the paper uses the EPL index developed by the OECD for its member countries during the 1985-2007 period. The baseline results suggest that firms operating in the countries with more stringent labour protection more slowly adjust to their target leverage. The results are robust when using alternative measures of EPLs (Aleksynska & Schindler, 2011; Allard, 2005; Botero et al., 2004), alternative measures of leverage, and alternative subsamples of countries and firms. To address the endogeneity issues, the paper uses three approaches: instrumental variable approach using legal origin as an instrument for labour protection (Botero

et al., 2004); examining the different effects of labour regulation's stringency across industries with different labour adjustment characteristics (Rajan & Zingales, 1998); and controlling for additional variables to capture potential confounding impacts that may be biasing the results. Overall, results from these tests jointly specify that main finding of the paper is unlikely to be driven by the potential endogeneity issues.

The paper next investigates the influence of the effectiveness of a country's legal enforcement on the relationship between EPLs and leverage SOA. As labour regulations have weak compliance and are not fully enforced in countries with weak legal systems (Rutkowski & Scarpetta, 2005), the leverage SOA is less sensitive to changes in labour laws in such countries. Extending the analyses, the paper further shows that an increase in the stringency of labour regulation afforded to temporary workers tends to lower firms' leverage SOA while the impact of EPL index for regular workers on leverage SOA is relatively weaker. Moreover, more stringent EPLs decreases the leverage SPA more severely for firms with greater financial constraints, as they find it harder to access the external capital markets.

5.4. Contributions and Implications

This study contributes to the literature in several ways. Overall, by using dynamic partial adjustment models of capital structure, this thesis introduces new determinants of leverage SOA including a financial firm-level factor – equity liquidity; a non-financial firm-level factor – CSP; and a country-level factor – EPL. Consistent with the extant empirical literature on dynamic capital structure adjustments, we contribute to the growing literature on the determinants of the leverage SOA (An et al., 2015; Çolak et al., 2018; Devos et al., 2017; Faulkender et al., 2012; Öztekin & Flannery, 2012). In detail, Chapter 2 of the thesis adds to recent research on the relationship between the sensitivity of cost of equity on leverage deviation and leverage SOA (Zhou et al., 2016) to show that firm-level liquidity affects both capital structure (Lipson & Mortal, 2009) and the SOA of leverage, and this effect is very distinct between under- and over-

levered firms. The chapter also contributes to the empirical literature on the association between equity liquidity and firms' capital structure decisions in the UK market. Although several studies have examined the capital structure choices of UK firms (Bennett & Donnelly, 1993; Bevan & Danbolt, 2002, 2004; Dang, 2013), the dynamic leverage adjustments have not been examined. The thesis thus fills this important gap in the literature by examining dynamic leverage adjustments in the UK. This chapter further contributes to the empirical literature on the joint relationship among equity liquidity, leverage deviation, target stability and leverage SOA, given that there is theoretical and empirical evidence that these elements are associated. By using an international sample, Chapter 2 examines how country-level environments affect the sensitivity of leverage SOA to liquidity, hence contributing to the extant literature on the impacts of macro-level institutional environments on corporate capital structure decisions and aggregate financial markets.

Chapter 3 introduces a new non-financial essential element, corporate sustainability performance, which explains the cross-sectional variation of leverage SOA. The chapter further explores the potential underlying economic channels and identifies four mechanisms that explain the association between CSP and leverage adjustment speeds: information asymmetry, equity mispricing, stakeholder engagements, and competitive advantages. This chapter highlights the impact of institutional settings on capital structure that strong institutional settings are a substitute for CSP that mitigates the positive association between CSP and leverage SOA. Finally, Chapter 4 contributes to a growing literature that explores the important role of labour market mechanisms on various corporate decisions, specifically, the significant role played by a country's labour protection in determining firms' optimal capital structure decisions. The study also adds to the large body of research on dynamic capital structure by showing that labour protection laws are a new and important element that firms take into account in determining the leverage adjustments.

This study has several implications. Firstly, corporate's managers may improve equity liquidity and/or invest more on sustainability activities at the firm-level to increase the speed of leverage adjustment, thus enhancing a firm's value. However, to the extent that such activities are costly, in financial and opportunity costs, these need to be traded off against the benefits of increasing leverage SOA. The thesis's findings have important implications for corporate strategic planning on the privately optimal levels of CSP and liquidity activities.

From a policy perspective, our findings speak to the importance of equity liquidity and CSP investments in a firm's financing performance. Governments and authorities should consider using regulations to encourage firms to improve their liquidity, as well as environmental, social, and corporate governance performance, and create good-quality institutional settings. Additionally, countries may use regulations on labour protection laws to shape firms' optimal capital structure decisions. They may also strengthen their institutional environments to enhance the impacts of equity liquidity, CSP, and EPL on firms' leverage SOA.

5.5. Limitations and directions for future research

The static trade-off theory of capital structure suggests that a corporate can maximize its value by operating at a target leverage level that balances the benefits and costs of debt financing. The dynamic trade-off view predicts that when firms deviate from their target levels, they will make adjustments to move back to the target (Fischer et al., 1989; Goldstein, Ju, & Leland, 2001; Leary & Roberts, 2005). However, due to financing frictions, this adjustment can involve nontrivial costs, making the capital structure adjustment dynamic in nature and the SOA unexpectedly slow. This thesis investigates three new firm-level and macro-level determinants that impact firm's speed of leverage adjustments. Given the importance of corporate capital structure's decision, future research could reveal more determinants that potentially affects the costs of firms' leverage adjustment to help firms maximize their values.

Additionally, the thesis examines the determinants of leverage SOA using an international context. Evidence shows that different countries are distinct in trading mechanisms and sustainability concerns, resulting in different levels of stock liquidity and sustainable investments (Brown & Zhang, 1997). It is, therefore, interesting to discover how stock liquidity and CSP affect dynamic leverage adjustments in different markets. In the future, study could focus on a single market in the different stock trading mechanisms such as pure order-driven (e.g., Australia), quote-driven (e.g., US), developed, or emerging markets to have a comparison among these distinct markets. Moreover, the observation is that findings from the thesis suggest that firms in an under-levered position display only a weak propensity to move back to their target ratios. Another important topic for future analysis would involve a closer examination of what drives the different behaviors of over- and under-levered firms.

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Nature of contribution by PhD candidate

Data collection, literature review, empirical analysis, writing up the initial draft.

Extent of contribution by PhD candidate (%)

70%

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Name	Nature of Contribution
Yue (Susanna) Lu	Interpretation of results; editing and proofreading.
Martin Bai	Conceptualization, Supervision, Visualization, Review & Editing

Certification by Co-Authors

The undersigned hereby certify that:

- ❖ the above statement correctly reflects the nature and extent of the PhD candidate's contribution to this work, and the nature of the contribution of each of the co-authors; and
- ❖ that the candidate wrote all or the majority of the text.

Name	Signature	Date
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Martin Bai		27/08/2020

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Chapter 2. Ho, L., Lu, Y., & Bai, M. (2020). Liquidity and speed of leverage adjustment. Australian Journal of Management, forthcoming.

Nature of contribution by PhD candidate

Literature review, data collection, empirical analysis, writing up the initial draft

Extent of contribution by PhD candidate (%)

70%

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Chapter 3. Currently under third-round review of The British Accounting Review. Ho, L.; Bai, M.; Lu, Y.; & Qin, Y. (2020). The effect of corporate sustainability performance on Leverage adjustments.

Nature of contribution by PhD candidate *data collection, literature review, empirical analysis, writing up the initial draft*

Extent of contribution by PhD candidate (%) *70%*

CO-AUTHORS

Name	Nature of Contribution
<i>Yue (Susanna) Lu</i>	<i>Interpretation of the results, editing and proofreading.</i>
Martin Bai	Conceptualization, Supervision, Visualization, Review & Editing
Yafeng Qin	Data collection, interpretation, editing and proofreading

Certification by Co-Authors

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Martin Bai	<i>[Signature]</i>	27/08/2020
Yafeng Qin	<i>[Signature]</i>	27/08/2020

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Please indicate the chapter/section/pages of this thesis that are extracted from a co-authored work and give the title and publication details or details of submission of the co-authored work.

Chapter 4. Currently under review of Management Science. Ho, L; Bai, M; & Lu, Y (2020). OECD Labor Protection and Dynamic Leverage Adjustments.

Nature of contribution by PhD candidate

Data collection, literature review, empirical analysis, writing up the initial draft

Extent of contribution by PhD candidate (%)

70%

CO-AUTHORS

Name	Nature of Contribution
Yue (Susanna) Lu	Initiation of the research topic; editing and proofreading
Martin Bai	Conceptualization, Supervision, Visualization, Review & Editing

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