Essays on income distribution:

Special reference to pay inequality, labour share and income inequality

A thesis

submitted in fulfilment

of the requirements for the degree

of

Doctor of Philosophy in Finance

at

The University of Waikato

by

Roya Taherifar

2023

Abstract

This thesis comprises three essays on important areas of income distribution: pay inequality, labour share, and income inequality. The primary objective of this research is to enhance our understanding of the factors influencing or the consequences associated with these three domains. The first two essays in this thesis focus on firm-level income distribution by investigating the determinants and impacts of pay inequality and labour share within firms. The third essay gives attention to the determinants of income inequality at the macro-level.

The first essay investigates the relationship between CEO-employee pay inequality and employee performance. Existing empirical studies are inconsistent about the directionality of the effect. However, this study argues that seemingly contradictory predictions about the linkage between pay inequality and employee performance are more complementary than contradictory. Using a sample of Australian firms, this study estimates expected pay inequality according to CEOs' and employee skills, company characteristics, and the labour market. Consistent with our expectation, our result shows that pay inequality is positively associated with CEOs' skills while negatively related to employee skills, employee outside opportunities and corporate governance effectiveness. We then assess the impact of pay inequality on employee performance. Our results show that pay inequality explained by individuals' skills, company characteristics, and the labour market is positively associated with employee performance. This positive impact on employee performance declines at high levels of such explained pay inequality. However, pay inequality unexplained by those factors has a negative impact on employee performance. In general, this study has managerial implications for designing compensation structures across hierarchical levels within a firm to motivate employees and enhance their performance.

The second essay examines the drivers of labour share and its relationship with personal income distribution. Recent decades in Australia have seen a fall in labour share and a rise in income inequality, resulting in a growing number of empirical studies attempting to explain these trends and their relationship. However, most studies rely heavily on country or industry aggregate macro data and downplay the importance of firm-level data. Using panel data for Australian listed firms between 2004 and 2019, we first examine the impact of technological progress, product market power and labour market power on firm labour share. The results show that the decline in Australian labour share is mainly driven by technological progress and increasing product market power. However, labour market power does not have a significant

impact on labour share. Further analysis shows that technological progress is not a significant driver of labour share in firms with highly skilled employees or those firms that are less capital-intensive. Technological progress and product market power have a more considerable negative impact on labour share in firms with a higher level of external funds. This study also examines the impact of within-firm labour share on pay inequality between CEOs and employees. It finds that declining labour share is a significant factor in the evolution of pay inequality. Moreover, a 10% decline in labour share increases pay inequality by 4.19%. Additional tests show that the significant determinants of labour share, technological progress, and product market power can moderate the negative impact of labour share on pay inequality. We find that labour share has a larger negative impact on pay inequality in firms with lower technological productivity and higher product market power. Overall, this study extends the current literature by documenting firm-level drivers of labour share in Australia, covering all sectors, and providing novel firm-level evidence on the relationship between labour share and pay inequality.

Turning to our analysis of income distribution at the macro-level, the third essay explores the impact of financial development on income inequality. Despite the development of the financial system, income inequality has risen in many countries since the 1980s. This has led to a debate about whether financial development comes at the cost of income inequality. Despite the increasing academic focus on this subject, the income distributional impact of financial development remains unsolved. This study argues that a country's openness to international trade and capital flows may affect the nexus between financial development and income inequality. Using a panel of 71 developing and developed countries for 1994–2017, our empirical results suggest that in an economy relatively closed to the world financial or goods markets, growing financial development does not significantly influence income inequality. However, if an economy is relatively open to the world financial and goods markets, inequality within the domestic economy increases as its financial markets develop. This finding is consistent across different econometric methods, subsamples and interaction analyses, and distinct financial development indicators. Overall, the evidence of the pro-inequality impact of financial development in open countries informs policymakers about the importance of redistribution policies in countries with a higher degree of openness.

Notes on Publications

Each chapter in this thesis has resulted in several publications, including working papers and conference presentations. Some of these have been submitted to journals for possible publication and are under review.

Chapter 2: Is performance affected by the CEO-Employee pay gap? Evidence from Australia

Presented at the 2021 NZAE Virtual PhD Workshop, Auckland, 26-27 October 2021.

Presented at the New Zealand Finance Meeting, 10^{th} annual meeting, Auckland University of Technology, New Zealand, 9-10 December 2021.

Published as Waikato University Economics Discussion Paper 21/14.

Chapter 3: The drivers of labour share and impact on pay inequality: A firm-level investigation

Presented at the NZAE, Victoria University of Wellington, New Zealand, 29 Jun- 1 July 2022.

Published as Waikato University Economics Discussion Paper 23/03

Chapter 4: Does economic openness matter in the impact of financial development on income inequality?

Will be presented at the NZAE, Auckland University of Technology, New Zealand, 28 Jun- 30 Jun 2023.

Published as Waikato University Economics Discussion Paper 23/04

Acknowledgements

My PhD journey has been a life-changing experience that has pushed me beyond my limits and helped me grow in ways I never thought possible. It has taught me the importance of perseverance, determination, discipline, and hard work. I am deeply grateful to the many people who have contributed to my journey and helped shape my perspective. My utmost thanks go to my chief supervisor, Professor Mark J Holmes. His exceptional supervision has been invaluable, providing me with the tools and knowledge necessary to conduct quality research and has shaped my attitude toward research. I will always be grateful for his insightful feedback, constructive criticism, and thoughtful suggestions, which have played an instrumental role in shaping the outcome of this thesis. I am truly fortunate to have had him as my supervisor, who was a source of sage advice on both academic and non-academic challenges. I am also sincerely thankful to Dr Gazi Hassan, my second supervisor, for his time and valuable inputs that allowed me to enhance the quality of this thesis. His suggestions on research questions and methodology helped improve my critical thinking and develop my econometrics knowledge, which I am truly grateful for. I would also like to thank Dr Martin Bai and Dr Greg Hou for their invaluable contributions and critical inputs in the early stages of this thesis. Additionally, I want to express my gratitude to Prof. Kathryn Pavlovich, Dr Amanda Williamson, Dr Cécile L'Hermitte, Prof. Mark Harcourt, and Dr Narges Safari for their generous help at different points.

I am immensely grateful to Prof. Frank Scrimgeour and Maria Neal for giving me the opportunity to lecture during my PhD. Their trust in my abilities has been instrumental in shaping my future academic career. In addition, I want to express my heartfelt appreciation to Amanda Sircombe and Denise Martin for their outstanding support with administrative matters during my study at the School of Accounting, Finance, and Economics, University of Waikato. Without their tireless help, this journey would not have been successful. I am also indebted to Judy McDonald for proofreading several chapters for me. Her keen eye for detail and expertise have been invaluable to me. Additionally, I would like to thank the various University of Waikato librarians who have assisted me with tracking down materials. Lastly, I want to acknowledge the University of Waikato for awarding me a PhD scholarship, which allowed me to pursue my studies and achieve my academic goals. I am incredibly grateful for their support and investment in my future.

I am deeply grateful to my friends Zahra, Ahmad, Shima, Evelize, Mona, Sarah, Zaira, Sandamali, Mono, Fasana, Srinath, and all the other brilliant PhD candidates from Waikato Management School who have been a constant source of inspiration and unwavering support throughout this journey. Their friendship and meaningful conversations have been a lifeline during the most challenging moments, and I could not have made it this far without their encouragement and guidance.

I would like to thank my family who stand by my side during this journey. Thank you so much, Mom and Dad, for your unconditional love and support, and to my beloved sisters, Leila and Mahsa, for always being my biggest cheerleaders and for believing in me even when I doubted myself. Last, but definitely not least, thanks Matija for all the support, encouragement and love you give me on a daily basis.

Table of Contents

List of Tables

Lists of Figures

List of Appendices

Chapter 1
Introduction

1.1 Overview on income distribution

The distribution of income refers to the way in which the total income generated in society is distributed among its members. One of the main questions in this subject, which has been a central topic in political philosophy throughout history, is what constitutes a just distribution of income. Several schools of thought have responded to this question, with answers defining just distribution based on the well-being of the least well-off member of the society (e.g., egalitarianism, social contract theories (chiefly Rawls), and Marxism); emphasising consequences (e.g., utilitarianism, Pareto Principles, and the absence of envy concept); and addressing proportionality and individual responsibility (e.g., equity theory, desert theory, and Robert Nozick's theory) (Konow, 2003). Different answers to the same question make the issue more complex and raise the question of which school of thought does my opinion align with? More importantly, what do I think is a just income distribution?

Defining a just distribution often requires taking a step back and investigating the underlying mechanisms and dynamics of income distribution. Once the facts are clear, the term "Income Distribution" may also raise concerns about fairness. By considering the various driving factors of income distribution, and its impact on society overall, one can make informed decisions about how just income distribution should be. Therefore, the broad objective of this thesis is to extend the current literature on the underlying factors and effects of income distribution, which ultimately can contribute to determining what a just distribution should be, rather than recommending a definition for a fair distribution.

Investigating the driving factors of income distribution and its consequences is important. On one hand, examining the determinants of income distribution sheds light on the factors contributing to income disparities in society, thereby enabling policymakers and economists to develop targeted interventions to alter the distribution of income. On the other hand, studying the impacts of income distribution provides insights into how income distribution can be related to topics such as economic growth and sustainability, poverty, and the overall welfare of individuals and communities. As a result, understanding both the determinants and effects of income distribution provides a strong foundation for designing an appropriate distribution of income that leads to desired outcomes in society and for formulating a plan to achieve the targeted income distribution.

To achieve our objective, it is crucial to clearly define the scope of the income distribution under examination. In other words, it is important to specify the group of individuals whose income distribution is being analysed. The study of income distribution in the field of economics can be divided into two distinct approaches: the personal distribution of income (PDI) and the functional distribution of income (FDI). PDI examines the distribution of income among individuals or households while FDI focuses on the distribution of income returns among the various factors of production. These approaches can be analysed at the firm level, involving the distribution of income within specific organizations; and the macro level, which examines the overall distribution of income. This thesis uses both approaches by focusing on three scopes of the distribution of income: Pay Inequality (PDI at the firm level), Labour Share (FDI at the firm level) and Income Inequality (PDI at the macro level) in which we contribute to the literature by filling the gap related to either their determinants or impacts.

1.1.1 Pay inequality

Pay inequality within firms has been defined in different ways, including disparities in pay among individuals doing the same job (horizontal pay inequality); among individuals in different levels of an organisation (vertical pay inequality); or among all individuals in an organisation (overall pay inequality). Most research has focused on the effects of horizontal or overall inequality (Downes & Choi, 2014; Gupta et al., 2012). However, vertical pay inequality – especially between chief executive officer (CEO) and rank-and-file employees – has been the subject of debate and criticism by the popular press and regulators. The Economic Policy Institute's 2021 report (Bivens & Kandra, 2022) highlights that in the US from 1978 to 2021, the compensation of top CEOs (based on a "realized" measure that counts stock awards when vested and stock options when cashed in and ownership is taken) increased by 1460%, which is far higher than S&P stock market growth (1,063%) and top 0.1% earnings growth (385% between 1978 and 2020) while compensation of the typical employee rose by 18.1% from 1978 to 2021. This higher growth in top CEO compensation over typical worker compensation led to a rising gap between CEOs and average employees. The report shows that the ratio over the last two decades has been far higher than at any point in the 1960s, 1970s, 1980s, or early 1990s.

In 2021, a CEO in the US earned 399 times the average pay of a typical worker, up from 366 times in 2020, 59 times in 1989 and 20 times in 1965.

CEO-employee pay inequality is not just a problem in the US; it is a global issue. Several studies and reports have shown an increasing pay gap between CEOs and average workers in many countries. For example, according to a report by Business Standard (2022) (Kumar, 2021), the difference between CEO and median employee salaries in India has grown from 179 to 184 between 2019 and 2021. Additionally, Speke et al. (2022) illustrate that FTSE100 companies in the UK paid their CEOs, on average, 112 times more than the average compensation of their employees in 2021, an increase from the 88 times ratio observed in 2020. Recently, Kotnik and Sakinç (2022) performed an analysis that compared the CEO-to-average-employee pay ratio in 11 EU countries using a sample of publicly-traded companies listed in the S&P Europe 350 index. Their findings indicate that the pay inequality between CEOs and average employees varied greatly, with ratios ranging from 211 to 51. Specifically, Ireland, France, and the UK were found to have the highest ratios at 211, 113, and 105, respectively. Conversely, Belgium and Italy were identified as having the lowest ratios at 51 and 54, respectively.

In response to the growing pay inequality between CEOs and employees, various countries have implemented regulations aimed at improving corporate pay policies, promoting transparency, and mitigating pay inequality. The Securities and Exchange Board of India (SEBI) rule has required that publicly traded companies disclose the remuneration of their top management vis-à-vis other employees since 2015.[1] In a similar vein, in the US, the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 has imposed additional regulations on executive compensation, such as disclosure of the CEO-worker pay ratio. Since 2017, the Pay Ratio Disclosure Rule requires most public companies listed in the US to disclose the median annual total compensation of all employees as well as the ratio of the CEO's total compensation to this value. Following this, the UK's Companies (Miscellaneous Reporting) Regulations 2018 requires all publicly listed firms with more than 250 UK employees to publish the ratio between their CEO's remuneration and the median, lower quartile and upper quartile pay of their UK employees from 2019. In addition to the pay ratio disclosure rule, in 2021, the 'Tax Excessive CEO Pay Act' was also introduced by the US Senate. The legislation would impose an additional corporate tax on companies that pay their CEOs at least 50 times more than the median pay of employees based on the CEO-to-median-worker pay ratio reported to the Securities and Exchange Commission by public companies. According to this, the corporate tax rate would increase by 0.5% for those companies reporting at a ratio of 50 to 1 and grow to a rate of 5% for those companies reporting a ratio of 500 to 1 or higher.[2]

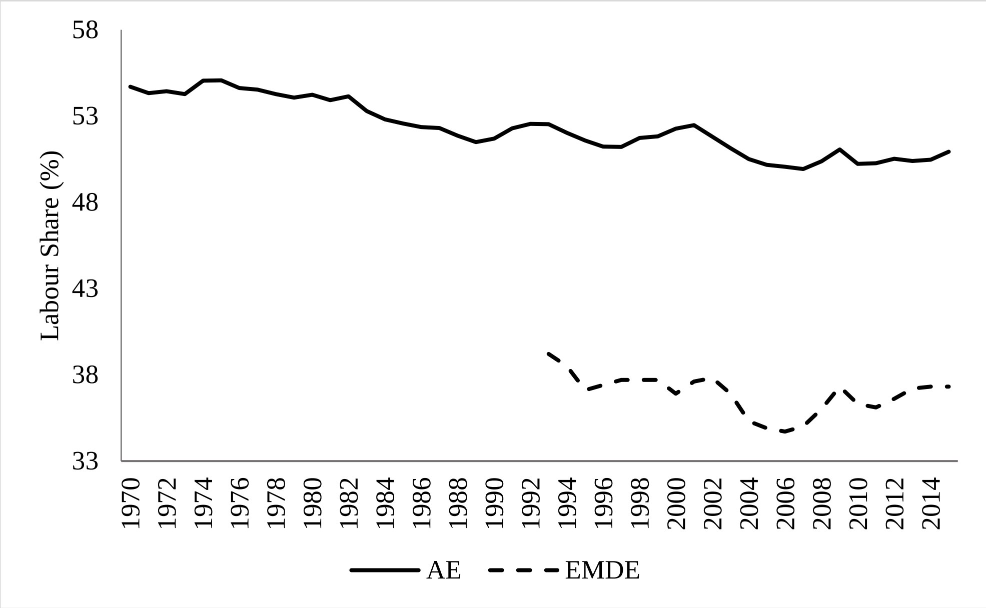
The debate surrounding the introduction and implementation of these new regulations expands the literature on the effects of CEO-employee pay inequality. In an organisational setting, some studies show that increasing the gap between executives' and employees' compensation is associated with higher firm value and operating performance (e.g., Banker et al., 2016; Faleye et al., 2006). In contrast, other studies show that high pay ratios are associated with lower performance in Korea (Shin et al., 2015) and lower perceived investment potential in an experiment using participants from Singapore (Kelly & Seow, 2016). A recent study by Rouen (2020) finds that the portion of the CEO-employee pay inequality explained by economic factors is positively related to firm performance; while the unexplained portion of the CEO-employee pay inequality is negatively associated with firm performance. Research on the impacts of CEO-employee pay inequality has mostly focused on its association with firm performance and little is known about its impact on employee performance. Therefore, Chapter 2 of this thesis contributes to this area of research by exploring the relationship between CEO-employee pay inequality and employee performance.

1.1.2 Labour share

National income is defined as the sum of all income available to the residents of a given country in a given year that can be distributed between labour (as wages, salaries, and bonuses) and capital (as rent, interest, and profit). Hence, the labour share and capital share are part of the national income allocated to labour and capital, respectively. For a long time, the idea accepted by most economists was that the labour share and capital share are quite stable in the long term, and this stability was a fundamental feature of macroeconomic models. The stability of labour share was one of the famous Kaldor (1961) "stylised facts" of economic growth. This stability had a broad implication for the shape of the well-known Cobb-Douglas production function that often characterises economic modelling. Keynes (1939, p. 48) called this empirical constancy "one of the most surprising, yet best-established, facts in the whole range of economic statistics".

Over the past few decades, however, empirical studies have challenged the idea of stable labour share and uncovered a decline in aggregate labour share in many countries for which data were available (Dao et al., 2019; Karabarbounis & Neiman, 2014). Dao et al. (2019) show that, in advanced economies, labour share has declined since 1980, reaching the lowest level in the past half century (at 49.9%) just before the global financial crisis. In emerging market and developing economies, though data are more limited, labour shares have also declined since the early 1990s in more than half of them – especially the larger economies in this group (Fig. 1.1). The falling labour share implies that an economy's value added is distributed less to those who produce the value added and more to those who own the means of production.

Figure 1.1. Evolution of the labour share of income



Note: For advanced economies (AE) the figure shows averages weighted by nominal GDP in current US dollars. For emerging markets and developing economies (EMDE) the figure shows year-fixed effects weighted least squares regressions (using nominal GDP weights) that also include country-fixed effects. Year-fixed effects are normalized to reflect the level of the labour share in 2000.

Source: Dao et al. (2019)

This steady decline in labour share leads to a growing literature on the drivers of this downward trend and numerous potential explanations have been suggested. One set of explanations involves technological change (Acemoglu & Restrepo, 2018; Bentolila & Saint-Paul, 2003; Eden & Gaggl, 2018; Karabarbounis & Neiman, 2014). For example, Karabarbounis and Neiman (2014) put forward the notion that the fall in the cost of capital relative to labour has displaced labour and has lowered the labour share. Alongside technological change, the rise in global integration through trade and participation in global value chains can also lead to a decline in labour share (Elsby et al., 2013). Similarly, Böckerman and Maliranta (2012) present evidence that exposure to international trade is related to the labour share decline in Finland. Another stream of literature emphasises the role of product market power in the falling labour share (Autor et al., 2020; De Loecker et al., 2020). Some studies indicate that the rise in the US aggregate mark-up, driven by the reallocation of economic activity toward large and high mark-up firms with lower labour share, decreases the aggregate labour share (Baqaee & Farhi, 2020; De Loecker et al., 2020). Furthermore, some researchers claim that decreased labour market power is a potential cause of the declining labour share (e.g., Farber et al., 2021; Gouin-Bonenfant, 2018). Piketty (2014) stresses the role of social norms and labour market institutions, such as unions and the real value of the minimum wage. For example, Farber et al. (2021) document a positive correlation between state-level labour share and state union membership rates.

In addition to studying the drivers of labour share, investigating the consequences of a declining labour share is also important. Several studies assert that the decline in the labour share has been accompanied by rising income inequality (e.g., Glyn, 2011; Morrisson, 2000; Piketty, 2014). The first reason for this relationship is that, within the workforce, lower-skilled workers have borne the brunt of the fall in labour share (Autor & Dorn, 2013; Goos et al., 2014). Second, Wolff (2010) shows that capital ownership is typically concentrated at the top of the income distribution. Therefore, a transfer from labour share to capital share leads to an increase in income inequality. Few studies have investigated the relationship between labour share and income inequality. For example, Jacobson and Occhino (2012) find that a one percentage point decline in the US labour share raises the Gini index by 0.33 percentage points. More recent research by Dao et al. (2017) suggests that a lower labour share is associated with higher Gini coefficients. Similarly, Sauer et al. (2020) find that the most robust factor behind rising income inequality is the declining labour share for 73 countries (mostly observations from advanced OECD countries) between 1981 and 2010.

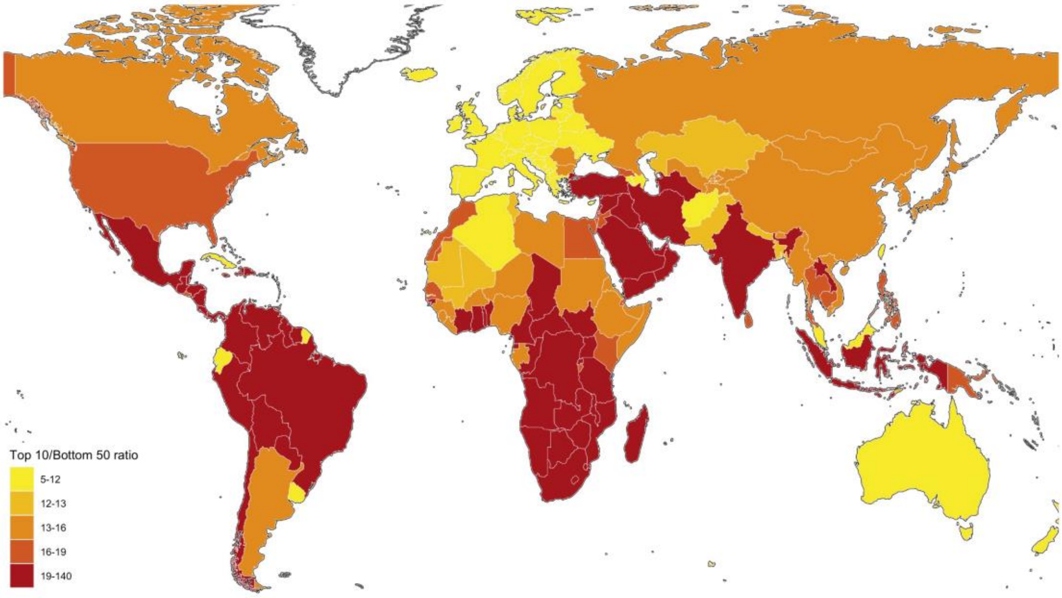
Empirical studies in this area have used datasets at different levels of aggregation. With regard to the determinants of labour share, most studies are based on country-level data (e.g., Checchi & García-Ieñalosa, 2010; Hogrefe & Kappler, 2013; Young & Lawson, 2014; Young & Tackett, 2018) and industry-level data (e.g., Alvarez-Cuadrado et al., 2018; Elsby et al., 2013; Hutchinson & Persyn, 2012; Pianta & Tancioni, 2008; Young & Zuleta, 2017). Turning to the relationship between labour share and income inequality, using country-level data, a few studies show that declining labour share is associated with rising income inequality (e.g., Dao et al., 2017; Daudey & García-Peñalosa, 2007; Jacobson & Occhino, 2012; Sauer et al., 2020). More recently, the literature has moved towards looking at what factors are driving the changes in the labour share at the firm level. Nevertheless, the firm-level link between labour share and pay inequality has not received sufficient attention in the existing literature. Therefore, Chapter 3 of this thesis contributes to this area of research by exploring the main drivers of labour share and its relationship with income inequality at the firm level.

1.1.3 Income inequality

In 2021, the global average income per adult reached €16,700 per annum (or €1,390 per month) (Chancel et al., 2022). This average income per adult is the amount that would be distributed to each individual to equalise the distribution of income without altering the total output. However, not everyone earns that amount. Many people earn much less than €1,390 while others earn dozens of times that much. A straightforward way to reveal global income inequality is to analyse the share of income captured by different groups of individuals in the distribution of income across the world. At maximum equality, we would expect the global bottom 50% (*B50*) to capture 50% of global income and the global top 10% (*T10*) to capture exactly 10% of the total. The data show that in practice at the global level, B50 captured only 8% of global income (€230 per month) and T10 earned 52% of the total (€7,300 per month) which seems far from an absolutely equal world (Chancel et al., 2022).

Moving beyond the global level of income inequality, there are variations in income inequality across regions and countries. A common index used to compare overall inequality across the world is the ratio of the average income in the top 10% to the average income in the bottom 50% of incomes (*T10/B50*). If income were distributed equally, the T10/B50 income gap would be exactly equal to one. In 2021, the highest T10/B50 income gap was 32 in MENA, 31 in Sub-Saharan Africa, 27 in Latin America, and 22 in South and South-East Asia. Conversely, the most equal region based on the T10/B50 income gap was Europe, with a value of 9.5, which is almost half that found in East Asia, Russia and Central Asia, and North America, which have T10/B50 values of around 16. In addition to regional differences, there is significant variation in inequality across countries. Fig. 1.2 presents T10/B50 income gaps for all countries across the world. Among high-income countries, the T10/B50 income gap is between 7 and 10 in Germany, France, Denmark and the UK, while the US income gap is over 17. Among low- and middle-income countries, some countries (e.g., Brazil and India) exhibit extreme inequality, some face high levels of income inequality (e.g., China) and some show moderate to relatively low levels (e.g., Malaysia, Uruguay). Therefore, the level of income inequality varies greatly across countries, even within the same income group.

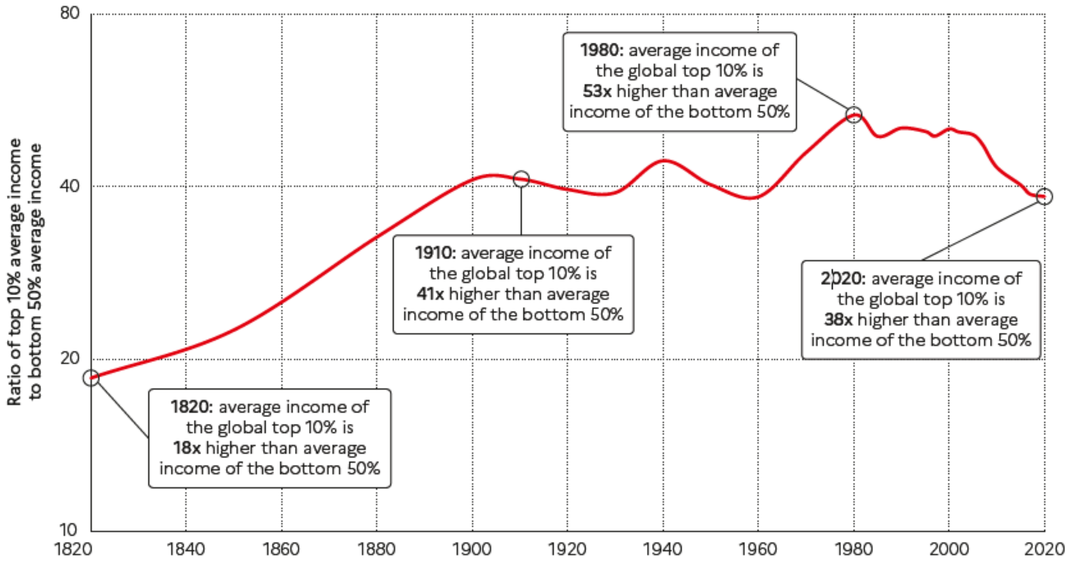
Figure 1.2. Top 10/Bottom 50 income gaps across the world, 2021



Source: Chancel et al. (2022)

Has income inequality been lower than now? The historical data on global income inequality shows that income inequality has increased during the last two centuries. Fig. 1.3 presents the global *T10/B50* income gap during the period 1820-2020. As it shows, the global T10/B50 income gap increased by 127% between 1820 and 1910 (from 18 in 1820 to 41 in 1910) and then it fluctuated around 40 for the half-century since 1960. It reached the highest values of 53 in 1980 and 50 in 2000, before declining to 38 in 2020. As argued by Chancel and Piketty (2021), the recent decline in the global T10/ B50 income gap mostly happened after the 2008 financial crisis but we cannot be sure whether the decline will continue in the future or not. In addition to the rise in global income inequality, income inequality has increased in most countries in recent decades. However, the rise has not been uniform: certain countries have experienced spectacular increases in inequality (including the US, Russia and India) while others (European countries and China) have experienced relatively smaller rises (Chancel et al., 2022).

Figure 1.3. Global income inequality: bottom 50%, middle 40% and top 10%, 1820-2020



Source: Chancel et al. (2022)

The existing empirical literature has identified several potential factors that explain income inequality, such as monetary policy (Coibion et al., 2017; Furceri et al., 2018; Lenza & Slacalek, 2018; Mumtaz & Theophilopoulou, 2017); skilled-biased technological changes (Jaumotte et al., 2013; Pi & Zhang, 2018); innovation (Philippe Aghion et al., 2019; Chu & Cozzi, 2018); and trade and financial globalisation (de Haan & Sturm, 2017; Furceri & Loungani, 2018; Jaumotte et al., 2013). Among those factors, interest has recently been growing in the role of financial development in income inequality. After the recent financial crises of 2008–2009, many public debates were concerned with the benefits and harms caused by the financial sector to the rest of society. The privatization of banks' profits and the socialization of their losses is a common argument made in political debates in many developed countries (Jauch & Watzka, 2016). Although a growing body of evidence suggests that financial institutions and financial markets exert a powerful influence on economic development and economic stability (Levine, 1997, 2005), the income distributional impact of financial development is under question. It remains unclear whether widening income inequality is a consequence of financial development. Therefore, Chapter 4 of this thesis contributes to this area of research by exploring the income inequality impact of financial development.

1.2 Problem statements and research questions

As the previous section highlights, there is a potential research area within each scope of income distribution, including pay inequality, labour share, and income inequality, in terms of their determinants or impacts. This section delves deeper into the literature gap and proposes research questions that the current thesis intends to answer.

With regard to the impact of CEO-employee pay inequality on employee performance, the literature has not reached a consensus. On one hand, the behavioural point of view, referring to Equity Theory and Relative Depreciation Theory, predicts a negative relationship between pay disparity and employee performance. Supporting this view, empirical studies show that higher pay disparity increases detrimental actions such as shrinking or quitting (Akerlof & Yellen, 1990; Chen & Sandino, 2012; Corneliben et al., 2011), increases absenteeism (Mahy et al., 2016) and raises turnover among lower-paid employees (Jia et al., 2014; Messersmith et al., 2011; Wade et al., 2006). On the other hand, the economic perspective, referring to Tournament Theory and Expectancy Theory, argues that pay disparity positively influences employee motivation and leads to better performance. Studies show that a large pay disparity between hierarchy levels in an organisation provides incentives for lower levels to increase their efforts and performance (DeVaro, 2006; Ehrenberg & Bognanno, 1990; Faleye et al., 2013; Main et al., 1993). Against a background of such contradictory findings, a recent branch of the literature discusses the role of pay inequality's drivers on its association with performance. For example, scholars have shown that pay inequality created by explained (unexplained) compensation is positively (negatively) related to team performance in sports settings (Trevor et al., 2012) and future firm performance (Rouen, 2020). However, the current literature offers limited clear guidance regarding the role of pay inequality determinants in its relationship with employee performance. Hence, the second chapter of this thesis seeks to answer the following questions: (I) What is the overall impact of pay inequality within the firm on employee performance? (II) Does distinguishing between pay inequality explained by an individual's skill, firm characteristics, and labour market and unexplained pay inequality reconcile the behavioural and economic perspectives? (III) If yes, what different impacts does each of them have on employee performance? (IV) Is there an optimum point for pay inequality, which maximises employee performance?

Regarding the drivers of labour share and its link with personal income distribution within firms, there have not been enough investigations. However, as discussed by Karabarbounis and Neiman (2014), studying the labour share at the firm level has some benefits. It allows us to overcome important measurement issues confronted by most of the labour share literature such as the treatment of capital depreciation (Bridgman, 2018), housing (Rognlie, 2015), self-employment (Elsby et al., 2013; Gollin, 2002), intangible capital (Koh et al., 2020), and business owners taking capital instead of labour income (Smith et al., 2019). In addition, most economic activities take place inside firms, where production and compensation decisions are taken that eventually impact labour share and income inequality between those who provide services in the form of labour and those whose contribution is primarily tied to capital. Only a few studies (e.g., Autor et al., 2020; De Loecker et al., 2020; Growiec, 2012; Guschanski & Onaran, 2018; Siegenthaler & Stucki, 2015) have focused on firm-level determinants of labour share. The results of these studies emphasise the importance of firm-level analysis in investigating the movement in labour share. However, the link between within-firm labour share and pay inequality between CEOs, whose compensation is linked to capital income, and employees, which is one of the drivers of income inequality, has not been investigated. Therefore, the third chapter is an attempt to answer the following questions: (I) What are the impacts of the three main factors – technological progress, product market power, and labour market power – on within-firm labour share? and (II) Is there a relationship between labour share and income inequality within firms?

Turning to income inequality at the macro level, the debate on the income distributional impact of financial development has remained controversial. On one hand, the financial development-income inequality link is explained by two linear-based hypotheses: the inequality-widening hypothesis and the inequality-narrowing hypothesis. The inequality-widening hypothesis states that the development of the financial sector might disproportionately benefit the rich, who can offer collateral and are more likely to repay the loan, while excluding the poor, thus raising income inequality (Gimet & Lagoarde-Segot, 2011; Jauch & Watzka, 2016; Rajan & Zingales, 2003a). Conversely, the inequality-narrowing hypothesis posits that when the financial sector develops, the poor, who were previously excluded from obtaining loans, might gain access and therefore, mitigate income inequality (Beck et al., 2007; Clarke et al., 2006; Galor & Zeira, 1993; Kim et al., 2021). In another approach, recent studies show an inverted U-shaped relationship in which financial development increases income inequality up to a threshold level of financial development. After this critical threshold is reached, financial development benefits the poor and mitigates income inequality (Greenwood & Jovanovic, 1990; Kim & Lin, 2011). To try to discover the driving factors for these contradictory results, we argue that the country's openness to trade market and capital flow may impact the nexus between financial development and income inequality since trade and financial openness play a role in promoting financial development and determining income inequality. The fourth chapter answers the following questions. (I) Is the relationship between financial development and income inequality uniform with the level of openness? (II) To what extent does financial development contribute to the rise in income inequality?

1.3 Contribution of the thesis

This research aim is to extend the current literature on determinants and impacts of income distribution by seeking to answer the outlined research questions. We believe that understanding what determines income distribution and its effects on other factors provides an avenue for valuable future research. This section provides a brief explanation of the contribution of each study to the fields of pay inequality, labour share and income inequality respectively.

First, this thesis provides novel empirical evidence about the impact of CEO-employee pay inequality on employee performance inside firms. Previous studies aimed at reconciling contradictory viewpoints have primarily concentrated on the association between pay inequality and firm performance. However, there is a lack of research dealing with employee performance. Therefore, this study extends the current literature to the relationship between CEO-employee pay inequality and employee performance, using a firm-level dataset. In addition, our findings extend the empirical studies on Tournament Theory in organisational settings. With reference to our dataset, there is no study that we are aware of that investigates the CEO-employee pay inequality impact on employee performance in Australia, despite the recent media attention to CEO pay ratios in this country. The results of this research can assist managers in designing a compensation system between hierarchical levels within an organisation and recommend to regulators that CEO pay ratio disclosure per se without the disclosure of relevant information about workforces may lead to misinterpretation.

Second, this study contributes to the academic literature on labour share and income inequality. This research is among the first to consider the firm-level dynamics of labour share. It extends the firm-level empirical studies of labour share's determinants by examining the impact of three leading channels: technological progress, product market power, and labour market power. In addition, earlier studies on the parallel movement of declining labour share and rising income inequality have examined macro-level relationships. However, there is a lack of research dealing with the relationship between labour share and income inequality within firms. Furthermore, using Australia as a case study, our findings contribute to a debate that has been dominated by evidence from the United States. This study is the first to document the firm-level determinants of labour share in Australia and its relationship with income inequality.

The results of this research provide insights for policymakers about limiting the further decline in labour share and the associated increases in income inequality.

Third, this research provides novel empirical findings about the relationship between financial development and income inequality. Specifically, we explore whether the level of openness matters in shaping the link between financial development and income inequality. The empirical findings of this research contribute to the current literature on nonlinearity in the link between financial development and income inequality by determining how the inequality impact of financial development depends on the level of a country's openness to both trade and financial markets. This research adds more dimensions to the financial development-income inequality link. In addition, this research calls attention to the need for policymakers to consider the level of financial and trade openness when exploring possible benefits from financial development.

1.4 Why Australia as a case study?

There are three main reasons to study Australia's distribution of income in the first and second essays. First, in keeping with the global trend, the past few decades have witnessed a surge in CEO pay ratios in Australia. The ratio of CEO pay to median employee pay increased from 15.3:1 in 1993 to 51.4:1 in 2008 in the top 100 Australian publicly-listed firms (ASX100), due to the substantial growth in CEO compensation over this period (Baker & Denniss, 2010; Productivity Commission, 2009). In recent years, data from the Australian Bureau of Statistics shows that the average CEO compensation to average earnings ratio has remained consistently high, fluctuating between 69.1 and 59.7 between 2012 and 2019. In addition to pay inequality in Australia, the movements in functional and personal income distribution are also noteworthy. Recent research indicates that the labour share in Australia has substantially declined since the mid-1970s (Gianni, 2019), while income inequality has increased and now exceeds the OECD average (Sila & Dugain, 2019). These observed patterns in functional and personal income distribution show the need to study the determinants of income distribution and its impacts in Australia.

Second, the availability of both Australian firm-level and macro-level data provides us with an opportunity to assess our primary research questions in both chapters 2 and 3. The initial assessment reveals that Thomson Reuters Datastream (TRD) provides our variables of interest, such as CEO compensation, employees' average compensation, detailed annual reports, and stock market data for 2845 companies listed on the Australian Securities Exchange between 2004 and 2019. Moreover, the Australian Bureau of Statistics offers a range of regional- and industry-level data on the Australian economy, labour, population, and education, which is crucial to enhancing the depth and scope of our analysis.

Third, Australia has common economic and political experiences with many other countries while also possessing distinct characteristics. Like many developed countries, Australia has experienced an increase in globalization and international trade, which has had both positive and negative effects on the economy and the distribution of income. Australia has also adopted a neoliberal economic policy that emphasizes free market policies, deregulation, and privatization which can eventually influence income inequality. In addition to these similarities, Australia has a strong social welfare system that provides support for those in need. However, the effectiveness of this system in addressing income inequality has been questioned. Thus, valuable lessons from this research on the distribution of income could provide insights for other countries facing similar economic and political experiences.

1.5 Thesis outline

The remainder of this thesis is structured as follows. Chapter 2 pays special attention to the income distribution between people at different organisational hierarchy levels and investigates whether pay inequality between CEOs and employees has an impact on employee performance. This chapter empirically assesses the difference between the impact of pay inequality that is attributed to individuals' skills, company characteristics, and labour market and the impact of pay inequality that is based on other unknown factors, on employee performance.

Chapter 3 focuses on the income distribution between labour and capital within firms. First, this chapter examines the impact of three leading factors – technological progress, product market power and labour market power – on firm-level labour share. Second, it investigates the role of declining labour share in rising pay inequality between CEOs and employees. Chapter 4 employs macro-level data to study the linkage between financial development and income inequality. This chapter is an attempt to answer the question of whether the inequality impact of financial development depends on a country's openness to trade market and capital flow.

Finally, Chapter 5 summarises the key findings of the thesis and discusses their implications. The chapter also proposes avenues for future research and highlights the limitations of the thesis. It is important to note that three main research chapters (Chapters 2, 3 and 4) are stand-alone to be submitted for publication. Hence, the relevant literature and methodology are identified in each of the chapters. Thus, this thesis does not contain a separate dedicated literature review and methodology chapters.

1.6 References

Acemoglu, D., & Restrepo, P. (2018). The race between man and machine: Implications of technology for growth, factor shares, and employment. *American Economic Review*, *108*(6), 1488–1542. https://doi.org/10.1257/AER.20160696

Aghion, Philippe, Akcigit, U., Bergeaud, A., Blundell, R., & Hemous, D. (2019). Innovation and top income inequality. *The Review of Economic Studies*, *86*(1), 1–45. https://doi.org/10.1093/RESTUD/RDY027

Akerlof, G. A., & Yellen, J. L. (1990). The fair wage-effort hypothesis and unemployment. *The Quarterly Journal of Economics*, *105*(2), 255–283. https://doi.org/10.2307/2937787

Alesina, A., & Perotti, R. (1996). Income distribution, political instability, and investment. *European Economic Review*, *40*(6), 1203–1228. https://doi.org/10.1016/0014-2921(95)00030-5

Alesina, A., & Rodrik, D. (1994). Distributive politics and economic growth. *The Quarterly Journal of Economics*, *109*(2), 465–490. https://doi.org/10.2307/2118470

Alvarez-Cuadrado, F., Long, N. V, & Poschke, M. (2018). Capital-labor substitution, structural change and the labor income share. *Journal of Economic Dynamics and Control*, *87*, 206–231. https://doi.org/10.1016/J.JEDC.2017.12.010

Atkinson, A. B. (2009). Factor shares: the principal problem of political economy? *Oxford Review of Economic Policy*, *25*(1), 3–16. https://doi.org/10.1093/oxrep/grp007

Autor, D., & Dorn, D. (2013). The growth of low-skill service jobs and the polarization of the US labor market. *American Economic Review*, *103*(5), 1553–1597. https://doi.org/10.1257/AER.103.5.1553

Autor, D., Dorn, D., Katz, L. F., Patterson, C., & Van Reenen, J. (2020). The fall of the labor share and the rise of superstar firms. *The Quarterly Journal of Economics*, *135*(2), 645–709. https://doi.org/10.1093/qje/qjaa004

Baker, D., & Denniss, R. (2010). *Reining it in executive pay in Australia*. The Australia Institute Research that matter. https://australiainstitute.org.au/report/reining-it-in-executive-pay-in-australia/

Bampinas, G., Konstantinou, P., & Panagiotidis, T. (2017). Inequality, demographics and the housing wealth effect: Panel quantile regression evidence for the US. *Finance Research Letters*, *23*, 19–22. https://doi.org/10.1016/J.FRL.2017.01.001

Banker, R. D., Bu, D., & Mehta, M. N. (2016). Pay gap and performance in China. *Abacus*, *52*(3), 501–531. https://doi.org/10.1111/abac.12082

Baqaee, D. R., & Farhi, E. (2020). Productivity and misallocation in general equilibrium. *The Quarterly Journal of Economics*, *135*(1), 105–163. https://doi.org/10.1093/qje/qjz030

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2007). Finance, inequality and the poor. *Journal of Economic Growth*, *12*(1), 27–49. https://doi.org/10.1007/S10887-007-9010-6

Bentolila, S., & Saint-Paul, G. (2003). Explaining movements in the labor share. *Contributions in Macroeconomics*, *3*(1). https://doi.org/doi:10.2202/1534-6005.1103

Bivens, J., & Kandra, J. (2022). *CEO pay has skyrocketed 1,460% since 1978: CEOs were paid 399 times as much as a typical worker in 2021*. Economic Policy Institute. https://www.epi.org/publication/ceo-pay-in-2021/

Böckerman, P., & Maliranta, M. (2012). Globalization, creative destruction, and labour share change: Evidence on the determinants and mechanisms from longitudinal plant-level data. *Oxford Economic Papers*, *64*(2), 259–280. https://doi.org/10.1093/OEP/GPR031

Bridgman, B. (2018). Is labour's loss capital's gain? Gross versus net labour shares. *Macroeconomic Dynamics*, *22*(8), 2070–2087. https://doi.org/10.1017/S1365100516001000

Brueckner, M., & Lederman, D. (2018). Inequality and economic growth: The role of initial income. *Journal of Economic Growth*, *23*(3), 341–366. https://doi.org/10.1007/S10887-018-9156-4/TABLES/11

Chancel, L., & Piketty, T. (2021). Global income inequality, 1820–2020: The persistence and mutation of extreme inequality. *Journal of the European Economic Association*, *19*(6), 3025–3062. https://doi.org/10.1093/JEEA/JVAB047

Chancel, L., Piketty, T., Saez, E., & Zucman, G. et al. (2022). *World inequality report 2022*. World Inequality Lab. https://wir2022.wid.world/

Chen, C. X., & Sandino, T. (2012). Can wages buy honesty? The relationship between relative wages and employee theft. *Journal of Accounting Research*, *50*(4), 967–1000. https://doi.org/10.1111/j.1475-679X.2012.00456.x

Chu, A. C., & Cozzi, G. (2018). Effects of patents versus R&D subsidies on income inequality. *Review of Economic Dynamics*, *29*, 68–84. https://doi.org/10.1016/J.RED.2017.12.006

Clarke, G. R. G., Xu, L. C., & Zou, H. (2006). Finance and income inequality: What do the data tell us? *Southern Economic Journal*, *72*(3), 578–596. https://doi.org/10.1002/J.2325-8012.2006.TB00721.X

Coibion, O., Gorodnichenko, Y., Kueng, L., & Silvia, J. (2017). Innocent bystanders? Monetary policy and inequality. *Journal of Monetary Economics*, *88*, 70–89. https://doi.org/10.1016/J.JMONECO.2017.05.005

Corneliben, T., Himmler, O., & Koenig, T. (2011). Perceived unfairness in CEO compensation and work morale. *Economics Letters*, *110*(1), 45–48. https://doi.org/10.1016/j.econlet.2010.10.011

Dao, M. C., Das, M., & Koczan, Z. (2019). Why is labor receiving a smaller share of global income? Theory and empirical evidence. *Economic Policy*, *34*(100), 723–759. https://doi.org/10.1093/epolic/eiaa004

Dao, M. C., Das, M., Koczan, Z., & Lian, W. (2017). *Why is labor receiving a smaller share of global income? Theory and empirical evidence* (Working Paper No. 2017/169). IMF. https://www.imf.org/en/Publications/WP/Issues/2017/07/24/Why-Is-Labor-Receiving-a-Smaller-Share-of-Global-Income-Theory-and-Empirical-Evidence-45102

Daudey, E., & García-Peñalosa, C. (2007). The personal and the factor distributions of income in a cross-section of countries. *The Journal of Development Studies*, *43*(5), 812–829. https://doi.org/10.1080/00220380701384406

de Haan, J., & Sturm, J. E. (2017). Finance and income inequality: A review and new evidence. *European Journal of Political Economy*, *50*, 171–195. https://doi.org/10.1016/J.EJPOLECO.2017.04.007

De Loecker, J., Eeckhout, J., & Unger, G. (2020). The rise of market power and the macroeconomic implications. *The Quarterly Journal of Economics*, *135*(2), 561–644. https://doi.org/10.1093/QJE/QJZ041

DeVaro, J. (2006). Strategic promotion tournaments and worker performance. *Strategic Management Journal*, *27*(8), 721–740. https://doi.org/10.1002/smj.542

Downes, P. E., & Choi, D. (2014). Employee reactions to pay dispersion: A typology of existing research. *Human Resource Management Review*, *24*(1), 53–66. https://doi.org/10.1016/j.hrmr.2013.08.009

Eden, M., & Gaggl, P. (2018). On the welfare implications of automation. *Review of Economic Dynamics*, *29*, 15–43. https://doi.org/10.1016/J.RED.2017.12.003

Ehrenberg, R. G., & Bognanno, M. L. (1990). Do tournaments have incentive effects? *Journal of Political Economy*, *98*(6), 1307–1324. https://doi.org/10.1086/261736

Elsby, M. W. L., Hobijn, B., & Şahin, A. (2013). The decline of the U.S. labor share. *Brookings Papers on Economic Activity*, *2013*(2), 1–63. https://doi.org/10.1353/ECA.2013.0016

Faleye, O., Mehrotra, V., & Morck, R. (2006). When labor has a voice in corporate governance. *Journal of Financial and Quantitative Analysis*, *41*(3), 489–510. https://doi.org/10.1017/S0022109000002519

Faleye, O., Reis, E., & Venkateswaran, A. (2013). The determinants and effects of CEO-employee pay ratios. *Journal of Banking and Finance*, *37*(8), 3258–3272. https://doi.org/10.1016/j.jbankfin.2013.03.003

Farber, H. S., Herbst, D., Kuziemko, I., & Naidu, S. (2021). Unions and inequality over the twentieth century: New evidence from survey data. *The Quarterly Journal of Economics*, *136*(3), 1325–1385. https://doi.org/10.1093/QJE/QJAB012

Furceri, D., & Loungani, P. (2018). The distributional effects of capital account liberalization. *Journal of Development Economics*, *130*, 127–144. https://doi.org/10.1016/J.JDEVECO.2017.09.007

Furceri, D., Loungani, P., & Zdzienicka, A. (2018). The effects of monetary policy shocks on inequality. *Journal of International Money and Finance*, *85*, 168–186. https://doi.org/10.1016/J.JIMONFIN.2017.11.004

Furceri, D., & Ostry, J. D. (2019). Robust determinants of income inequality. *Oxford Review of Economic Policy*, *35*(3), 490–517. https://doi.org/10.1093/OXREP/GRZ014

Galor, O., & Zeira, J. (1993). Income distribution and macroeconomics. *The Review of Economic Studies*, *60*(1), 35–52. https://doi.org/10.2307/2297811

Gianni, L. C. (2019). *The labour and capital shares of income in Australia*. Reserve Bank of Australia. https://www.rba.gov.au/publications/bulletin/2019/mar/the-labour-and-capital-shares-of-income-in-australia.html

Gimet, C., & Lagoarde-Segot, T. (2011). A closer look at financial development and income distribution. *Journal of Banking & Finance*, *35*(7), 1698–1713. https://doi.org/10.1016/J.JBANKFIN.2010.11.011

Glyn, A. (2011). 5 Functional distribution and inequality. In B. Nolan, W. Salverda, & T. M. Smeeding (Eds.), *The Oxford Handbook of Economic Inequality* (pp. 101–126). Oxford University Press. https://doi.org/10.1093/OXFORDHB/9780199606061.013.0005

Gollin, D. (2002). Getting income shares right. *Journal of Political Economy*, *110*(2), 458–474. https://doi.org/10.1086/338747

Goos, M., Manning, A., & Salomons, A. (2014). Explaining job polarization: Routine-biased technological change and offshoring. *American Economic Review*, *104*(8), 2509–2526.

https://doi.org/10.1257/AER.104.8.2509

Gouin-Bonenfant, E. (2022). Productivity dispersion, between-firm competition, and the labor share. *Econometrica*, *90*(6), 2755–2793. https://doi.org/10.3982/ECTA18612

Greenwood, J., & Jovanovic, B. (1990). Financial development, growth, and the distribution of income. *Journal of Political Economy, 98,* 1076–1107. https://doi.org/10.1086/261720

Growiec, J. (2012). Determinants of the labor share. *Eastern European Economics, 50*(5), 23–65. https://doi.org/10.2753/EEE0012-8775500502

Gupta, N., Conroy, S. A., & Delery, J. E. (2012). The many faces of pay variation. *Human Resource Management Review*, *22*(2), 100–115. https://doi.org/10.1016/j.hrmr.2011.12.001

Guschanski, A., & Onaran, Ö. (2018). *The labour share and financialisation: Evidence from publicly listed firms* (Working Paper No. 19371). University of Greenwich, Greenwich Political Economy Research Centre. https://ideas.repec.org/p/gpe/wpaper/19371.html

Hogrefe, J., & Kappler, M. (2013). The labour share of income: Heterogeneous causes for parallel movements? *The Journal of Economic Inequality*, *11*(3), 303–319. https://doi.org/10.1007/s10888-012-9221-8

Hutchinson, J., & Persyn, D. (2012). Globalisation, concentration and footloose firms: In search of the main cause of the declining labour share. *Review of World Economics*, *148*(1), 17–43. https://doi.org/10.1007/s10290-011-0112-z

Jacobson, M., & Occhino, F. (2012). Labor's declining share of income and rising inequality. *Economic Commentary, 2012–13,* 1–6. https://doi.org/10.26509/FRBC-EC-201213

Jauch, S., & Watzka, S. (2016). Financial development and income inequality: A panel data approach. *Empirical Economics*, *51*(1), 291–314. https://doi.org/10.1007/S00181-015-1008-X/TABLES/7

Jaumotte, F., Lall, S., & Papageorgiou, C. (2013). Rising income inequality: Technology, or trade and financial globalization? *IMF Economic Review*, *61*(2), 271–309. https://doi.org/10.1057/IMFER.2013.7/FIGURES/7

Jia, L., Shaw, J. D., Tsui, A. S., & Park, T. Y. (2014). A social-structural perspective on employee-organization relationships and team creativity. *Academy of Management Journal*, *57*(3), 869–891. https://doi.org/10.5465/amj.2011.0147

Kaldor, N. (1961). Capital accumulation and economic growth. In Hague, D.C. (Eds.), *The Theory of Capital* (pp. 177-222). International Economic Association Series. Palgrave Macmillan. https://doi.org/10.1007/978-1-349-08452-4_10

Karabarbounis, L., & Neiman, B. (2014). The global decline of the labor share. *The Quarterly Journal of Economics*, *129*(1), 61–103. https://doi.org/10.1093/QJE/QJT032

Kelly, K., & Seow, J. L. (2016). Investor reactions to company disclosure of high CEO pay and high CEO-to-employee pay ratio: An experimental investigation. *Journal of Management Accounting Research*, *28*(1), 107–125. https://doi.org/10.2308/JMAR-51392

Keynes, J. M. (1939). Relative movements of real wages and output. *The Economic Journal*, *49*(193), 34. https://doi.org/10.2307/2225182

Kim, D. H., Hsieh, J., & Lin, S. C. (2021). Financial liberalization, political institutions, and income inequality. *Empirical Economics*, *60*(3), 1245–1281. https://doi.org/10.1007/S00181-019-01808-Z/TABLES/9

Kim, D. H., & Lin, S. C. (2011). Nonlinearity in the financial development–income inequality nexus. *Journal of Comparative Economics*, *39*(3), 310–325. https://doi.org/10.1016/J.JCE.2011.07.002

Koh, D., Santaeulalia-Lopis, R., & Zheng, Y. (2020). Labor share decline and intellectual property products capital. *Econometrica*, *88*, 2609–2628. https://doi.org/10.3982/ECTA17477

Konow, J. (2003). Which is the fairest one of all? A positive analysis of justice theories. *Journal of Economic Literature*, *41*(4), 1188–1239. https://doi.org/10.1257/002205103771800013

Kotnik, P., & Sakinç, M. E. (2022). Executive compensation in Europe: Realized gains from stock-based pay. *Review of International Political Economy* . https://doi.org/10.1080/09692290.2022.2078397

Kumar, B. (2021, August 11). *How can we solve India Inc's high CEO pay problem?* Business Standard. https://www.business-standard.com/podcast/current-affairs/how-can-we-solve-india-inc-s-high-ceo-pay-problem-122081100078_1.html

Kumhof, M., Rancière, R., & Winant, P. (2015). Inequality, leverage, and crises. *American Economic Review*, *105*(3), 1217–1245. https://doi.org/10.1257/AER.20110683

Lenza, M., & Slacalek, J. (2018). *How does monetary policy affect income and wealth inequality? Evidence from quantitative easing in the Euro area* (Working Paper No. 2190). European Central Bank. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3275976

Levine, R. (1997). Financial development and economic growth: Views and agenda. *Journal of Economic Literature*, *35*(2), 688–726. https://doi.org/http://www.jstor.org/stable/2729790

Levine, R. (2005). Chapter 12 Finance and growth: Theory and evidence. In P. Aghion & S. Durlauf (Eds.), *Handbook of Economic Growth Vol. 1, Part A* (pp. 865–934). Elsevier. https://doi.org/10.1016/S1574-0684(05)01012-9

Mahy, B., Rycx, F., & Volral, M. (2016). Are workers less absent when wage dispersion is small? *International Journal of Manpower*, *37*(2), 197–209. https://doi.org/10.1108/IJM-01-2015-0004

Main, B. G. M., O'Reilly III, C. A., & Wade, J. (1993). Top executive pay: Tournament or teamwork? *Journal of Labor Economics*, *11*(4), 606–628. https://doi.org/10.1086/298309

Messersmith, J. G., Guthrie, J. P., Ji, Y. Y., & Lee, J. Y. (2011). Executive turnover: The influence of dispersion and other pay system characteristics. *Journal of Applied Psychology*, *96*(3), 457–469. https://doi.org/10.1037/a0021654

Morrisson, C. (2000). Chapter 4 Historical perspectives on income distribution: The case of Europe. In A. B. Atkinson, & F. Bourguignon (Eds.), *Handbook of Income Distribution Vol. 1* (pp. 217–260). Elsevier. https://doi.org/10.1016/S1574-0056(00)80007-X

Mumtaz, H., & Theophilopoulou, A. (2017). The impact of monetary policy on inequality in the UK. An empirical analysis. *European Economic Review*, *98*, 410–423. https://doi.org/10.1016/J.EUROECOREV.2017.07.008

Nel, P. (2003). Income inequality, economic growth, and political instability in sub-Saharan Africa. *The Journal of Modern African Studies*, *41*(4), 611–639. https://doi.org/10.1017/S0022278X03004403

Panizza, U. (2002). Income inequality and economic growth: Evidence from American data. *Journal of Economic Growth*, *7*(1), 25–41. https://doi.org/10.1023/A:1013414509803/METRICS

Pi, J., & Zhang, P. (2018). Skill-biased technological change and wage inequality in developing countries. *International Review of Economics & Finance*, *56*, 347–362. https://doi.org/10.1016/J.IREF.2017.11.004

Pianta, M., & Tancioni, M. (2008). Innovations, wages, and profits. *Journal of Post Keynesian Economics, 31*(1), 101–123. https://doi.org/10.2753/PKE0160-3477310105

Piketty, T. (2014). *Capital in the twenty-first century*. Harvard University Press. https://doi.org/10.4159/9780674982918/HTML

Productivity Commission. (2009). *Executive remuneration in Australia: Productivity commission inquiry report* (Report No. 49). https://www.pc.gov.au/inquiries/completed/executive-remuneration/report

Rajan, R., & Zingales, L. (2003). *Saving capitalism from the capitalists : Unleashing the power of financial markets to create wealth and spread opportunity*. Princeton University Press.

Reich, R. B. (2010). *Aftershock : The next economy and America's future*. New York, Alfred A. Knopf.

Rognlie, M. (2015). Deciphering the fall and rise in the net capital share: Accumulation or scarcity?. *Brookings Papers on Economic Activity*, 1–54. https://www.jstor.org/stable/43684097

Rouen, E. (2020). Rethinking measurement of pay disparity and its relation to firm performance. *Accounting Review, 95*(1), 343–378. https://doi.org/10.2308/accr-52440

Sauer, P., Rao, N. D., & Pachauri, S. (2020). *Explaining income inequality trends: An integrated approach* (Working Paper No. 2020/65). UNU-WIDER. https://doi.org/10.35188/UNU-WIDER/2020/822-1

Shin, J. Y., Kang, S.-C., Hyun, J.-H., & Kim, B.-J. (2015). Determinants and performance effects of executive pay multiples: Evidence from Korea. *ILR Review, 68*(1), 53–78. https://doi.org/10.1177/0019793914556242

Siegenthaler, M., & Stucki, T. (2015). Dividing the pie: Firm-level determinants of the labor share. *ILR Review, 68*(5), 1157–1194. https://doi.org/10.1177/0019793915593952

Sila, U., & Dugain, V. (2019). *Income, wealth and earnings inequality in Australia: Evidence from the HILDA survey* (Working Paper No.1538). OECD Economics Department Working Papers. https://doi.org/https://doi.org/10.1787/cab6789d-en

Smith, M., Yagan, D., Zidar, O., & Zwick, E. (2019). Capitalists in the twenty-first century. *The Quarterly Journal of Economics*, *134*(4), 1675–1745. https://doi.org/10.1093/QJE/QJZ020

Speke, A., Window, H., & Hildyard, L. (2022). *UK CEO pay report 2021*. In High Pay Center and TUC. https://www.tuc.org.uk/research-analysis/reports/uk-ceo-pay-report-2021

Trevor, C. O., Reilly, G., & Gerhart, B. (2012). Reconsidering pay dispersion's effect on the performance of interdependent work: Reconciling sorting and pay inequality. *Academy of Management Journal*, *55*(3), 585–610. https://doi.org/10.5465/amj.2006.0127

Wade, J. B., O'Reilly, C. A., & Pollock, T. G. (2006). Overpaid CEOs and underpaid managers: Fairness and executive compensation. *Organization Science*, *17*(5), 527–544.

https://doi.org/10.1287/orsc.1060.0204

Wolff, E. N. (2010). *Recent trends in household wealth in the United States: Rising debt and the middle-class squeeze - an update to 2007* (Working Papers No. 589). Levy Economics Institute of Bard College. https://doi.org/10.2139/SSRN.1585409

Young, A. T., & Lawson, R. A. (2014). Capitalism and labor shares: A cross-country panel study. *European Journal of Political Economy*, *33*, 20–36. https://doi.org/10.1016/J.EJPOLECO.2013.11.006

Young, A. T., & Tackett, M. Y. (2018). Globalization and the decline in labor shares: Exploring the relationship beyond trade and financial flows. *European Journal of Political Economy*, *52*, 18–35. https://doi.org/10.1016/J.EJPOLECO.2017.04.003

Young, A. T., & Zuleta, H. (2017). Do unions increase labor shares? Evidence from US industry-level data. *Eastern Economic Journal*, *44*(4), 558–575. https://doi.org/10.1057/S41302-016-0086-6

---

[1] The disclosures are mandated under Section 197(12) of the Companies Act, 2013.
[2] For more information read "S.794 - Tax Excessive CEO Pay Act of 2021"

Chapter 2
Is performance affected by the CEO-Employee pay gap? Evidence from Australia

Abstract: It is argued that pay inequality between CEOs and employees impacts employee performance, although empirical studies are inconsistent about the directionality of the effect. This paper shows that seemingly contradictory predictions of behavioural and economic perspectives about the impact of pay inequality are more complementary than contradictory. Our results show that pay inequality attributed to individuals' skills, company characteristics, and labour market is positively associated with employee performance. However, this positive impact on employee performance declines at high levels of such pay inequality. In addition, pay inequality based on other unknown factors has a negative impact on employee performance.

Keywords: CEO compensation, pay inequality, pay ratio, employee performance, productivity

JEL Classification: D24, G34, J31, M12, M52

2.1 Introduction

The pay gap between executives and employees has become an indicator of pay inequality between the top and bottom income levels[1] and has attracted considerable attention from news media, regulators, and researchers. International news and business articles recommend that regulators reduce the pay inequality driven by executives' pay growth. Hence, the issue of pay inequality has led to mandatory financial disclosure from regulators. US and UK publicly listed firms have been obliged to disclose the ratio of their CEO's compensation to median employee pay from 2017 and 2019, respectively. Recently released reports recommend similar disclosures for Australian public firms, although pay inequality in Australia is still below that of countries such as the US and the UK. In the top 100 publicly Australian listed firms (ASX100), the gap between average CEO compensation and average weekly earnings rose from a multiple of 15.3 in 1993 to 51.4 in 2008, driven by the real growth in CEO compensation over this period (Productivity Commission, 2009).

In addition to the news media and regulators, researchers have recently joined the debate by positing that pay inequality, as the ratio of CEO compensation to average employee pay, impacts employee and firm performance (Faleye et al., 2013; Rouen, 2020). However, its effect remains ambiguous (Conroy et al., 2014). Some scholars find that pay inequality is positively associated with employee and firm performance (Banker et al., 2016; Faleye et al., 2013; Mueller et al., 2017). This result is interpreted as consistent with Tournament Theory (Lazear & Rosen, 1981) and Expectancy Theory (Lawler, 1981), which assert that pay inequality motivates employees to work harder to gain higher compensation. However, other studies show a negative relationship between pay inequality and performance (Bebchuk et al., 2011; Cowherd & Levine, 1992). These results are consistent with Equity Theory (Adams, 1965) and Relative Deprivation Theory (Crosby, 1984; Martin & Murnighan, 1981), arguing that employees compare their outcomes with others and feel a sense of inequity and deprivation if their outcome falls short of what they deserve.

Scholars (Conroy et al., 2014; Rouen, 2020; Trevor et al., 2012) argue that contradictory empirical findings in previous studies can be attributed to undermining the determinants of pay inequality. In other words, they examine the impact of observed pay inequality without considering factors causing the pay inequality between CEO and employee compensation such as CEO and employee inputs (e.g., effort, responsibility, and skill), firm characteristics, and labour market. By considering these factors, both perspectives seem compatible with each other

(Rouen, 2020). Pay inequality related to these factors may motivate employees to perform better, consistent with economic perspectives. In contrast, pay inequality attributed to unknown factors may lead to detrimental activities such as quitting the company or shirking, consistent with the behavioural perspective. Two seminal studies, by Trevor et al. (2012) and Rouen (2020), focus on this argument. In the sports setting, Trevor et al. (2012) assert that horizontal pay disparity explained (unexplained) by players' performance has a positive (negligible or slightly negative) impact on team performance. Rouen (2020) extends the Trevor et al. (2012) approach to pay inequality in organisational settings. He concludes that pay inequality created by explained (unexplained) compensation is positively (negatively) related to future firm performance.

Existing research offers little clear guidance about the consequences of pay inequality on employee performance. However, employee performance provides significant insights into evaluating how pay inequality affects employees' incentives and behaviour (Faleye et al., 2013). Furthermore, although Tournament Theory is conceptualised as a contest with an optimal prize that can maximise an employee's output (Connelly et al., 2013; Lazear & Rosen, 1981), examination of the threshold of pay inequality is almost absent from the literature. This paper aims to extend the integration of the contradictory perspective approach into the relationship between pay inequality and employee performance by answering four questions. First, what is the overall impact of pay inequality within the firm on employee performance? Second, can distinguishing between pay inequality explained by individuals' skills, firm characteristics, and labour market (pay equity) and unexplained pay inequality (pay inequity) reconcile the behavioural and economic perspectives? If yes, what impacts has each of them had on employee performance? Finally, is there an optimum point for pay equity that maximises employee performance?

To conduct our investigation, we analyse a sample of all Australian listed companies that meet the data availability restrictions from 2004 to 2019. Pay inequality is measured as the natural log of the ratio of total CEO compensation to average employee pay. Our empirical analysis is divided into two parts. In the first part, the determinants of pay inequality are examined. Pay equity is defined as predicted pay inequality by our model and pay inequity as the model's residual. In the second part, we investigate the impact of pay inequality on employee performance. Our results show that employee performance is negatively associated with pay inequality. Then, we conduct further analysis based on the decomposition of pay inequality into pay equity and pay inequity. We find that pay inequity has a significant negative impact on employee performance. In addition, there is an inverted U-shaped relationship between pay equity and employee performance. Our results suggest that both economic and behavioural perspectives can be supported by considering the role of inputs in our analysis.

Our study contributes to the academic literature on pay inequality and has implications for financial regulators and managers. First, we extend the existing approach (see Trevor et al. 2012) to the relationship between vertical pay disparity and employee performance in an organisational setting. Second, we extend the empirical studies on Tournament Theory in organisational settings by illustrating that neither very high nor very low pay equity can motivate employees to increase their performance and that there is a threshold. Third, although pay inequality in Australia has gained some media attention recently, there is no evidence that pay inequality impacts employee performance in Australia, according to the existing literature. Our findings can assist managers in designing a compensation system. Additionally, they suggest to regulators that CEO pay ratio disclosure, without providing an equity context, may lead to misinterpretation.

The remainder of this paper is structured as follows. The following section provides the theoretical and empirical literature review on pay inequality and develops our key hypothesises. The methodology is discussed in section 3, followed by our sample selection and empirical analysis in sections 4 and 5, respectively. The last section provides conclusions.

2.2 Literature review and hypothesis development

Individuals in an organisation are paid differently, and these differences influence their attitudes and performance. These pay differences are categorised into three types: vertical pay disparity, defined as pay differences across hierarchy levels in a corporation; horizontal pay disparity, defined as pay differences among people holding the same job; and overall pay disparity, which combines both vertical and horizontal pay disparity (Gupta et al., 2012). Wade, O'Reilly, and Pollock (2006) find evidence that CEOs' pay is a salient reference for employees in determining the fairness of their pay. Thus, the pay disparity between the CEO and the average employee impacts employees' reactions to their compensation. Although this study concentrates on CEO-Employee pay inequality as a type of vertical pay disparity, the literature review includes broader vertical pay disparity (between different hierarchy organisation levels) and critical horizontal pay disparity studies for more elaboration.

2.2.1 Theoretical and empirical background

The impact of pay disparity in an organisation has been conceptualised from both behavioural and economic perspectives (Conroy et al., 2014). The behavioural standpoint, mainly Equity Theory and Relative Deprivation Theory, predicts a negative impact of pay disparity on employee performance (Faleye et al., 2013). Equity Theory states that individuals evaluate the fairness of their compensation by comparing the ratio of their inputs (e.g., ability, intelligence, education, and effort) into the workplace to their outcome (e.g., compensation, security, and promotion) with others' ratios (Adams, 1965; Homans, 1974; Walster et al., 1973). Inequity exists when individuals' perceived ratios of inputs to outcomes are inconsistent with those of others. Therefore, individuals attempt to reduce inequity by changing their perceptions of their own or their reference group's inputs and outcomes, altering their actual inputs or outcomes, or leaving their companies (Cowherd & Levine, 1992). Similarly, the Relative Deprivation Theory argues that people feel relatively deprived when they have received less than what they deserve relative to their references. Their experience of deprivation leads to lower satisfaction and quitting the job (Levine, 1991).

Some studies support the behavioural perspective by providing evidence that large pay disparity leads to inequity perception and lower employee morale (Akerlof & Yellen, 1990; Chen & Sandino, 2012; Corneliben et al., 2011). For example, some studies illustrate that pay disparity among employees can lead to higher levels of absenteeism (Mahy et al., 2016) and is associated with higher turnover among lower-paid employees (Bloom & Michel, 2002; Jia et al., 2014; Messersmith et al., 2011; Shaw & Gupta, 2007; Wade et al., 2006). In addition, it has been shown that vertical pay disparity is detrimental to firm performance (Bebchuk et al., 2011; Z. Chen et al., 2013; Cowherd & Levine, 1992, Shin et al., 2015) and employee productivity (Pfeffer, 2007).

On the other hand, the economic perspective, mainly Tournament Theory and Expectancy Theory, argues that pay disparity positively impacts employees' motivation and leads to better performance (Conroy et al., 2014). Tournament Theory assumes that greater pay disparity between hierarchy levels in a corporation puts employees in competition for the prize of ultimate pay at the CEO level. Consequently, lower-level employees are motivated by higher pay at higher organisation levels and exert increased effort to climb the corporate ladder. Similarly, the Expectancy Theory argues that employees' motivation stems from the interplay among three factors, and all three must be strong. Employees must want an outcome such as pay, believe that increased effort will lead to the required performance level, and believe that performance will lead to the desired outcome. Then, they will be motivated to perform better. Some studies uncovered evidence favouring the economic perspective. They illustrate that the large pay disparity between hierarchy levels in an organisation provides incentives for lower levels to increase their effort and performance (DeVaro, 2006; Ehrenberg & Bognanno, 1990; Main et al., 1993), and eventually benefits firm performance (Banker et al., 2016; Faleye et al. 2013; Heyman, 2005; Kale et al., 2009; Lallemand et al., 2004; Lee et al., 2008; Mueller et al., 2017).

2.2.2 The elaboration of contradictory perspectives

Recent studies argue that behavioural and economic perspectives are more complementary than contradictory (Ridge et al., 2015; Shin et al., 2015). Therefore, they attempt to introduce a complementary approach. The first approach asserts a non-linear relation between pay disparity and outcome rather than a linear one. As a result, some studies illustrate a U-shaped relationship when examining the impact of pay disparity among workers (Grund & Westergaard-Nielsen, 2008; Mahy et al., 2011), or pay disparity between CEO and top management teams, on firm performance (Ridge et al., 2015). Alternatively, other studies find an inverse U-shaped relationship between CEO-employee pay disparity (Dai et al., 2017) or pay differences among employees (Mahy et al., 2011; Winter-Ebmer & Zweimüller, 1999) and employee performance. Shin et al. (2015) do not support a non-linear relationship between firm performance and CEO-employee pay disparity. Although evidence suggests that the relationships between pay disparity and outcomes may be non-linear, contradictory findings in these studies make general conclusions difficult.

The second approach argues that contradictory findings in prior studies stem from overlooking individuals' inputs in their compensation (Conroy et al., 2014; Gupta et al., 2012; Shin et al., 2015; Trevor et al., 2012), which is incompatible with critical assumptions in both perspectives. Therefore, some studies use control variables that explain employees' inputs (such as their talent and previous pay) in their models (Gerhart & Rynes, 2003). However, this procedure removes sources of pay disparity and is thus a sub-optimal approach (Gupta et al., 2012). Other studies argue that pay disparity related to legitimate reasons leads to higher productivity, consistent with economic perspectives. However, pay disparity for illegitimate reasons is unlikely to yield these benefits. Following this approach, it has been shown that pay-performance disparity is positively related to performance (Kepes et al., 2009; Jason D. Shaw et al., 2002). Some studies also examine the impact of pay inequity. For example, Shin et al. (2015) and Faleye et al. (2013) model the determinants of vertical pay disparity and estimate unexplained vertical pay disparity as the residual of their model.[2] Shin et al. (2015) find a negative relationship between absolute pay inequity and future firm performance. However, Faleye et al. (2013) do not find any significant relationship between pay inequity and employee performance.

Two studies attempt to consider both pay equity and inequity in their examination. Trevor et al. (2012) study horizontal pay disparity within interdependent sport teams and find that teams with high pay disparity created by variation in the individual performance of team members have higher team performance, while team performance reduces at high levels of pay disparity. They also show that pay disparity unexplained by individual performance has a negligible or slightly negative impact. Rouen (2020) separates the component of CEO and employee compensation explained by their inputs and economic factors. He defines pay disparity as the ratio of predicted CEO pay to expected average employee pay and unexplained pay disparity as the difference between the actual pay disparity and the calculated pay disparity. He finds robust evidence of a negative (positive) relation between unexplained (explained) pay disparity and future firm performance. Therefore, the role of inputs in measuring pay inequality should be demonstrated. In the absence of such a demonstration, the impact of pay inequality on performance could lead to an invalid approach to applying those theories (Rouen, 2020).

2.2.3 The impact of pay inequality on employee performance

As argued, pay inequality per se is an insufficient proxy for testing the behavioural and economic perspectives. Therefore, this study focuses on pay inequity and pay equity impacts on employee performance rather than pay inequality. Consistent with the behavioural perspective, we expect that pay inequity negatively influences employee performance. This leads to the first hypothesis, as follows:

H1: Pay inequity has a negative association with employee performance.

With regard to the previous studies, it is expected that pay equity positively relates to employee performance. However, a critical idea underlying Tournament Theory is the presence of optimal pay disparity, which is the level that can maximise employee performance in a contest (Lazear & Rosen, 1981). If the pay disparity is too small, contestants are not encouraged to compete, so the total productive output of the tournament drops. However, a high prize spread can also be detrimental because it induces high effort that contestants cannot sustain (Connelly et al., 2013). Therefore, tournament design involves strategically choosing optimal pay disparity spreads that maximise the productive output of the tournament. The empirical literature rarely refers to the existence of an optimum point for pay equity. For example, Brown et al. (2003) assert that pay disparity clearly explained by inputs may be seen as inequitable and detrimental when it is large. Trevor et al. (2012) also find that the positive impact of horizontal pay disparity, which is explained by their inputs, on team performance, is attenuated at high levels of such dispersion. This argument leads to our second prediction:

H2: Pay equity has an inverted U-shaped association with employee performance.

2.3 Methodology

Given our argument, pay inequality per se is not a reliable measure for examining its impact on performance. There is a need to consider the determinants of pay inequality to separate pay inequity from pay equity. First, this section describes our model to measure pay inequality explained by CEO's and employees' skills, company characteristics, and labour market. Therefore, we disentangle the components of each firm-year pay equity from pay inequity. Second, the model for examining the impact of the key pay ratios (pay inequality, pay equity and pay inequity) on employee performance is explained.

2.3.1 Breaking down pay inequality into pay equity and pay inequity

Following the empirical studies approach (e.g., Faleye et al., 2013; Shin et al., 2015), we model the natural logarithm of pay inequality (*LnPayInequality*) based on CEOs' and employees' skills, company characteristics and labour market, as in Eq. 2-1. Pay equity is defined as the predicted *LnPayInequality* in each firm-year (*PayEquity*), while pay inequity is the error term ε representing the deviation from the expected *LnPayInequality* inequality(*PayInequity*).

$$\begin{aligned} \mathrm{LnPayInequality}_{i,t} &= \alpha + \sum_a \beta_a \mathrm{CEO\ Skills}_{i,t} \\ &+ \sum_b \beta_b \mathrm{Employees\ Skills}_{i,k,t} + \sum_a \beta_a \mathrm{Company\ Characteristics}_{i,t} \\ &+ \sum_b \beta_b\ \mathrm{Labour\ Market}_{j,k,t} + \mathrm{Region\ Fixed\ Effects}_k \\ &+ \mathrm{Industry\ Fixed\ Effects}_j + \mathrm{Year\ Fixed\ Effects}_t + \varepsilon_{i,t} \qquad (2\text{-}1) \end{aligned}$$

In the above equation, *LnPayInequality* is calculated using the natural logarithm of the ratio of the total CEO compensation to the mean employee pay during the fiscal year.[3] Industries are defined using a two-digit Global Industry Classification Standard (GICS) code. Subscript *i* is the firm identifier, *j* is the industry identifier, *k* is the region identifier, and *t* is the fiscal year.

Highly skilled CEOs are required in larger firms with more complex operations, greater growth opportunities, and higher performance (Core et al., 1999). Firm size (*LnRevenue*), firm age (*LnAge*) and book-to-market ratio (*BTM*) are included to measure the complexity of a firm's operation and growth opportunities. In addition, the CEO's compensation is an increasing function of firm performance based on standard agency models. Firm performance is measured using the accounting return on asset (*ROA*), and annual stock return (*Ret*) (Core et al., 1999). Furthermore, it is expected that firms with noisier environments, computed by the standard deviation of common stock returns over the prior five years (*RetVar*), provide higher incentives to attract talented managers (Bloom & Michel, 2002; Core et al., 1999).

Employees' skill is measured by three ratios including, R&D intensity (*RDIntensity*), physical capital intensity (*PPTIntensity*) and workforce education (*Education*) (Faleye et al., 2013). These three ratios consider two different factors for the presence of highly skilled employees in the firm: task-based reasons such as executing R&D projects and operating high capital; and individual-based reasons, including knowledge levels. To put it differently, Firms with high R&D projects require highly skilled employees to execute those projects (Faleye et al., 2013; Toner, 2011). Additionally, capital-intensive firms with high net property, plant and equipment per employee need highly skilled employees to operate them. We use workforce education to measure the level of human capital (Barro, 2001).[4]

In addition to the skill levels of CEOs and employees, firm characteristics such as corporate governance effectiveness and capital structure can influence compensation structures. For instance, executives' incomes may increase with their bargaining power over board members, and this power tends to decrease with effective corporate governance (Core et al., 1999). Therefore, CEOs have higher bargaining power when they also hold the position of board chair (*IsCEOChair*) (Core et al., 1999; Faleye et al., 2011; Yermack, 1996) because they are more entrenched, more experienced, or more talented (Faleye et al., 2013). To measure the effectiveness of corporate governance, Board tenure (*BoardTenure*) and the percentage of independent board members on the compensation committee (*IndCommittee*) are also included in the model. We expect a positive relationship between these variables and corporate governance effectiveness. In addition, the capital structure (*Leverage*), measured by total long-term debt scaled by the total asset, is included to control pay inequality. *Leverage* may be negatively associated with compensation because it decreases companies' ability to meet their payroll obligations. However, leverage can be positively correlated with compensation since potential bankruptcy costs arising from high leverage should be compensated by higher pay (e.g., Berk et al., 2010; Chemmanur et al., 2013). Therefore, the sign of its impact on pay inequality is not predicted (Rouen, 2020; Shin et al., 2015).

Furthermore, labour market factors, which influence employees' bargaining power over executives, are included. Industry concentration (*IndConcentration*) measured using the revenue-based Hirschman–Herfindahl index over Datastream firms in the two-digit GCSI industry[5], determines market competitiveness. A highly concentrated industry shows a monopoly, which decreases employees outside opportunities and bargaining power. In addition, employee unionisation (*Union*), the percentage of employees who are members of a trade union in each region[6], unemployment rate (*UnemploymentRate*), and vacant job ratio (*VacantJob)*[7] are included. We expect that bargaining power increases with employee unionisation and decreases with industry concentration, unemployment rate and vacant job ratio.

2.3.2 The impact of pay ratios on employee performance

By following Faleye et al.'s (2013) equation, we examine the impact of key pay ratios (*LnPayInequality, PayEquity* and *PayInequity*) on employee performance using the following multivariate regression.

$$\begin{aligned} \text{Employee Performance}_{i,t} = {} & \alpha + \beta_1 \text{PayRatio}_{i,t} + \beta_2 \text{ LnAveEmployeePay}_{i,t} + \\ & \beta_3 \text{ Education}_{k,t} + \beta_4 \text{ PPEIntensity}_{i,t} + \beta_5 \text{ IndConcentration}_{j,t} + \beta_6 \text{ Union}_{k,t} + \\ & \beta_7 \text{ CEOTenure}_{i,t} + \beta_8 \text{ LnRevenue}_{i,t} + \beta_9 \text{ Leverage}_{i,t} + \text{Region Fixed Effects}_k + \\ & \text{Industry Fixed Effects}_j + \text{Year Fixed Effects}_t + \varepsilon_{i,t} \end{aligned} \quad (2\text{-}2)$$

where subscripts are defined as in the previous equation. Employee performance is measured as Total Factor Productivity (*TFP*) and the natural logarithm of revenue per employee (*SLE*). The primary variable of interest is *PayRatio*, which is either *LnPayInequality*, *PayEquity* or *PayInequity*. The later discussion can then include pay inequality to make comparisons with previous studies. Similar to prior studies, we control other factors affecting employee performance, including employees' skills, outside employees' opportunities, and firm characteristics. We expect that employee performance increases with skill, measured by PPE intensity (*PPTIntensity*) and employee education (*Education*), and outside opportunities, measured by Industry concentration (*IndConcentration*) and employee unionisation (*Union*).[8] We also control for the impact of the average employee compensation (*LnAveEmployeePay*), CEO experience (*CEOTenure*), firm size (*LnRevenue*) and capital structure (*Leverage*). Finally, the regression includes year, two-digit GICS industry, and region fixed effects. Appendix 2.1 defines all variables used in our empirical analysis.

Total Factor Productivity (*TFP*) is calculated following Faleye et al. (2006), where it is assumed that the firm's production function follows the Cobb-Douglas formula:

$$Y_{i,t} = A\, L_{i,t}^{\beta_j}\, K_{i,t}^{\alpha_j} \tag{2-3}$$

$Y_{i,t}$ is the revenue, $L_{i,t}$ is the number of employees, and $K_{i,t}$ is the net property, plant, and equipment of firm *i* in fiscal year *t* in industry *j*.[9] We transformed the above equation by taking the natural logarithm of both sides. We estimate a separate regression for each two-digit GICS industry group for all Datastream firms to control industry heterogeneity. Each regression includes a year-fixed effect, and the standard error is corrected by firm-level clustering. Finally, *TFP* is measured as the residual of the following equation.

$$y_{i,t} = a_{i,j,t} + \beta_j\, l_{i,t} + \alpha_j\, k_{i,t} + \varepsilon_{i,t} \tag{2-4}$$

TFP defines employee performance as the portion of firm productivity that is unaffected by capital. For robustness purpose, this study considers an additional employee performance proxy, measured as the natural logarithm of the revenue per employee (*SLE*) (Cronqvist et al., 2009). However, this measure captures productivity at the most basic level (Faleye et al., 2013).

Our model may face the challenge of a simultaneity problem since compensation decisions and employee performance are jointly determined, and therefore, the causality may run in both directions, from pay ratios to employee performance and vice versa. The appropriate way to control the endogeneity problem arising from reverse causality or a systematic measurement error on the explanatory variables is to use instrumental variables that are not subject to reverse causality for the variable of primary interest, pay ratio. Following the literature (e.g., Faleye et al., 2013), we consider the possibility of persistence in employee performance, influenced by the relationship between the current and previous level of performance, and address the endogeneity problem as best as we can using two-step "system generalised method of moments (SGMM)" (Arellano & Bond, 1991; Arellano & Bover, 1995) with robust standard errors. The SGMM estimator also controls for unobserved heterogeneity, dynamics in the system by using a lagged dependent variable, endogeneity problems arising from simultaneity, reverse causality, or mismeasurement of variables that may bias estimates. SGMM contains both a level equation and a first differences equation that are jointly estimated as a system. For the level equation, lagged first differences of pay ratios and firm-level ratios are used as instruments in our estimation. The level equation also uses the lagged values of employee compensation, CEO tenure and industry-level and region-level ratios as their instrument. For the first differences equation, the second lagged values of pay ratios and firm-level ratios are used as instruments. It also uses first differences of second lagged of other regressors as their instrument. The specification is checked using the Hansen statistic, a test of over-identifying restrictions for the validity of the instrument set. We also report a statistic for the absence of second-order serial correlation in the first-differenced residuals.

2.4 Sample and data

Our sample includes Australian Securities Exchange (ASX) firms and Australian regional macroeconomic data collected from three databases: Thomson Reuters Datastream (TRD), MorningStar (DatAnalysis), and the Australian Bureau of Statistics (ABS). TRD provides detailed annual reports and stock market data. Other detailed company information (such as an address, and industry group) is available in DatAnalysis. ABS covers a wide range of macroeconomic data by region and industry in Australia. All three databases are merged, as discussed below, to develop a final firm-year dimensional database used in this study.

Most of the variables are collected from TRD and ABS. TRD includes our variables of interest in this research: CEO compensation and employees' average compensation. CEO's compensation is defined in the TRD database as the highest remuneration in the firm.[10] Employees' average compensation is calculated as the ratio of wage and salaries expenses minus the highest remuneration to the number of employees minus one.[11] Since these two variables are our key variables, the firms in our initial sample are restricted to those with at least one observation of the highest remuneration package or wage and salary expenses from 2004 to 2019. This step yields a list of 2845 companies listed in ASX from 2004 to 2019. Then, financial data are collected from 2004 to 2019 for all 2845 firms. In addition, regional and industry-level data on Australia's economy, labour, population, and education are collected from ABS.

In order to merge TRD and ABS databases, industry groups and the state of incorporation identifiers are required for all firms. However, there are two issues. First, the state of incorporation for all companies and the two-digit GICS codes is not available in TRD. To address this problem, DatAnalysis is employed. The country of incorporation, registered office state and GICS for all companies are retrieved from DatAnalysis. Then, the missing values of the country of incorporation and registered office state in TRD are completed using data from

DatAnalysis. This process leads to 2649 firms being incorporated in Australia. In addition, we merge a two-digit GICS industry code to our sample based on the company name. The two-digit GICS industry code is not reported for 26 companies. This process reduces the number of our companies to 2623**.**

The second issue is that the industry identifiers differ in DatAnalysis and ABS. The former uses GICS and the latter ANZSIC. Thus, merging our sample and the ABS database creates another challenge. To solve this problem, we relate each two-digit GICS industry code to a two-digit ANZSIC code. If an exact match is not possible for the two-digit ANZSIC code, we use the broadest level of ANZSIC code that potentially maps to the GICS industry code. Appendix 2.2 illustrates the industry map. Given these steps, our initial sample leads to 2623 unique firms incorporated in Australia from 2004 to 2019.

Unfortunately, TRD does not provide complete compensation data for CEOs. Therefore, our sample is limited to those observations in our initial sample that covered CEO Compensation, total senior executive compensation or board member compensation.[12] Consequently, we lost a significant proportion of the observations obtained from Datastream, resulting in a final sample of 547 unique firms over the period 2004-2019. Then, all the continuous variables in our sample data are trimmed at the 1% and 99% levels to minimise the effect of any outliers.[13] Following all adjustments, the sample size reduces to 2132 firm-year observations (385 unique firms) in our first regression (refer to Table 2.4).

2.5 Empirical Analysis

This section begins with the summary statistics of all variables. It follows by estimating pay equity and pay inequity according to Eq. 2-1. We then discuss and test our hypotheses on the relationship between pay ratios and employee performance.

2.5.1 Descriptive statistics

Table 2.1 presents the mean and median for pay inequality over years, industries and regions. As shown in panel A, the median (mean) of pay inequality increased from 34.9 (50.94) to 47.64 (88.47) from 2004 to 2007 (before the GFC). After the GFC, pay inequality gradually declined and reached 18.31(38.82) in 2010. Since 2011, pay inequality has been more stable.[14] In addition, the median pay inequality is higher in banking, insurance, transportation and retail industries, where the CEO earns about 49, 41, 36 and 35 times more than the average employee, respectively (Table 2.1, panel B). Comparing pay inequality over different regions in Australia shows that two states, New South Wales and Victoria, have the highest median pay inequality with respective values of 26.10 and 28.69 (Table 2.1, panel C). Our sample does not show the pay inequality reported in the media. This discrepancy exists mainly as a consequence of our measure of pay inequality. Because of the lack of executives' compensation data, our average employee pay includes executive salaries. This leads to a higher average employee pay and lower pay inequality.

Table 2.2 provides descriptive statistics for all variables in this study. The mean and the median of *LnPayInequlity* are about 3.018 and 3.054.[15] Turning to employee performance, the mean (median) of total factor productivity (*TFP*) and revenue per employee (*SLE*) are 0.372 (0.229) and 6.175 (6.205). With regard to corporate governance, we find that about 10% of our sample firms have dual CEO Chairman positions. On average, 82% of the compensation committee members are independent board members.

Table 2.3 presents the Pearson correlation matrix for the firm-level and labour market variables. With regard to the pay ratios, there is a strong positive relation between *LnPayInequality* and *PayEquity* at 0.62. Similarly, the correlation between *LnPayInequality* and *PayInequity* is significantly positive at 0.78. However, the correlation between pay inequity and pay equity is slightly negative, consistent with prior research (Rouen, 2020). In addition, higher mean employee pay is associated with lower pay ratios. As we expected, there is a positive correlation between firm size (*LnRevenue*), firm performance (*ROA* and *Ret*) and pay inequality. Unsurprisingly, pay inequity is not highly correlated with our control variable. Consistent with our hypotheses H1 and H2, there is a positive correlation between pay equity and *TFP* (*SLE*) at 0.08 (0.22) and a negative correlation between pay inequity and *TFP* (*SLE*) at -0.35 (-0.38). As is shown, none of the variables is highly correlated, and the most significant correlation coefficient is 0.58 between *Union* and *Education*.

Table 2.1. Pay inequality over years, industries, and regions

Panel A: Pay inequality over the years

Year	Number of firms	Mean	1st Quartile	Median	3rd Quartile
2004	30	50.94	16.34	34.90	65.00
2005	36	50.45	22.18	43.33	65.35
2006	51	69.20	29.42	50.54	78.19
2007	56	88.47	31.16	47.64	79.34
2008	67	70.76	28.36	42.07	82.47
2009	137	45.62	10.59	26.13	54.82
2010	194	38.82	6.58	18.31	46.14
2011	205	50.73	6.64	21.54	47.63
2012	217	42.14	8.39	22.72	48.22
2013	236	33.97	7.47	19.52	36.96
2014	237	33.24	7.10	16.64	40.80
2015	256	35.03	7.68	18.77	41.74
2016	269	32.93	9.25	18.81	35.97
2017	281	35.02	10.17	19.31	41.00
2018	284	33.71	9.86	20.14	38.01
2019	274	37.21	9.33	19.50	35.93

Panel B: Pay inequality across different industries

Industry	Number of firms	Mean	1st Quartile	Median	3rd Quartile
Semiconductors & Semiconductor Equipment	14	5.64	3.25	5.27	6.71
Technology Hardware & Equipment	18	10.89	9.48	10.72	12.11
Household & Personal Products	17	15.79	10.04	14.66	17.03
Software & Services	116	16.07	6.93	12.58	19.49
Consumer Durables & Apparel	26	19.87	10.11	12.18	14.27
Utilities	63	20.47	4.00	12.01	33.93
Pharmaceuticals, Biotechnology & Life Sciences	75	21.67	4.09	7.33	15.79
Diversified Financials	168	21.88	8.83	18.85	26.52
Energy	250	23.14	4.15	10.68	27.10
Media & Entertainment	107	28.03	12.38	20.21	35.22
Commercial & Professional Services	150	30.64	9.18	17.35	46.57
Real Estate	148	35.93	12.47	24.66	51.11
Consumer Services	171	36.02	12.38	23.41	50.09
Automobiles & Components	19	36.67	4.84	8.74	27.09
Telecommunication Services	45	39.62	17.45	32.90	58.62
Capital Goods	168	45.67	8.65	19.44	41.03
Insurance	49	47.59	35.79	41.00	64.43
Transportation	90	49.67	25.17	36.16	66.51
Health Care Equipment & Services	126	50.03	15.52	25.51	58.50
Materials	651	50.39	7.78	23.28	54.06
Banks	100	59.00	28.03	49.94	82.15
Retailing	147	60.81	21.23	35.03	59.29
Food, Beverage & Tobacco	76	68.23	10.36	16.46	30.89
Food & Staples Retailing	36	76.83	20.62	34.91	138.48
Banks	100	59.00	28.03	49.94	82.15

Panel C: Pay inequality across regions

Region	Number of firms	Mean	1st Quartile	Median	3rd Quartile
NSW	1006	43.79	13.72	26.10	51.42
VIC	729	44.88	12.70	28.69	58.60
QLD	351	24.55	7.69	16.74	27.66
SA	100	19.91	10.13	14.24	23.60
WA	615	40.44	5.68	10.69	28.50
TAS	17	55.67	11.90	14.90	27.87
NT	12	2.44	2.12	2.25	2.91

Note: Table 2.1 presents the summary statistics of pay inequality over years, industries, and regions. Pay Inequality is calculated as CEO compensation to average employee compensation. Panel A reports summary statistics of pay inequality over 2004-2019. Panel B reports summary statistics of pay inequality in different industries. Panel C reports summary statistics of pay inequality in different regions. Pay inequality is trimmed at 1% and 99%.
All variables are defined in Appendix 2.1.

Table 2.2. Descriptive statistics of the sample

	Obs.	Mean	S.D.	Min	1st Quartile	Median	3rd Quartile	Max
LnPayInequality	2830	3.018	1.143	0.307	2.222	3.054	3.804	6.790
PayEquity	2132	3.000	0.707	-0.007	2.552	3.024	3.513	5.280
PayInequity	2132	0.000	0.877	-2.875	-0.553	-0.037	0.472	3.891
TFP	3454	0.372	1.175	-3.515	-0.360	0.229	1.084	4.349
SLE	3472	6.175	1.387	-0.324	5.456	6.205	6.969	10.217
LnAveEmployeePay	2937	11.511	0.987	7.494	11.075	11.524	11.927	15.143
LnRevenue	3864	5.893	2.542	-2.364	4.950	6.203	7.554	10.833
BTM	3892	0.760	0.658	-0.102	0.326	0.585	0.980	4.348
LnAge	3924	2.543	0.878	-0.587	2.103	2.613	3.141	4.208
ROA	3879	2.234	15.931	-87.400	-0.510	5.230	9.870	46.880
Ret	3780	0.010	0.479	-1.696	-0.215	0.068	0.285	1.342
STDRet	3445	0.134	0.072	0.038	0.080	0.115	0.176	0.435
Leverage	3947	15.866	15.148	0.000	0.294	13.526	26.066	71.935
IsCEOChair	4032	0.105	0.307	0.000	0.000	0.000	0.000	1.000
BoardTenure	3886	5.824	2.752	0.880	3.940	5.380	7.160	16.060
IndCommittee	3848	82.662	23.797	0.000	67.000	100.000	100.000	100.000
PPEIntensity	3491	2.565	8.037	0.000	0.029	0.135	1.056	83.402
RDIntensity	3964	0.456	2.095	0.000	0.000	0.000	0.000	21.252
IndConcentration	4001	0.094	0.103	0.023	0.036	0.065	0.108	1.000
Education	4032	19.880	3.014	11.327	17.446	19.834	22.228	24.845
Union	4032	13.967	2.375	10.419	12.157	13.710	15.860	22.263
Unemployment	4032	5.390	0.666	2.962	4.825	5.376	5.897	7.697
VacantJob	4032	2.153	1.160	0.316	1.305	1.851	2.653	5.231

Note: Table 2.2 presents summary statistics for the main variables in our samples. Continuous variables are trimmed at 1% and 99%.
All variables are defined in Appendix 2.1.

Table 2.3. Correlation matrix

Panel A: from variable LnPayInequality to STDRet

	1	2	3	4	5	6	7	8	9	10	11	12
1-LnPayInequality	1.00											
2- PayEquity	0.6273*	1.00										
3- PayInequity	0.7788*	0.00	1.00									
4-TFP	-0.2112*	0.0793*	-0.3491*	1.00								
5-SLE	-0.1109*	0.2192*	-0.3830*	0.6890*	1.00							
6-LnAverageEmployee	-0.6437*	-0.2353*	-0.6805*	0.3467*	0.4827*	1.00						
7-LnRevenue	0.5104*	0.7955*	0.00	0.1441*	0.4057*	-0.1147*	1.00					
8-BTM	-0.1220*	-0.2095*	0.00	0.0490*	0.0463*	0.00	-0.0703*	1.00				
9-LnAge	0.1360*	0.2575*	0.00	0.0472*	0.0533*	-0.01	0.1117*	0.0590*	1.00			
10-ROA	0.1666*	0.2456*	0.00	0.1075*	0.2237*	-0.0713*	0.3704*	-0.2926*	-0.0480*	1.00		
11-Ret	0.0794*	0.1101*	0.00	0.0367*	0.0670*	-0.02	0.1059*	-0.4497*	-0.02	0.3545*	1.00	
12-STDRet	-0.3006*	-0.4466*	0.00	0.02	-0.2614*	0.0391*	-0.5832*	0.1886*	-0.1237*	-0.3583*	-0.1482*	1.00
13-Leverage	0.1995*	0.3076*	0.00	-0.1393*	0.1242*	-0.0535*	0.3242*	-0.0468*	-0.0625*	0.1128*	0.01	-0.2849*
14-IsCEOChair	-0.02	0.00	0.00	0.0368*	0.00	-0.03	-0.0414*	-0.0381*	0.0549*	0.0367*	-0.02	0.03
15-CEOTenure	-0.02	-0.04	-0.02	0.00	-0.03	-0.02	0.0980*	-0.0481*	0.2735*	0.1240*	0.03	-0.2253*
16-BoardTenure	-0.01	-0.04	0.00	0.00	-0.01	-0.02	0.1098*	-0.0556*	0.2687*	0.1188*	0.0370*	-0.2210*
17-IndCommittee	0.0774*	0.1061*	0.00	0.02	0.1088*	0.1010*	0.1910*	-0.03	0.0686*	0.0721*	0.00	-0.1925*
18-PPEIntensity	-0.2008*	-0.3430*	0.00	0.1149*	0.2859*	0.3669*	-0.2152*	0.1553*	-0.01	-0.0558*	-0.0529*	0.1377*
19-RDIntensity	-0.0697*	-0.0882*	0.00	0.01	-0.0993*	0.03	-0.0957*	-0.1420*	0.02	0.02	0.03	0.03
20-IndConcentration	0.03	0.0834*	0.00	-0.0860*	0.0335*	0.01	0.1534*	-0.1109*	0.03	-0.01	0.0350*	-0.1634*
21-Education	0.0446*	0.1347*	0.00	-0.0625*	-0.0492*	-0.01	0.01	-0.0745*	0.01	0.00	0.0447*	-0.1984*
22-Union	0.1924*	0.2767*	0.00	-0.0650*	0.0778*	-0.0643*	0.2521*	-0.0618*	-0.0625*	0.1503*	0.0401*	-0.1339*
23-Unemployment	-0.02	-0.03	0.00	0.0514*	-0.0395*	-0.0529*	-0.02	0.0950*	0.00	-0.0731*	0.03	-0.0472*
24-VacantJob	-0.03	-0.01	0.00	0.1467*	0.0466*	0.0718*	-0.1851*	0.03	0.0671*	-0.0781*	-0.0995*	0.3269*

Table 2.3. (continued)

Panel B: from variable *Leverage* to *VacantJob*

	13	14	15	16	17	18	19	20	21	22	23	24
13-Leverage	1.00											
14-IsCEOChair	-0.0464*	1.00										
15-CEOTenure	0.00	0.1813*	1.00									
16-BoardTenure	-0.01	0.1833*	1.0000*	1.00								
17-IndCommittee	0.0787*	-0.0785*	-0.01	0.00	1.00							
18-PPEIntensity	0.02	0.01	-0.1055*	-0.1129*	-0.02	1.00						
19-RDIntensity	-0.0628*	0.02	0.0987*	0.0910*	0.02	-0.0696*	1.00					
20-IndConcentration	0.0496*	-0.0397*	0.0669*	0.0723*	0.0483*	-0.0803*	0.1274*	1.00				
21-Education	0.0328*	-0.0344*	0.02	0.02	-0.0469*	-0.0696*	0.0921*	0.0616*	1.00			
22-Union	0.1364*	-0.03	0.01	0.01	0.1289*	-0.02	0.01	0.1371*	-0.5516*	1.00		
23-Unemployment	0.03	-0.03	0.01	0.00	-0.0547*	-0.0604*	-0.01	-0.02	0.0498*	-0.0840*	1.00	
24-VacantJob	-0.2469*	0.0386*	-0.1198*	-0.1240*	0.0400*	0.1440*	-0.1034*	-0.1717*	-0.2776*	0.0440*	-0.3249*	1.00

Note: Table 2.3 presents Pearson correlations for the main variables in our samples. Continuous variables are trimmed at 1% and 99%.
* Indicates significance at 5%.
All variables are defined in Appendix 2.1.

2.5.2 The determinants of pay inequality

Table 2.4 reports the result of implementing the model described in Eq. 2-1. These variables explain 37.6% of the variation in *LnPayInequality* (adjusted R-squared of 37.6%). The regression includes the year, two-digit GICS industry, and region fixed effect. The standard errors are clustered at the firm level. All continuous variables are trimmed at the 1st and 99th percentile to minimise the impact of any potential outliers.

Table 2.4. The determinants of pay inequality

		LnPayInequality	
	Predicted Sign	Coefficient	Standard Error
LnRevenue	+	0.174 ***	0.025
BTM	-	-0.129 **	0.062
LnAge	+	0.245 ***	0.066
ROA	+	-0.001	0.002
Ret	+	0.011	0.059
Ret Var	+	0.455	0.859
Leverage	+/-	0.009 ***	0.002
IsCEOChair	+	0.171	0.185
BoardTenure	-	-0.038 ***	0.014
IndCommittee	-	-0.003 *	0.002
PPTIntensity	-	-0.047 ***	0.008
RDIntensity	-	-0.023	0.015
Education	-	0.073	0.1
IndConcentration	+	-0.000	0.000
Union	-	-0.009	0.038
UnemploymentRate	+	0.128 **	0.057
VacantJob	+	0.105 **	0.051
Constant		0.714	1.949
Year Fixed Effects		Yes	
Industry Fixed Effects		Yes	
Region Fixed Effects		Yes	
Firm-level clustering standard error		Yes	
Observation		2132	
Firms		385	
Adjusted R^2		0.376	

Note: Table 2.4 presents the result of the regression model used to explain pay inequity. LnPayInequality is measured as the natural log of the ratio of total CEO compensation to average employee pay. The regression includes region, industry, and year-fixed effects. Continuous variables are trimmed at 1% and 99%. Robust standard errors are clustered at the firm level.
*, **, *** Indicate significance at the 10%, 5% and 1% levels, respectively.
All variables are defined in Appendix 2.1.

The result illustrates that CEO's skill and corporate governance effectiveness play an essential role in the level of pay inequality within firms. Regarding CEO's skill level, we find that proxies for CEO's skills such as *LnRevenue*, *LnAge*, and Inverse *BTM* have both statistically and economically significant positive associations with pay inequality. In fact, a 10% increase in *LnRevenue* and *LnAge* is associated with a 1.74% and 2.45% increase in pay inequality, and a one-unit standard deviation increase in a firm's risk (inverse BTM) leads to 8% rise in pay inequality. Regarding corporate governance effectiveness, the coefficients

BoardTenure and *IndCommittee* are negative and significant at 1% and 10%, respectively. Economically, their impact is also significant. our result shows that an increase of one standard deviation in *BoardTenure* and *IndCommittee* is associated with a decrease of 10% and 6.8% in pay inequality, respectively.

In addition, we find that pay inequality decreases by employees' skills and outside opportunities. One standard deviation increases in employees' skill measured by *PPTIntensity* leads to 31% decline in pay inequality. In addition, the unemployment rate and the percentage of vacant jobs have statistically and economically significant positive impact on pay inequality by decreasing employees' bargaining power. In our sample, one standard deviation increase in *UnemploymentRate* and *VacantJob* is associated with 8.8% and 13% increase in pay inequality.

2.5.3 The effect of pay ratios on employee performance

Table 2.5 presents the model's result using Eq. 2-2, examining the relationship between pay ratios and employee performance. First, we focus on the association between pay inequality and employee performance. As shown in both columns (1) and (5), pay inequality is significantly negatively related to employee performance with a p-value of less than 0.01. Its coefficient implies that a 10% increase in pay inequality leads to a 3.4% and 3% decrease in employee performance as measured by TFP and SLE, respectively, which are economically significant. Next, we explore the impact of pay equity and pay inequity on employee performance, shown in Columns (2) and (6). In both columns, the coefficient of pay equity is negative but not statistically significant. Columns (3) and (7) show the impact of pay inequity on employee performance. Consistent with hypothesis H1, we find that a 10% rise in pay inequity leads to a 3% fall in employee performance, which is statistically significant with a p-value less than 0.01. We repeat our regression by including both pay equity and pay inequity in the equation, columns (4) and (8). The coefficient of pay inequity remains negative and highly significant with a p-value of less than 0.01. However, the coefficient of pay equity becomes more statistically significant.

We also control the possible effect of other factors on employee performance. As expected, the coefficient of *LnAveEmployeePay* and *LnRevenue* are positive and significant in all columns. In fact, a 10% increase in *LnAveEmployeePay* and *LnRevenue* is associated with 1.5% to 4.7% and 2.3% to 4% improvement in employee performance, respectively. In addition, the results show that a 10% rise in industry concentration can increase employee performance by 8.5% to 13.5%. One explanation is that employees increase their performance to secure their careers, particularly in highly concentrated industries where there are fewer outside opportunities available to them. On the other hand, the company does not want to lose their employees because there are not enough potential employees in the market. Therefore, the company also motivates its employees to achieve higher productivity.

Table 2.5. The impact of pay ratios and employee performance

	Predicted Sign	TFP (1)	TFP (2)	TFP (3)	TFP (4)	SLE (5)	SLE (6)	SLE (7)	SLE (8)
LnPayInequality	+/-	-0.346***				-0.305***			
		(0.0000)				(0.0000)			
PayEquity	+		-0.295*		-0.490***		-0.101		-0.283*
			(0.0821)		(0.0032)		(0.5355)		(0.0726)
PayInequity	-			-0.309***	-0.345***			-0.302***	-0.323***
				(0.0000)	(0.0000)			(0.0000)	(0.0000)
LnAveEmployeePay	+	0.150**	0.471***	0.219***	0.165**	0.343***	0.616***	0.358***	0.327***
		(0.0322)	(0,0000)	(0.0041)	(0.0332)	(0,0000)	(0,0000)	(0,0000)	(0)
Education	+	-0.011	-0.067	-0.100	-0.057	0.053	-0.041	-0.057	-0.032
		(0.9101)	(0.5417)	(0.3317)	(0.5801)	(0.5899)	(0.6944)	(0.5655)	(0.7547)
PPEIntensity	+	0.001	-0.017	0.010	-0.009	0.0630***	0.0539***	0.0724***	0.0615***
		(0.8923)	(0.1942)	(0.3583)	(0.4946)	(0,0000)	(0.0002)	(0,0000)	(0.0000)
IndConcentration	-	1.357*	1.199	1.102	0.973	1.108***	1.068**	0.933*	0.857*
		(0.0704)	(0.1861)	(0.2416)	(0.2875)	(0.0033)	(0.0287)	(0.0523)	(0.0727)
Union	+/-	0.0694**	0.054	0.031	0.046	-0.017	-0.026	-0.043	-0.034
		(0.0271)	(0.14)	(0.3779)	(0.1923)	(0.5248)	(0.439)	(0.1893)	(0.2966)
CEOTenure	+	-0.002	0.001	0.006	-0.004	-0.008	-0.002	-0.002	-0.007
		(0.8632)	(0.923)	(0.6378)	(0.7262)	(0.4779)	(0.8751)	(0.9004)	(0.5863)
LnRevenue	+	0.294***	0.275***	0.234***	0.324***	0.401***	0.342***	0.333***	0.385***
		(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0,000)	(0,000)	(0.000)	(0.0000)
Leverage	+/-	-0.0113***	-0.00907***	-0.0127***	-0.00850***	-0.004	-0.002	-0.004	-0.002
		(0,0000)	(0.0028)	(0,0000)	(0.0042)	(0.1491)	(0.4617)	(0.1394)	(0.565)
Constant		-2.874	-4.565**	-1.892	-0.799	-0.154	-1.214	1.706	2.339
		(0.1414)	(0.0407)	(0.3911)	(0.7192)	(0.9336)	(0.5485)	(0.4186)	(0.2614)
Observation		2356	1932	1932	1932	2364	1938	1938	1938
Firms		409	368	368	368.000	409	368	368	368
Adjusted R2		0.442	0.441	0.462	0.469	0.626	0.585	0.604	0.606
Root MSE		0.813	0.815	0.799	0.794	0.751	0.771	0.753	0.751

Note: Table 2.5 reports the relation between pay ratios and employee performance. Employee performance is measured as SLE, the natural log of revenue per employee, and TFP, the residual of industry-specific Cobb–Douglas production functions. LnPayInequality is measured as the natural log of the ratio of total CEO compensation to average employee pay. PayEquity is the predicted pay inequality in each firm-year and PayInequity is the residual of Eq. 2-1. Each regression includes region, industry, and year fixed effects. Continuous variables are trimmed at 1% and 99%. P-values are reported in parentheses based on robust standard errors clustered at the firm level.
*, **, *** Indicate significance at the 10%, 5% and 1% levels, respectively.
All variables are defined in Appendix 2.1.

Table 2.6 presents the estimated coefficient by two-step SGMM used to solve the endogeneity problem in our model. Since SGMM considers the persistence in employee performance, it shows the short-run impact of pay ratios on employee performance. Columns (1) and (5) in Table 2.6 confirm our prior results in Table 2.5 It demonstrates that increasing pay inequality is perceived as unfair income distribution, leading to a negative effect on employee performance. The coefficient of *LnPayInequalit* in column (1) implies that a 10% increase in *LnPayInequality* is associated with a decrease of 1.8% in employee performance measured by TFP in the short run which is economically non-trivial. [16] Our result contrasts with Faleye et al.'s (2013) result, with no significant relationship between pay inequality and employee performance in the US. One explanation may be the difference in calculating average employee pay. Faleye et al. (2013) measure the average employee pay as total labour expenses less total executive compensation divided by the number of employees. In contrast, we calculate it as total employee expenses less total CEO pay divided by the number of employees minus one.[17] The second explanation may be the difference in the context of the experiment. Equity and Relative Deprivation theories assert that the impact of pay inequality can be different in different samples, in which employees have different norms or values.[18] Australia is one of the wealthiest countries globally (Credit Suisse Research Institute, 2019), and it is widely regarded as an egalitarian country where the principle of a "Fair Go" is strongly supported by the community and all political parties (Saunders & Wong, 2013). The Labour Party is Australia's oldest political party, established federally in 1901. Australian political leaders continue to stress the importance of the "Fair Go" in defining what Australia stands for as a nation. Moreover, several studies (e.g., Chesters, 2010; Meagher & Wilson, 2008) examined Australian attitudes towards income inequality and found that most Australians believe that income inequality between the lowest and highest income levels is significant. Therefore, it would be anticipated that the behavioural perspective is more dominant in Australia.

Table 2.6. The impact of pay ratios on employee performance using SGMM

	TFP				SLE			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LnPayInequality	-0.181**				-0.224**			
	(0.0417)				(0.0121)			
PayEquity		-0.690***		-0.555***		-0.389		-0.472*
		(0.0085)		(0.0096)		(0.1477)		(0.0724)
PayInequity			-0.134*	-0.180**			-0.176**	-0.227***
			(0.0964)	(0.0188)			(0.0294)	(0.0021)
L.TFP	0.549***	0.727***	0.613***	0.611***				
	(0.0000)	(0.0000)	(0.0000)	(0.0000)				
L.SLE					0.531***	0.592***	0.602***	0.5756***
					(0.0000)	(0.0000)	(0.0000)	(0.0000)
LnAverageEmployee	0.048	0.081	0.103	0.018	0.075	0.211***	0.066	0.0195
	(0.569)	(0.1594)	(0.2876)	(0.8341)	(0.4015)	(0.0039)	(0.4512)	(0.0021)
Education	-0.059	0.015	-0.091	-0.030	0.026	0.022	-0.021	0.038
	(0.5375)	(0.7912)	(0.1646)	(0.6467)	(0.7867)	(0.7594)	(0.7588)	(0.5319)
PPEIntensity	-0.008	-0.0380**	-0.013	-0.027	0.018	-0.004	0.0244*	0.008
	(0.5699)	(0.0224)	(0.5008)	(0.1157)	(0.1576)	(0.8317)	(0.075)	(0.6147)
IndConcentration	1.617**	0.843	1.165	0.877	0.861*	0.828**	0.785	0.517
	(0.0262)	(0.1314)	(0.1026)	(0.1083)	(0.0799)	(0.042)	(0.169)	(0.2945)
Union	0.054	0.068	-0.012	-0.001	0.049	0.064	0.037	0.038
	(0.2615)	(0.1876)	(0.8326)	(0.9803)	(0.3455)	(0.19)	(0.4841)	(0.4576)
CEOTenure	-0.007	-0.008	0.001	-0.010	-0.014	-0.008	-0.004	-0.010
	(0.4173)	(0.313)	(0.8671)	(0.2298)	(0.1395)	(0.4199)	(0.6322)	(0.3325)
LnRevenue	0.149***	0.178***	0.102***	0.202***	0.229***	0.197***	0.151***	0.250***
	(0.0017)	(0.0015)	(0.0036)	(0.0004)	(0.0001)	(0.0015)	(0.0003)	(0.0001)
Leverage	0.001	0.004	0.000	0.002	0.003	0.003	0.000	0.004
	(0.8159)	(0.1817)	(0.9241)	(0.4941)	(0.3986)	(0.306)	(0.9122)	(0.2134)
_Constant	0.175	-0.638	0.874	1.569	0.091	-1.098	0.704	1.011
	(0.9431)	(0.7059)	(0.6685)	(0.413)	(0.9724)	(0.5467)	(0.7309)	(0.6003)
Observation	1841	1577	1577	1577	1853	1585	1585	1585
Firms	348	317	317	317	350	318	318	318
Number of Ins.	187	183	179	203	187	183	183	207
Arellano-Bond test for AR(1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Arellano-Bond test for AR(2)	0.433	0.631	0.504	0.552	0.543	0.930	0.928	1.000
Hansen test of over identification	0.246	0.395	0.616	0.580	0.437	0.622	0.380	0.577
Difference-in-Hansen tests of exogeneity	0.501	0.431	0.710	0.475	0.304	0.742	0.551	0.819

Note: Table 2.6 present the impact of pay ratios on employee performance. Employee performance is measured as SLE, the natural log of revenue per employee, and TFP, the residual of industry-specific Cobb–Douglas production functions. All coefficient are estimated using SGMM (SGMM, in column 3 and 4, is different from what explained in the paper. The only difference is that the first differences equation uses the first differences of the third lagged average employee compensation as a instrument). Continuous variables are trimmed at 1% and 99%. P-values are reported in parentheses based on robust standard errors clustered at the firm level.
*, **,*** indicate significance at the 10%, 5% and 1% level, respectively.
All variables are defined in Appendix 2.1.

Columns (2) and (6), shows mixed results for the association between *PayEquity* and employee performance. Regarding TFP as a proxy of employee performance, the coefficient of *PayEquity* is statistically and economically significant negative. In fact, a 10% increase in *PayEquilty* leads to a 6.9% decline in employee performance in the short run. However, Focusing on *SLE* as a measure of employee performance, we cannot find a statistically significant impact of *PayEquity* on employee performance. Therefore, the significance level of its impact on employee performance is ambiguous. In addition, Columns (3) and (7) provide further evidence of the negative and significant relationship between *PayInequity* and employee performance, consistent with our hypothesis. The negative coefficient of *PayInequity* means that employees respond differently to *PayInequity* that is in their favour (negative *PayInequity*) than *PayInequity* which is not (positive *PayInequity*). In fact, negative *PayInequity* is perceived as favourable pay inequality because the pay inequality is less than an expected amount. Our result shows that moving from favourable pay inequality to expected pay inequality decreases employee performance. In contrast, positive *PayInequity* is interpreted as unfavourable pay inequality since the pay inequality is more than an expected amount. In this situation, increasing *PayInequity* from zero to a positive amount leads to reduced employee performance. Hence, employees have higher performance in the presence of favourable *PayInequity* rather than unfavourable *PayInequity*. Finally, columns (4) and (8) show the further examination of our regression when both *PayEquity* and *PayInequity* are included. In all columns, there is a negative and significant relation between *PayEquity*, *PayInequity* and employee performance.

2.5.4 Examining a non-linear relationship between pay equity and employee performance

In the previous section, we examine the linear relation between pay ratios and employee performance. The analysis illustrates that pay inequality and pay inequity negatively affect employee performance, while the result for pay equity is unclear. As discussed under hypothesis 2, this section investigates whether pay equity has a non-linear relationship with employee performance, based on Tournament Theory. Table 2.7 shows that the coefficient estimates of squared pay equity and pay equity are significantly negative and positive, creating an inverse U-shaped relation between pay equity and employee performance. The finding does not change in the SGMM model. However, the value of the turning point slightly decreases. This result supports the view that there is a non-linear relationship between pay equity and employee performance, suggesting that there is an optimum level of pay equity. Therefore, a pay equity level that is too high or too low is sub-optimal in terms of employee productivity. This result suggests that a reward system that is linked to individuals' inputs can increase employee performance. However, the non-linear relationship indicates that increasing pay equity above the turning point may lead to lower employee productivity. Therefore, it is essential for managers to consider the current level of pay equity in their company before deciding to increase it.

We also examine the non-linear relationship between two other pay ratios (pay inequality and pay inequity) and employee performance.[19] The results do not indicate a non-linear association between these two ratios and employee performance. The coefficient of pay inequality is significantly negative, and the coefficient of the square term of pay inequality is significantly positive. However, its turning point (minimum point) exceeds the maximum pay inequality in our sample. Similar to our analysis of pay inequality, the coefficient of pay inequity is significantly negative, and the coefficient of the square term of pay inequity is significantly positive. Nevertheless, we find that there is an extreme turning point at the 95th percentile. Hence, our analysis shows an inverse U-shaped relationship between pay equity and employee performance and a linear negative relationship between other ratios, pay inequality pay inequity, and employee performance.

Table 2.7. Non-linear relationship between pay equity and employee performance

	TFP				SLE			
	Primary1	SGMM1	Primary2	SGMM2	Primary3	SGMM3	Primary3	SGMM4
Lag.TFP		0.647***		0.650***				
		(0.000)		(0.0000)				
Lag.SLE						0.536***		0.539***
						(0.000)		(0.0000)
PayEquity	2.207***	1.037**	1.775***	0.820**	2.887***	1.078**	2.513***	0.749**
	(0.000)	(0.0499)	(0.0002)	(0.0418)	(0.000)	(0.0122)	(0.0000)	(0.0330)
Squared PayEquity	-0.400***	-0.246***	-0.357***	-0.210***	-0.480***	-0.214***	-0.442***	-0.188***
	(0.000)	(0.001)	(0.0000)	(0.0012)	(0.000)	(0.0001)	(0.0000)	(0.0002)
PayInequity			-0.288***	-0.107			-0.250***	-0.187**
			(0.0000)	(0.1371)			(0.0000)	(0.0100)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1932	1577	1932	1351	1938	1585	1938	1355
Firms	368	317	368	281	368	318	368	283
Adjusted R2	0.482	-	0.501	-	0.636	-	0.648	-
Root MSE	0.784	-	0.770	-	0.722	-	0.710	-
Number of Ins		207		231		207		231
Arellano-Bond test for AR(1)		0		0.000		0		0
Arellano-Bond test for AR(2)		0.529		0.548		0.97		0.996
Hansen test of over identification		0.424		0.689		0.792		0.775
Difference-in-Hansen tests of exogeneity		0.501		0.798		0.895		0.935
Turning Point	2.7560	2.1047	2.484	1.9513	3.0086	2.5223	2.840	1.9888
Percentile that the turning point belongs	33	-	20	-	47	-	38	-
Lower-bond slope	2.2125	1.0407	1.7800	0.8230	2.8931	1.0808	2.5186	0.7513
Lowerbond p-value	0.0000	0.0248	0.000	0.208	0.0000	0.0061	0.000	0.164
Upperbond slope	-2.0214	-1.5651	-1.998	-1.3993	-2.1793	-1.1785	-2.15846	-1.2392
upprbond p-value	0.0000	0.0000	0.000	0.000	0.0000	0.0000	0.000	0.000
P-value /utest	0.0000	0.0248	0.0001	0.028	0.0000	0.0061	0.000	0.0164

Note: Table 2.6 present the non-linear relationship between pay equity and employee performance. Employee performance is measured as SLE, the natural log of revenue per employee, and TFP, the residual of industry-specific Cobb–Douglas production functions. Pay Equity is the predicted pay inequality in each firm-year according to Eq. 2-1 and Pay Inequity is the residual of Eq. 2-1. The regression includes region, industry, and year fixed effects. In the SGMM columns the result of SGMM estimation is reported (SGMM2 and SGMM4 are different from what is explained in the paper. The only difference is that the level equation uses the second lagged values of employee compensation, CEO tenure and industry-level and region-level ratios as their instruments). Continuous variables are trimmed at 1% and 99%. P-values are reported in parentheses based on robust standard errors clustered at the firm level.
*, **,*** indicate significance at the 10%, 5% and 1% level, respectively. All variables are defined in Appendix 2.1.

2.6 Limitations and future study directions

Our results should be viewed in light of their potential limitations. First, we assume that employees are aware of their CEO's compensation and that the CEO's pay is a reference against which to evaluate their compensation. Although we do not directly test this assumption, the focus of regulators and news on executive compensation, empirical studies on CEO pay ratio, and the robustness of our findings support this assumption. A related limitation is that our study is limited to vertical pay disparity. However, individuals compare their compensation using a variety of referents. Therefore, a future avenue for research would be comparing the impact of different types of pay disparity and investigating the overall effect of pay disparities. Second, behavioural theories depend on individuals' perceptions of inputs and outcomes, which contribute to their reactions (Gupta et al., 2012). However, we do not assess employees' perceived inputs and outcomes in this study. Following Adams (1965), we assume that employees consider their effort as input and monetary reward as an outcome. Therefore, future research might explore how other perceived outcomes (such as a high-quality working environment) moderate the effect of compensation disparity on performance.

A further limitation is the lack of publicly available data. Therefore, our measure of pay inequity probably will be associated with compensation based on factors that we were unable to detect. Despite this limitation, results consistent with previous research support our conceptual and empirical modelling of pay equity and inequity. A related limitation is that our result is based on Australian listed firms, where there is a strong emphasis on egalitarianism. Hence, our findings may not hold in a cross-cultural setting with varying degrees of pay disparity and inequity aversion. Therefore, another avenue for future research would be to investigate whether cultural views on compensation influence this relationship. A final limitation is that we assume all employees in different working places react homogeneously to pay disparity. It is still unknown whether individuals with different characteristics in various jobs and working environments have the same reaction to pay equity and pay inequity. Developing appropriate conceptual models for investigating this question will be another future research area. Given these limitations, we suggest our study does provide new insight into the accumulating research on pay dispersion and supports the notion that such research is vital for understanding how to design compensation systems properly.

2.7 Conclusion

Using a dataset of Australian listed companies, we study how within-firm pay inequality between CEO and employee relates to employee performance and whether breaking down pay inequality into pay equity and pay inequity can provide an appropriate basis for integrating behavioural and economic perspectives. We find that higher pay inequality is significantly associated with lower employee productivity, indicating that the behavioural perspective is dominant in our sample. In order to separate pay inequality from pay equity, we estimate pay inequality according to CEOs' and employees' inputs, company characteristics and the labour market. Consistent with our expectations, we find that pay inequality is positively related to CEOs' skills but negatively associated with employees' input and outside opportunities, as well as corporate governance effectiveness. In addition, we find that pay inequity, which is an unexplained part of pay inequality, is negatively related to employee performance, consistent with the behavioural perspective. However, the relationship between pay equity and employee performance is not clear. We examine the possibility of a non-linear pay equity impact. Our results suggest that, at least in our sample, at a higher level of pay equity, increased pay equity diminishes employee performance. We find an inverted U-shaped relationship between pay equity and employee performance.

Our findings extend the previous integrated approach to the relationship between vertical pay disparity and employee performance in an organisation setting. In general, our results suggest that employees exhibit higher performance where there is a small level of pay inequity and a large amount of pay equity. However, it should be noted that increasing pay equity beyond a specific threshold tends to decrease employee performance. In addition, our findings have managerial implications for the design of compensation between hierarchical levels. We believe that a pay system based on individuals' input into the workplace can effectively motivate employees and increase their performance. However, managers should consider the current level of pay equity in their company before deciding to increase pay equity. Our non-linear analyses indicate that an increase in pay equity may have a negative impact on employee performance for companies that already exhibit high levels of pay equity. Our findings also have implications for regulators. They suggest that CEO pay ratio disclosure per se, without putting it into an equity context, will lead to misinterpretation. Without detailed knowledge of employees' and CEOs' input, financial statement users may interpret the CEO pay ratio with insufficient information. We believe disclosure of relevant information about workforces can help financial statement users to more accurately judge the effect of pay structure on performance.

2.8 References

Adams, J. S. (1965). Inequity in social exchange. *Advances in Experimental Social Psychology*, *2*, 267–299. https://doi.org/10.1016/S0065-2601(08)60108-2

Akerlof, G. A., & Yellen, J. L. (1990). The fair wage-effort hypothesis and unemployment. *The Quarterly Journal of Economics*, *105*(2), 255–283. https://doi.org/10.2307/2937787

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277–297. https://doi.org/10.2307/2297968

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*(1), 29–51. https://doi.org/10.1016/0304-4076(94)01642-D

Banker, R. D., Bu, D., & Mehta, M. N. (2016). Pay gap and performance in China. *Abacus*, *52*(3), 501–531. https://doi.org/10.1111/abac.12082

Barro, R. J. (2001). Human capital and growth. *American Economic Review*, *91*(2), 12–17. https://doi.org/10.1257/aer.91.2.12

Bebchuk, L. A., Cremers, K. J. M., & Peyer, U. C. (2011). The CEO pay slice. *Journal of Financial Economics*, *102*(1), 199–221. https://doi.org/10.1016/j.jfineco.2011.05.006

Berk, J. B., Stanton, R., & Zechner, J. (2010). Human capital, bankruptcy, and capital structure. *The Journal of Finance*, *65*(3), 891–926. https://doi.org/10.1111/j.1540-6261.2010.01556.x

Bloom, M., & Michel, J. G. (2002). The relationships among organizational context, pay dispersion, and among managerial turnover. *Academy of Management Journal*, *45*(1), 33–42. https://doi.org/10.5465/3069283

Brown, M. P., Sturman, M. C., & Simmering, M. J. (2003). Compensation policy and organizational performance: The efficiency, operational, and financial implications of pay levels and pay structure. *Academy of Management Journal*, *46*(6), 752–762. https://doi.org/10.5465/30040666

Chemmanur, T. J., Cheng, Y., & Zhang, T. (2013). Human capital, capital structure, and employee pay: An empirical analysis. *Journal of Financial Economics*, *110*(2), 478–502. https://doi.org/10.1016/j.jfineco.2013.07.003

Chen, C. X., & Sandino, T. (2012). Can wages buy honesty? The relationship between relative wages and employee theft. *Journal of Accounting Research*, *50*(4), 967–1000. https://doi.org/10.1111/j.1475-679X.2012.00456.x

Chen, Z., Huang, Y., & Wei, J. (2013). Executive pay disparity and the cost of equity capital. *Journal of Financial and Quantitative Analysis*, *48*(3), 849–885. https://doi.org/10.1017/S0022109013000306

Chesters, J. (2010). *Evidence and perceptions of inequality in Australia*. (Discussion Paper No. 635). The Australian National University, Centre for Economic Policy Research. https://www.cbe.anu.edu.au/researchpapers/CEPR/DP635.pdf

Connelly, B. L., Tihanyi, L., Crook, T. R., & Gangloff, K. A. (2013). Tournament theory: Thirty years of contests and competitions. *Journal of Management*, *32*, 1-64. https://doi.org/10.1177/0149206313498902

Conroy, S. A., Gupta, N., Shaw, J. D., & Park, T.-Y. (2014). A multilevel approach to the effects of pay variation. *Research in Personnel and Human Resources Management*, *40*(1), 16–47. https://doi.org/10.1108/S0742-730120140000032001

Core, J. E., Holthausen, R. W., & Larcker, D. F. (1999). Corporate governance, chief executive officer compensation, and firm performance. *Journal of Financial Economics*, *51*(3), 371–406. https://doi.org/10.1016/S0304-405X(98)00058-0

Corneliben, T., Himmler, O., & Koenig, T. (2011). Perceived unfairness in CEO compensation and work morale. *Economics Letters*, *110*(1), 45–48. https://doi.org/10.1016/j.econlet.2010.10.011

Cowherd, D. M., & Levine, D. I. (1992). Product quality and pay equity between lower-level employees and top management: An investigation of distributive justice theory. *Administrative Science Quarterly*, *37*(2), 302–320. https://doi.org/10.2307/2393226

Cronqvist, H., Heyman, F., Nilsson, M., Svaleryd, H., & Vlachos, J. (2009). Do entrenched managers pay their workers more? *The Journal of Finance*, *64*(1), 309–339. https://doi.org/10.1111/j.1540-6261.2008.01435.x

Crosby, F. (1984). Relative deprivation in organizational settings. *Research in Organizational Behavior*, *6*, 51–93.

Dai, Y., Kong, D., & Xu, J. (2017). Does fairness breed efficiency? Pay gap and firm productivity in China. *International Review of Economics and Finance*, *48*, 406–422. https://doi.org/10.1016/j.iref.2017.01.003

DeVaro, J. (2006). Strategic promotion tournaments and worker performance. *Strategic Management Journal*, *27*(8), 721–740. https://doi.org/10.1002/smj.542

Ehrenberg, R. G., & Bognanno, M. L. (1990). Do tournaments have incentive effects? *Journal of Political Economy*, *98*(6), 1307–1324. https://doi.org/10.1086/261736

Faleye, O., Hoitash, R., & Hoitash, U. (2011). The costs of intense board monitoring. *Journal of Financial Economics*, *101*(1), 160–181. https://doi.org/10.1016/j.jfineco.2011.02.010

Faleye, O., Mehrotra, V., & Morck, R. (2006). When labor has a voice in corporate governance. *Journal of Financial and Quantitative Analysis*, *41*(3), 489–510. https://doi.org/10.1017/S0022109000002519

Faleye, O., Reis, E., & Venkateswaran, A. (2013). The determinants and effects of CEO-employee pay ratios. *Journal of Banking and Finance*, *37*(8), 3258–3272. https://doi.org/10.1016/j.jbankfin.2013.03.003

Gerhart, B., & Rynes, S. (2003). *Compensation: Theory, evidence, and strategic implications*. Sage. https://doi.org/10.4135/9781452229256

Grund, C., & Westergaard-Nielsen, N. (2008). The dispersion of employees' wage increases and firm performance. *ILR Review*, *61*(4), 485–501. https://doi.org/10.1177/001979390806100403

Gupta, N., Conroy, S. A., & Delery, J. E. (2012). The many faces of pay variation. *Human Resource Management Review*, *22*(2), 100–115. https://doi.org/10.1016/j.hrmr.2011.12.001

Heyman, F. (2005). Pay inequality and firm performance: Evidence from matched employer–employee data. *Applied Economics*, *37*(11), 1313–1327. https://doi.org/10.1080/00036840500142101

Homans, G. (1974). *Social behavior: Its elementary forms* (Revised ed.). Harcourt Brace Jovanovich.

Jia, L., Shaw, J. D., Tsui, A. S., & Park, T. Y. (2014). A social-structural perspective on employee-organization relationships and team creativity. *Academy of Management Journal*, *57*(3), 869–891. https://doi.org/10.5465/amj.2011.0147

Kale, J. R., Reis, E., & Venkateswaran, A. (2009). Rank-order tournaments and incentive alignment: The effect on firm performance. *The Journal of Finance*, *64*(3), 1479–1512. https://doi.org/10.1111/j.1540-6261.2009.01470.x

Kepes, S., Delery, J., & Gupta, N. (2009). Contingencies in the effects of pay range on organizational effectiveness. *Personnel Psychology*, *62*(3), 497–531. https://doi.org/10.1111/j.1744-6570.2009.01146.x

Kulik, C. T., & Ambrose, M. L. (1992). Personal and situational determinants of referent choice. *Academy of Management Review*, *17*(2), 212–237. https://doi.org/10.5465/amr.1992.4279534

Lallemand, T., Plasman, R., & Rycx, F. (2004). Intra-firm wage dispersion and firm performance: Evidence from linked employer-employee data. *Kyklos*, *57*(4), 533–558. https://doi.org/10.1111/j.0023-5962.2004.00268.x

Lawler, E. E. (1981). *Pay and organization development*. Pearson FT Press.

Lazear, E., & Rosen, S. (1981). Rank-order tournaments as optimum labor contracts. *Journal of Political Economy*, *89*(5), 841–864. https://doi.org/10.1086/261010

Lee, K. W., Lev, B., & Yeo, G. H. H. (2008). Executive pay dispersion, corporate governance, and firm performance. *Review of Quantitative Finance and Accounting*, *30*(3), 315–338. https://doi.org/10.1007/s11156-007-0053-8

Levine, D. I. (1991). Cohesiveness, productivity, and wage dispersion. *Journal of Economic Behavior and Organization*, *15*(2), 237–255. https://doi.org/10.1016/0167-2681(91)90031-R

Mahy, B., Rycx, F., & Volral, M. (2011). Wage dispersion and firm productivity in different working environments. *British Journal of Industrial Relations*, *49*(3), 460–485. https://doi.org/10.1111/j.1467-8543.2009.00775.x

Mahy, B., Rycx, F., & Volral, M. (2016). Are workers less absent when wage dispersion is small? *International Journal of Manpower*, *37*(2), 197–209. https://doi.org/10.1108/IJM-01-2015-0004

Main, B. G. M., O'Reilly III, C. A., & Wade, J. (1993). Top executive pay: Tournament or teamwork? *Journal of Labor Economics*, *11*(4), 606–628. https://doi.org/10.1086/298309

Martin, J., & Murnighan, J. (1981). Relative deprivation: A theory of distributive injustice and organizational illegitimacy. *Social Psychology in Organizations: Advances in Theory and Research, JAI Press, Greenwich, CT*, 296–321.

Meagher, G., & Wilson, S. (2008). Richer, but more unequal: Perceptions of inequality in Australia 1987-2005. *Journal of Australian Political Economy*, *61*, 220–243. https://doi.org/10.3316/informit.435297195557099

Messersmith, J. G., Guthrie, J. P., Ji, Y. Y., & Lee, J. Y. (2011). Executive turnover: The influence of dispersion and other pay system characteristics. *Journal of Applied Psychology*, *96*(3), 457–469. https://doi.org/10.1037/a0021654

Mueller, H., Ouimet, P., & Simintzi, E. (2017). Within-firm pay inequality. *The Review of Financial Studies*, *30*(10), 3605–3635. https://doi.org/10.1093/rfs/hhx032

Pfeffer, J. (2007). Human resources from an organizational behavior perspective: Some paradoxes explained. *Journal of Economic Perspectives*, *21*(4), 115–134. https://doi.org/10.1257/JEP.21.4.115

Productivity Commission. (2009). *Executive remuneration in Australia: Productivity commission inquiry report* (Report No. 49). https://www.pc.gov.au/inquiries/completed/executive-remuneration/report

Credit Suisse Research Institute (2019). *Global wealth report 2019*. https://www.credit-suisse.com/media/assets/corporate/docs/about-us/research/publications/global-wealth-databook-2019.pdf

Ridge, J. W., Aime, F., & White, M. A. (2015). When much more of a difference makes a difference: Social comparison and tournaments in the CEO’s top team. *Strategic Management Journal*, *36*(4), 618–636. https://doi.org/10.1002/SMJ.2227

Rouen, E. (2020). Rethinking measurement of pay disparity and its relation to firm performance. *Accounting Review*, *95*(1), 343–378. https://doi.org/10.2308/accr-52440

Saunders, P., & Wong, M. (2013). Examining Australian attitudes to inequality and redistribution. *Journal of Australian Political Economy*, *71*, 51–75. https://doi.org/10.3316/informit.357084817207021

Shaw, J. D., & Gupta, N. (2007). Pay system characteristics and quit patterns of good, average, and poor performers. *Personnel Psychology*, *60*(4), 903–928. https://doi.org/10.1111/j.1744-6570.2007.00095.x

Shaw, Jason D., Gupta, N., & Delery, J. E. (2002). Pay dispersion and workforce performance: Moderating effects of incentives and interdependence. *Strategic Management Journal*, *23*(6), 491–512. https://doi.org/10.1002/smj.235

Shin, J. Y., Kang, S.-C., Hyun, J.-H., & Kim, B.-J. (2015). Determinants and performance effects of executive pay multiples: Evidence from Korea. *ILR Review*, *68*(1), 53–78. https://doi.org/10.1177/0019793914556242

Toner, P. (2011). *Workforce skills and innovation: An overview of major themes in the literature* (Working Paper No. 2011/01). OECD Science, Technology and Industry Working Papers. https://doi.org/10.1787/5kgkdgdkc8tl-en

Trevor, C. O., Reilly, G., & Gerhart, B. (2012). Reconsidering pay dispersion’s effect on the performance of interdependent work: Reconciling sorting and pay inequality. *Academy of Management Journal*, *55*(3), 585–610. https://doi.org/10.5465/amj.2006.0127

Wade, J. B., O’Reilly, C. A., & Pollock, T. G. (2006). Overpaid CEOs and underpaid managers: Fairness and executive compensation. *Organization Science*, *17*(5), 527–544. https://doi.org/10.1287/orsc.1060.0204

Walster, E., Berscheid, E., & Walster, G. W. (1973). New directions in equity research. *Journal of Personality and Social Psychology*, *25*(2). https://psycnet.apa.org/record/1973-20995-001

Winter-Ebmer, R., & Zweimüller, J. (1999). Intra-firm wage dispersion and firm performance. *Kyklos*, *52*(4), 555–572. https://doi.org/10.1111/j.1467-6435.1999.tb00233.x

Wooldridge, J. (2012). *Introductory econometrics: a modern approach*. Mason, Ohio : South-

Western Cengage Learning.

Yermack, D. (1996). Higher market valuation of companies with a small board of directors. *Journal of Financial Economics*, *40*(2), 185–211. https://doi.org/10.1016/0304-405X(95)00844-5

2.9 Appendix

Appendix 2.1 Definition of variables

Table A.2.1. Definition of variables

Variables	Definition	Source
Pay Ratio:		
PayInequality	The natural logarithm of (CEO Compensation / average employee compensation)	Author's calculation
PayEquity	Predicted pay inequality between CEO and employees by Eq. 2-1	Author's calculation
PayInequity	The residual of Eq. 2-1 shows the deviation from pay equity	
CEO compensation	CEO compensation is total compensation, including short-term pay (e.g. salary and fees, accrued bonus), post-employment benefits (e.g., superannuation) and share-based payment rights.	Datastream
LnAveEmployeePay	The natural logarithm of Employee benefits (Wages and salaries, superannuation, share-based payments) minus CEO compensation divided by the number of employees minus one	
CEO's Bargaining Power:		
LnRevenue	The natural log of total sales in millions of dollars,	Datastream
BTM	Book value of equity /(share price * total shares outstanding)	Datastream
LnAge	Natural log of (current fiscal date – listing date) per year	
Ret	Log (return during the fiscal year)	Datastream
ROA	(Net Income + (Interest Expense on Debt-Interest Capitalized) * (1-Tax Rate)) / Average of Last Year's and Current Year's Total Assets * 100	Datastream
STDRet	Rolling 60-month standard deviation of returns.[20]	
STDROA	Rolling 5-year standard deviation of returns.[21]	
Leverage	Total long-term debt scaled by the total assets	Datastream
BoardSize	The total number of board members at the end of the fiscal year	Datastream
IsCEOBoard	An indicator equal to 1 if the CEO is a board member and 0 otherwise	Datastream
IsCEOChair	An indicator equal to 1 if the CEO is the chairman of the board and 0 otherwise	Datastream
BoardTenure	The average number of years that each board member has been on the board.	Datastream
IndCommittee	Percentage of independent board members on the compensation committee as stipulated by the company	Datastream
Employee Bargaining Power:		
RDIntensity	Research and development expenses scaled by total asset, assumed equal to zero when R&D is missing in Datastream.	Datastream
PPTIntensity	Net property, plant and equipment per employee in millions of dollars.	Datastream
Education	The percentage of the population with at least a bachelor's degree in each region in each year.	
IndConcentration	The sales-based Herfindahl index is calculated based on all Datastream firms in the same industry. Revenue is trimmed at the 5 and 95th percentiles.	
Union	The percentage of employees who are members of trade unions in each region for each year.	ASB
UnemploymentRate	The percentage of those looking for a job in the labour force in each region for each year.	ASB
VacantJob	The ratio of vacant jobs to total jobs in each industry in each year.	ASB

Appendix 2.2 Industry map to join GICS to ANZSIC

Table A.2.2. Industry map to join GICS to ANZSIC

GICS IndustryGroup (two-digit)	ANZSIC code
Materials	Mining (B)
Energy	Oil & gas extraction (07)
Real Estate	Property operators & real estate services (67)
Software & Services	Computer system design & related services (70)
Capital Goods	Construction (E)
Diversified Financials	Finance (62)
Retailing	Retail trade (G)
Consumer Services	Accommodation and food services (H)
Commercial & Professional Services	Professional, scientific & technical services (except computer design) (69)
Health Care Equipment & Services	Health care and social assistance (Q)
Food, Beverage & Tobacco	Food product manufacturing (11)
Media & Entertainment	Information media and telecommunications (J)
Pharmaceuticals, Biotechnology & Life Sciences	Basic chemical & chemical product manufacturing (18)
Utilities	Electricity, gas, water and waste services (D)
Transportation	Transport, postal and warehousing (I)
Banks	Finance (62)
Insurance	Insurance & superannuation funds (63)
Telecommunication Services	Telecommunications services (58)
Food & Staples Retailing	Food retailing (41)
Household & Personal Products	Other services (S)
Technology Hardware & Equipment	Information media and telecommunications (J)
Consumer Durables & Apparel	Textile, leather, clothing & footwear manufacturing (13)
Semiconductors & Semiconductor Equipment	Other services (S)
Automobiles & Components	Other services (S)

[1] The world scope data illustrates that the global income share of the top 1% increased from 16% in 1980 to 22% in 2000. Then, it declined slightly to 20% by 2016. However, the income share of the global bottom 50% has fluctuated around 9% since 1980.

[2] Although the main argument of both studies was the impact of simple vertical pay disparity on performance, they also examine the impact of the residual (*PayInequity*) on firm performance (Shin et al., 2015) and employee performance (Faleye et al., 2013).

[3] We used total CEO remuneration to forecast expected CEO remuneration for two reasons. Firstly, our sample is not limited to large corporations where the executive's salary is broken down into fixed salary, non-cash benefits and contingent benefits normally in the form of bonuses. Secondly, in cases of CEOs' salary breakdown availability, there are a large number of zero bonuses. Labour expenses also include wage and salaries, superannuation and share-based payments.

[4] This variable is calculated at the regional level because of data limitations.

[5] Revenue is trimmed at the 5 and 95 percentiles to remove the effect of outliers in the calculation of the Hirschman–Herfindahl index.

[6] The trade union members data are collected from the Australian Bureau of Statistics (ABS), which are presented at regional level.

[7] Another proxy, considered in the literature as a proxy of outside opportunity, is industry homogeneity. It is calculated as the mean partial correlation between a firm's return and an equally weighted industry index. In this study, this variable is not included because the lack of data on an equally weighted GICS industry index.

[8] Union may have a positive or negative impact on employee performance (Faleye et al., 2013).

[9] Beta and alpha are heterogenous across industries.

[10] CEO compensation is reported in TRD based on the US dollar. Therefore, we also collect the USD/AUD currency rate from TRD. We calculate CEO compensation in AUD by multiplying CEO compensation in USD by the currency rate in the fiscal date of each firm-year.

[11] If number of employees is missing, we use the employee numbers from the previous year

[12] We also consider total senior executive compensation or board member compensation to check later that it is possible to manually collect data on CEOs. If we restrict the search to CEOs the number of observations was 543 unique firms and 3882 observations.

[13] The outliers in variables may render the distribution non-normal, affecting the descriptive statistics.

[14] The trend of pay inequality in our sample is consistent with the Productivity Commission's report in 2009 and the Australian Council of Superannuation Investors (ACSI) report in August 2020.

[15] Unlogged pay inequality is equal to 20.45 and 21.20. Therefore, we use the natural log of pay inequality in our analyses to reduce the influence of outliers.

[16] Although obtaining the direction of the bias in the coefficients is generally complicated, it can be determined as the covariance between the independent variable and the error term in a simple model, as suggested by Wooldridge (2012). Following this approach and assuming that pay inequality and employee performance have a negative effect on each other, it can be shown that the asymptotic OLS bias is negative. Comparing the long-term pay inequality coefficient from the dynamic model estimated by OLS (not tabulated) and the SGMM result suggests that SGMM has corrected the bias in the right direction.

[17] We use a different method because of the lack of information on executive compensation and the number of executives in TRD and DatAnalysis.

[18] These theories indicate that social dictates can affect what society tells individuals, what they are entitled to and what they find desirable.

[19] We do not tabulate these results to conserve space, but they are available upon request.

[20] Calculated if the data were available for at least 36 months.

[21] Calculated if the data were available for at least 36 months.

Chapter 3

The drivers of labour share and impact on pay inequality: A firm-level investigation

Abstract: Income inequality and labour share have followed divergent trends in Australia. Empirical studies have attempted to explain their movement and their relationship using macro data. However, what is lacking is a firm-level study to capture the determinants of labour share specific to the firm's production technology and market structures with an investigation into the impact on pay inequality inside firms. Hence, we conduct the first Australian firm-level study using a sample of Australian listed firms over the period 2004-2019. First, we examine the impact of technological progress, product market power and labour market power on the labour share. The results show that the decline in Australian labour share is mainly driven by technological progress and increasing product market power. However, labour market power does not have a significant impact on labour share. These findings are robust to an array of sensitivity tests. Second, we examine the impact of labour share on pay inequality within firms. We find robust evidence that declining labour share is a significant driving force in the evolution of pay inequality. Moreover, a 10% decline in labour share raises pay inequality by 4.19%. Additional tests show that technological progress and product market power can moderate the negative impact of labour share on pay inequality.

Keywords: Income distribution, Mark-up, Labour share, Pay inequality, Total factor productivity

JEL Classification: D33, J31, D42

3.1 Introduction

The worldwide shift in the functional distribution of income between significant factors of production (capital and labour) and the rise in income inequality has been observed in many countries. For example, several studies have documented a decline in aggregate labour share (e.g., Dao et al., 2019; Karabarbounis & Neiman, 2014) and an increase in inequality (e.g., OECD 2015) in most countries. This divergent trend between labour share and income inequality has also been emphasised in Australia in recent decades. Regardless of the measurement method, Australian labour share has experienced a significant decline since the mid-1970s (Gianni, 2019), while income inequality has increased and now exceeds the OECD average (Sila & Dugain, 2019).

The decline in labour share and the rise in income inequality have led to a growing literature on personal and functional income distribution drivers. Several potential explanations for the declining labour share have been proposed, including technological progress (Bentolila & Saint-Paul, 2003; Karabarbounis & Neiman, 2014), market concentration (Autor et al., 2020; De Loecker et al., 2020; Kehrig & Vincent, 2021), labour market institution (Piketty, 2014) and globalisation (Elsby et al., 2013). Some studies go a step further and argue that declining labour share is a driver of income inequality. Atkinson (2009) proposes a theoretical framework and shows that the transition from labour share to capital share can increase income inequality under plausible characterisations of capital and labour incomes. The negative association between labour share and income inequality has been illustrated in a few empirical studies (Dao et al., 2017; Daudey & García-Peñalosa, 2007; Erauskin, 2020; Jacobson & Occhino, 2012; Sauer et al., 2020)

Despite the surge of interest in the determinants of labour share and its link with personal income distribution, there has not been enough investigation at the firm level. In fact, existing research on the drivers of declining labour share relies heavily on country or industry aggregate macro data and downplays the importance of firm-level data. In addition, there is little clear guidance about the link between functional and personal income distribution inside firms. However, firm-level study is essential for two main reasons. First, most economic activities are organised within firms, where production and compensation decisions are taken that eventually impact the functional distribution of income and pay inequality between those who provide services in the form of labour and those whose contribution is primarily tied to capital. Second, studying the labour share at the firm level allows us to overcome important measurement issues confronted by most of the labour share literature such as the treatment of capital depreciation (Bridgman, 2018), self-employment (Elsby et al., 2013; Gollin, 2002), intangible capital (Koh et al., 2020) and business owners taking capital instead of labour income (Smith et al., 2019). Nevertheless, only a few studies (e.g., Autor et al., 2020; De Loecker et al., 2020; Growiec, 2012; Guschanski & Onaran, 2018; Siegenthaler & Stucki, 2015) have investigated the firm-level determinants of labour share. Furthermore, the impact of a firm's labour share on the pay inequality between the CEO, whose compensation is linked to capital income, and employees (pay inequality) as one of the drivers of income inequality[1] has not been investigated. Therefore, what is lacking is a firm-level analysis of factors determining Australian labour share and the impact of labour share on pay inequality within firms. Therefore, this paper aims to address these gaps by examining two related questions: (i) What factors explain a firm's labour share? and (ii) Is there a relationship between labour share and pay inequality within firms?

To fulfil our aim, we analyse a sample of Australian listed firms over the period 2004-2019. Our empirical analysis is divided into two parts. In the first part, we examine the underlying determinants of labour share at the firm level. We consider three leading channels: technological progress, product market power and labour market power, which have been proposed in the literature as the main drivers of labour share movement. We find that technological progress and product market power are salient factors in explaining the level of labour share. Employees in firms with higher technological progress and product market power gain a lower proportion of these firms' value added. In the second part, we investigate the impact of labour share on pay inequality within firms. Our finding indicates a significant negative association between labour share and pay inequality. Lastly, we conduct further analysis to explore how potential drivers of labour share may affect the relationship between labour share and pay inequality.

This study contributes to the academic literature on labour share and pay inequality and has implications for policymakers. First, to the best of our knowledge, this study is the first that documents the firm-level determinants of labour share in Australia. Our findings thus contribute to the debate that has been dominated by evidence from the United States. Second, it extends the empirical study of the firm-level determinants of labour share by considering the impact of three leading channels: technological progress, product market power and labour market power. Third, our study provides novel insight into the link between labour share and pay inequality within firms. Investigating this link within firms help us detect a determinant of pay inequality and, more importantly, sheds light on possible way of overcoming the pay inequality problem.

Finally, our findings can help policymakers limit further declines in labour shares and increases in pay inequality in Australia.

The remainder of this paper is organised as follows. Section 2 discusses the related literature on the determinants of labour share, as well as the conceptual framework of the relationship between labour share and pay inequality. It also presents the development of two main key hypothesises in this study. Section 3 presents our empirical methods to examine the impact of technological progress, product market power, and labour market power on labour share and also the impact of labour share on pay inequality within firms. Section 4 provides detailed information about the sources of data used, the criteria for selecting the sample, the methods of measurement, and presents descriptive statistics of the variables under study. Following this, Section 5 presents the empirical analysis and findings based on the collected data. Finally, section 6 provides concluding remarks, implications, and avenues for future research.

3.2 Literature Review and hypothesis development

This section, first, reviews the existing theoretical and empirical literature on the drivers of declining labour share to shape our first hypothesis about firm-level causes of the fall in Australia's labour share. Second, it reviews the related literature about the linkage between functional and personal income distribution at the macro level. Thereafter it extends the literature into the relationship between labour share and pay inequality within firms and develops our second hypothesis.

3.2.1 Determinant of labour share: A short review and hypothesis

There is an ongoing debate about the underlying causes of the declining labour share. One stream in the literature points to technological progress as a primary reason (Bentolila & Saint-Paul, 2003; Karabarbounis & Neiman, 2014). Karabarbounis and Neiman (2014) hypothesise that the fall in the cost of capital relative to labour encourages firms to replace one factor of production with another. However, the type of capital and labour can complicate this substitution. For example, equipment substitutes differently with regard to labour than to buildings and structures (Eden & Gaggl, 2019; Hubmer & Restrepo, 2021) and some employees may benefit from technical changes, while others suffer as a result (Acemoglu & Autor, 2011). Furthermore, Bentolila and Saint-Paul (2003) propose a theoretical model to illustrate the relationship between technological progress and labour share. Their model implies that, under specific assumptions, the variation of labour share may be due to different values of the capital-output ratio, the elasticity of substitution and capital-augmenting technical progress. According to their model, the impact of capital intensity and capital-augmenting on labour share can be either positive or negative depending on the elasticity of substitution between capital and labour. Hence, a common element in these papers is the elasticity of substitution between capital and labour. While some studies find an elasticity of substitution of below one (Chirinko, 2008; Chirinko & Mallick, 2017; Oberfield & Raval, 2021), Grossman et al. (2021) show that a slowdown in labour productivity growth or capital-augmenting technological progress can eventually result in declining labour shares even if capital and labour are gross complements.

Another stream of literature points to rising product market power, measured by mark-up or industry concentration, as a potential cause of declining labour share (e.g., Autor et al., 2020; De Loecker et al., 2020). In the absence of competition, firms gain market power and price their goods above their marginal cost, leading to higher mark-up (De Loecker et al., 2020). Bentolila and Saint-Paul (2003) theoretically and empirically show that the increase in mark-up is associated with a lower labour share. In addition, some studies show that an increase in the US aggregate mark-up, driven by the reallocation of economic activity toward large and high-mark-up firms with lower labour share, decreases the aggregate labour share (Baqaee & Farhi, 2020; De Loecker et al., 2020). Similarly, Autor et al. (2020) present evidence that the rise in the US industry concentration positively impacts the decline in the labour share across industries.

Furthermore, some researchers assert that a decline in labour market power leads to a shift in functional income distribution (e.g., Farber et al., 2021; Gouin-Bonenfant, 2018). Declining labour market power may have allowed firms to exercise greater monopsony, and, as a result, stronger wage markdowns (Grossman & Oberfield, 2021). Kehrig and Vincent (2021) theoretically show that a higher wage markdown leads to a lower labour share. A stronger wage markdown may result from labour market deregulation, such as de-unionisation or increasing labour market concentration. Many authors point to de-unionisation as an explanation for the decline in labour market power (Stansbury & Summers, 2020). For example, Farber et al. (2021) document a positive correlation between state-level labour share and state union membership rates. In addition, increasing a firm’s labour concentration in the relevant labour markets could account for stronger markdowns of wages relative to marginal revenue productivity and perhaps to a smaller labour share. Gouin-Bonenfant (2018) shows that a higher dispersion of productivities, which implies a greater concentration of employment, results in a lower aggregate labour share. Azar et al. (2020) use data from online job postings to show an inverse correlation between real wages and market concentration. Similarly, Benmelech et al. (2020) show that the negative correlation is stronger in the presence of low unionisation rates.

Empirical studies of labour share have used different levels of analysis. Most studies are based on country-level data (e.g., Hogrefe & Kappler, 2013; Young & Lawson, 2014; Young & Tackett, 2018) and industry-level data (e.g., Alvarez-Cuadrado et al., 2018; Elsby et al., 2013; Hutchinson & Persyn, 2012; Pianta & Tancioni, 2008; Young & Zuleta, 2017). Only a few studies (e.g., Autor et al., 2020; De Loecker et al., 2020; Growiec, 2012; Guschanski & Onaran, 2018; Siegenthaler & Stucki, 2015) have focused on firm-level labour share. For example, Siegenthaler and Stucki (2015) examine the firm-level determinants of labour share in Switzerland. They find that the growth in the firm's share of workers using information and communication technology is the primary cause of the declining labour share. Similarly, Growiec (2012) investigate the sources of labour share variations in Poland using quarterly firm-level panel data. They show that changes in the ownership structure and human capital accumulation explain the downward trend in the labour share. In addition, Guschanski and Onaran (2018) provide international evidence for the negative impact of financialisation on firm-level labour share due to increased shareholder value orientation. The result of these studies emphasises the importance of firm-level analysis in investigating the movement in labour share. Hence, In this paper, first, we examine the impact of the three channels previously described – technological progress, product market power, and labour market power – on Australian firms' labour share. Given the related literature, our first hypothesis is as follows:

H1: A firm's labour share decreases with technological progress and product market power and increases with labour market power.

3.2.2 Labour share and pay inequality: A conceptual framework and hypothesis

The decline in labour share has been associated with the debate on rising income inequality. As argued by Glyn (2011), Morrisson (2000), and Piketty (2014), capital income tends to be more unequally distributed than labour income and hence a transfer from labour income to capital income leads to an increase in income inequality. For example, Wolff (2010) shows that capital ownership (e.g., stock ownership, bonds, trust, and business equity) is mainly concentrated at top of the income distribution in the U.S. during the period 2001–2007. Furthermore, Atkinson (2009) proposes a standard approach for analysing the relationship between functional income distribution (labour/capital share) and income inequality. His study asserts that the positive linkage between capital share and income inequality is possible under plausible characterisations of capital and labour incomes.

An empirical relationship between labour share and income inequality has been investigated by a few studies using macro-level data. For example, using a sample of 39 developed and developing countries between 1970 and 1994, Daudey and García-Peñalosa (2007) find that a larger labour share is associated with a lower Gini coefficient. Similarly, Jacobson and Occhino (2012) show that a 1% decrease in the U.S. labour share is associated with a 0.15% to 0.33% increase in the Gini index. A recent report by Dao et al. (2017) suggests that lower labour share is associated with higher Gini coefficients for 49 countries (mostly advanced countries) between 1991 and 2014. Sauer et al. (2020) find that the most robust factor behind rising income inequality is the declining labour share for 73 countries (mostly observations from advanced OECD countries) between 1981 and 2010. Similarly, using a sample of 62 developed and developing countries for the period 1990-2015, Erauskin (2020) shows that the declining labour share is strongly associated with a smaller income share for the lowest two quintiles and a larger income share for the highest quintile.

The current literature on the relationship between functional income distribution and personal income distribution has focused mostly on macro-level data and obscured the relationship inside the firm. However, the linkage between labour share and income inequality at the macro level can be extended to the firm level. At the macro level, individuals' income comes from two main sources, capital and labour. Since the distribution of capital income is more concentrated on the top of income distribution (Piketty, 2014; Wolff, 2010), declining labour share (increasing capital share) raises income inequality. The same argument can be implicitly applied at the firm level. Individual remuneration package inside firms consists of short-term pay (e.g. salary and fees, accrued bonus), post-employment benefits (e.g., superannuation) and share-based payments. Among them, share-based payments (such as stock options and stock appreciation rights), which is a type of compensation based on the share of the company, is an effective mechanism to align the divergent interests of executives and shareholders (Jensen & Meckling, 1979). In other words, the part of employee's compensation, share-based payment, is linked with shareholder wealth (capital share) within a firm. Similar to capital income, share-based payment is not equally distributed among all individuals within the firm and this inequality is more pronounced among individuals at different hierarchical levels in an organisation. For example, Cheffins and Thomas (2004) assert that CEOs receive vastly higher stock options in comparison with other counterparties. Empirical studies in Australia show that long-term incentives, such as share-ownership or share-option schemes, comprise the largest percentage of Australian CEO compensation (Hamson, 2021) and an increase in shareholder wealth leads to an increase in CEO compensation (Merhebi et al., 2006). Since the distribution of share-based payment is not equal and mainly contributes to the top executives' compensation, we expect that a fall in labour share, resulting in a transfer from labour share to capital share, leads to a rise in pay inequality between CEO and average employee. This conceptual framework, though simple, provides a lens through which we can interpret the firm-level evidence on labour shares and pay inequality. Hence, our second hypothesis is as follows:

H2: Labour share is negatively associated with pay inequality within firms.

3.3 Methodology

This section consists of two parts. The first part explains our empirical model to examine the impact of three main channels: technological progress, product market power, and labour market power on labour share. The second part describes the model for examining the impact of labour share on pay inequality within firms.

3.3.1 Determinants of the labour share

Based on empirical studies that examine the impact of technological progress, product market power, and labour market power on labour share within firms (e.g., Autor et al., 2020; Bentolila & Saint-Paul, 2003;), we model the impact of these channels as follows:

$$\mathrm{LnLabourShare}_{i,t} = \alpha_0 + \alpha_1\, \mathrm{LnLabourShare}_{i,t-1} + \beta_1 \mathrm{LnCapital/VA}_{i,t} + \beta_2\, \mathrm{TFP}_{i,t} + \beta_3\, \mathrm{LnMarkup}_{i,t} + \beta_4\, \mathrm{HHIEmp}_{j,t} + \beta_5\, \mathrm{Union}_{k,t} + \beta_6\, \mathrm{delta.LnEmpNum}_{i,t} + \beta_7\, \mathrm{BTM}_{i,t} + \beta_8\, \mathrm{LnAge}_{i,t} + \beta_9\, \mathrm{LnRevenue}_{i,t} + \beta_{10}\, \mathrm{Leverage}_{i,t} + u_{i,j,k,t} \qquad (3\text{-}1)$$

In the above equation, labour share is our dependent variable measured as labour expenses divided by value added in each firm-year. The model includes a lagged dependent variable to reflect the persistence of labour share over time (Bentolila & Saint-Paul, 2003). Subscript *i* is the firm identifier, *j* is the industry identifier, defined using a two-digit Global Industry Classification Standard (*GICS*) code, *k* is the region identifier, *t* is the fiscal year, and u is an error term that contains region, industry, firm, and year fixed effect.

$$u_{i,j,k,t} = \theta_{k,j,i,t} + \varepsilon_{i,t} = \gamma_k + \delta_j + \mu_i + \tau_t + \varepsilon_{i,t} \qquad (3\text{-}2)$$

Where $\varepsilon_{i,t}$ assumed to be independent and identically distributed with mean zero and constant variance.

Three main labour share drivers in our equation are technological progress, product market power and labour market power. Technological progress is included in our model by using two proxies, capital to value-added ratio (*LnCapital/VA*$_{i,t}$) and Total Factor Productivity (*TFP*$_{i,t}$). Following Bentolila and Saint-Paul (2003) and Autor et al. (2020), *LnCapital/VA*$_{i,t}$ is measured as the natural logarithm of gross property, plant and equipment to value-added ratio. Based on Bentolila and Saint-Paul's (2003) model, *LnCapital/VA*$_{i,t}$ and *TFP*$_{i,t}$ can be negatively or positively associated with labour share. If labour and capital are complements (negative elasticity of substitution), increasing *LnCapital/VA*$_{i,t}$ or *TFP*$_{i,t}$ increases labour share. The converse applies if labour and capital are substitutes.[2] Therefore, we would expect a lower labour share in firms with higher technological progress if labour and capital are substitutes. Regarding product market power, we include firm-level mark-up (*LnMarkup*), measured by De Loecker et al.'s (2020) approach, in our equation. Lastly, labour market power is included using two proxies, labour market concentration (*HHIEmp*) and union membership (*Union*).

In addition to these three channels, we control the effect of labour adjustment cost (*delta.LnEmpNum*) by the growth rate of the number of employees, following Bentolila and Saint-Paul (2003). Firm size (*LnRevenue*), firm age (*LnAge*) and book-to-market ratio (*BTM*) are included to measure the complexity of a firm's operation and growth opportunities. The capital structure (*Leverage*), measured by total debt scaled by total assets, is also included. *Leverage* may be negatively associated with compensation because it decreases companies' ability to make their payroll. However, leverage can be positively correlated with compensation since potential bankruptcy costs arising from high leverage should be compensated by higher pay.

A potential problem arises when estimating the above equations. As discussed in the literature, the inclusion of the lagged dependent variable in the empirical model implies a correlation between the regressors and the error term, since lagged labour share depends on $u_{i,j,k,t-1}$, a function of the region, industry, and firm fixed effect, which could bias the coefficient estimates. In addition, region, industry and firm fixed effect are potentially correlated with our explanatory variables. The appropriate way to control the endogeneity problem is to use instrument variables that are not subject to reverse causality for all variables of interest. Following other studies in this stream of literature (e.g., Bentolila & Saint-Paul, 2003), the preferred estimator is the "system generalised method of moments (SGMM)" (Arellano & Bond, 1991; Arellano & Bover, 1995) with robust standard errors. The econometrics literature shows that the two-step SGMM estimator is the most widely used technique to deal with potential endogeneity (Windmeijer, 2005). In addition, SGMM controls for unobserved heterogeneity and dynamics in the system since there is the possibility of persistence in labour share and mismeasurement of variables that may bias estimates.

SGMM estimates a system of equations that express labour share as a function of the covariates in both levels and first differences. We treat the labour share and all right-hand side variables except *Union* as potentially endogenous variables. Regarding the first differences equation, since differencing induces a first-order moving average of the residuals, we use the second and third, rather than first, lagged values of endogenous variables as instruments. Turning to level equations, we use the first and second lagged first differences of all endogenous variables. The identification assumptions in this model are as follows. In the level equation, If there is a variable, say $Z^{L}_{i,j,k,t}$, satisfying the condition $E(Z^{L}_{i,j,k,t}\,\varepsilon_{i,t})=0$ and we can assume that $E(Z^{L}_{i,j,k,t}\,\theta_{k,j,i,t})$ does not depend on t, then we have $E(\Delta Z^{L}_{i,j,k,t}\,u_{i,j,k,t})= 0$, i .e. $\Delta Z^{L}_{i,j,k,t}$ is a valid instrument for the level equation. Similarly, for the equation estimated in the first difference $Z^{D}_{i,j,k,t}$ is a valid instrument. The specification is checked using the Hansen statistic, a test of over-identifying restrictions for the validity of the instrument set. We also report a statistic for the absence of second and third-order serial correlation in the first-differenced residuals. This is based on the standardized average residual autocovariance, which are asymptotically N(0, 1) variables under the null of no autocorrelation, and should not be significantly different from zero if the residuals in levels are serially uncorrelated (note that, due to differencing, first-order autocorrelation is expected ex-ante).

3.3.2 Labour share and pay inequality

In order to examine our second hypothesis, we assume a log-linear relation between the two variables of interest, labour share and pay inequality using the following equation:

$$\begin{aligned}&\mathrm{LnPayInequality}_{i,t} = \alpha_0 + \alpha_1 \mathrm{LnPayInequality}_{i,t-1} + \beta_1\,\mathrm{LnLaborShare}_{i,t} +\\ &\beta_2\,\mathrm{LnRevenue}_{i,t} + \beta_3\,\mathrm{BTM}_{i,t} + \beta_4\,\mathrm{LnAge}_{i,t} + \beta_5\,\mathrm{ROA}_{i,t} + \beta_6\,\mathrm{Ret}_{i,t} + \beta_7\,\mathrm{STDRet}_{i,t} +\\ &\beta_8\,\mathrm{Leverage}_{i,t} + \beta_9\,\mathrm{IsCEOChair}_{i,t} + \beta_{10}\,\mathrm{BoardTenure}_{i,t} + \beta_{11}\,\mathrm{IndCommittee}_{i,t} +\\ &\beta_{12}\,\mathrm{PPEIntensity}_{i,t} + \beta_{13}\,\mathrm{RDIntensity}_{i,t} + \beta_{14}\,\mathrm{IndConcentration}_{j,t} + \beta_{15}\,\mathrm{Education}_{k,t} +\\ &\beta_{16}\,\mathrm{Union}_{k,t} + \beta_{17}\,\mathrm{UnemploymentRate}_{k,t} + \beta_{18}\,\mathrm{VacantJobRatio}_{j,t} + u_{i,j,k,t} \qquad (3\text{-}3)\end{aligned}$$

In the above equation, pay inequality is calculated using the ratio of the total CEO compensation to the mean employee pay during the fiscal year. We also consider the persistence of pay inequality over time. The coefficient of interest, β_1, captures the association between labour share and pay inequality. Subscript i is the firm identifier, j is the industry identifier, defined using a two-digit Global Industry Classification Standard (GICS) code, k is the region identifier, t is the fiscal year, and u is an error term that contains region, industry, firm, year fixed effect (Eq. 3-2).

Similar to prior studies (Core et al., 1999; Faleye et al., 2013; Taherifar et al., 2021), we control firm and labour market characteristics that can potentially affect pay inequality and may also be related to labour share. Hence, we include the firm's operation and growth opportunity proxies such as firm size (*LnRevenue*), firm age (*LnAge*), book-to-market ratio (*BTM*), return on asset (*ROA*), annual stock return (*Ret*), the standard deviation of common stock returns (*STDRet*), and capital structure (*Leverage*). Furthermore, executives' bargaining power over board members is controlled by including CEO chair duality (*IsCEOChair*), Board tenure (*BoardTenure*) and the percentage of independent board members on the compensation committee (*IndCommittee*). Finally, labour bargaining power, measured by employees' skills and labour market characteristics, is also controlled. Employees' skills are measured by R&D intensity (*RDIntensity*), physical capital intensity (*PPTIntensity*), and workforce education (*Education*). Labour market characteristics, such as industry concentration (*IndConcentration*), employee unionisation (*Union*), unemployment rate (*UnemploymentRate*), and vacant job ratio (*VacantJob),* are included. All variables are explained in Appendix 3.2.

The most critical concern in the estimation of Eq. 3-3 is the simultaneity problem because compensation decisions jointly impact labour share and pay inequality inside firms. Therefore, the causality may run in both directions, from labour share to pay inequality and vice versa. Similar to the previous section, we address this endogeneity problem using two-step *SGMM* with robust standard errors. For the level equation, the second lagged first differences in pay inequality, labour share, firm performance and firm risk are used as instruments in our estimation. The level equation also uses the lagged values of all other right-hand side firm-level ratios as its instrument. The first differences equation uses the third lagged values of pay inequality, labour share, and firm performance. It also uses the second lagged first differences of all other right-hand side firm-level ratios as their instrument. Similarly, the specification is checked using the Hansen statistic. The first-order autocorrelation, second-order autocorrelation, and third-order autocorrelation for testing the absence of serial correlation are reported.

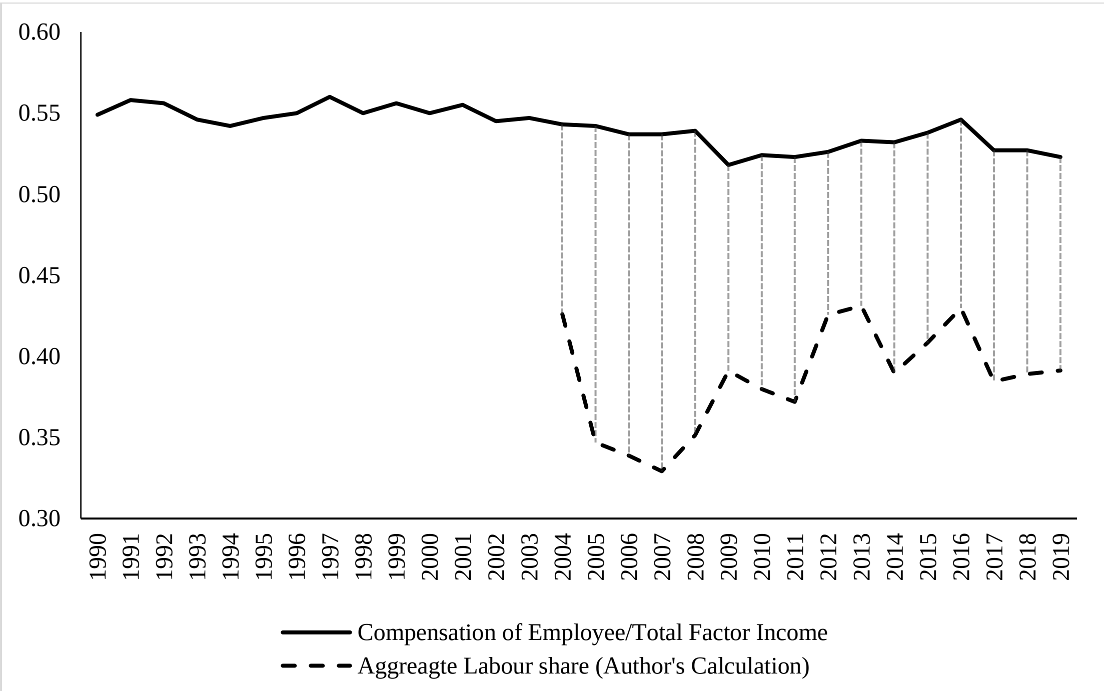
3.4 Data, sample, and measurement

The financial data for this research are obtained from the Thomson Reuters DataStream database (TRD).[3] We start with all Australian listed firms covering all sectors of the economy over the period 2004–2019. In addition, Australian regional and industry-level data are collected from the Australian Bureau of Statistics (ABS). In order to merge TRD and ABS databases, industry groups and the region of incorporation are required for all firms. However, there are two issues. First, the state of incorporation for all companies and the GICS codes are not available in TRD. To address this problem, the country of incorporation, registered office region and GICS for all companies are retrieved from MorningStar DatAnalysis (MD). Then, the missing values of the country of incorporation and registered office region in TRD are completed using data from MD. Second, the industry identifiers differ in MD and ABS; the former uses GICS and the latter uses Australian and New Zealand Standard Industrial Classification (ANZSIC). To overcome this problem, we relate each two-digit GICS industry code to a two-digit ANZSIC code. If an exact match is not possible for the two-digit ANZSIC code, we use the broadest level of the ANZSIC code that potentially maps to the GICS industry code (Appendix 3.3 illustrates the industry map). Using these steps, our primary required dataset, including firm-level, industry-level, and region-level data, is constructed.

Our primary variable of interest is the firm-level labour share. Following Hartman-Glaser et al. (2019) and Donangelo (2021), labour share is defined as labour cost divided by value added in each firm at the end of the fiscal year. Labour cost is proxied by staff expenses, including wages and benefits such as health insurance and contributions to pension plans. In addition, value-added is defined as earnings before interest, tax, depreciation, and amortisation plus labour cost. We follow Hartman-Glaser et al. (2019) and exclude firm-year observations with negative sales, negative number of employees, negative total assets, and negative staff expenses from our primary analysis. In addition, we eliminate firm-year observations with zero asset turnover. We also exclude firms that do not report a sector code. Consistent with the literature (Autor et al., 2020; Donangelo, 2021; Donangelo et al., 2019), all observations in which labour share is negative or greater than one are excluded from the sample. Our final sample of firm-level labour share includes 8,515 firm-year observations and 1,592 unique firms.

Fig. 3.1 demonstrates a correspondence between the aggregate firm-level labour share and the national account labour share. The aggregate labour share is calculated as the weighted average of labour share based on the share of value added in our sample, and the national account labour share is the ratio of employee compensation to total factor income, which is equal to GDP less net taxes on production and imports. Fig. 3.1 shows that the aggregate labour share and national account labour share movement are quite similar. However, the national account labour share is larger and smoother than the aggregate labour share from 2004 to 2019. As De Loecker et al. (2020) discussed, listed firms are larger, older, more capital-intensive, and involve a more significant role for multinationals, which may cause a lower labour share among listed firms than in the whole economy. Generally, this correspondence provides some confidence that our estimation is a robust proxy of the aggregate labour share and can be employed to shed some light on the determinants of the labour share over the period 2004 - 2019.

Figure 3.1. The relationship between firm-level aggregate labour share and national account's labour share



Note: The ratio of employee compensation to total factor income is from the Australian Bureau of Statistics, (2019-2020)

In addition to labour share, other financial variables are also calculated based on data availability in the *TRD* database. The second variable of interest, pay inequality, is calculated as the ratio of total CEO compensation to the mean employee expenses during the fiscal year. CEO's compensation is defined in the *TRD* database as the highest remuneration within a firm.[4] Employees' average compensation is calculated as the ratio of employee expenses minus the highest remuneration to the number of employees minus one.[5] Appendix 3.1 details the measurement of all significant variables such as *LnCapital/VA*, *TFP*, *LnMarkup*, and *HHIEmp*.

For all variables, we exclude observations with missing values, resulting in a sample of 3292 firm-year observations with 659 unique firms. In addition, all continuous financial variables are winsorised at the 1% level in each two-digit GICS to reduce the influence of possible outliers.

Table 3.1 provides descriptive statistics for all variables in the sample of 3292 observations. On average, the proportion of Australian firms' value-added paid to labour is 55% over the period 2004-2019. Fifty per cent of the labour share in our sample lies between 37.7% and 73.3%. In addition, the average mark-up in our sample is 1.48 (*LnMarkupOP* is equal to 0.395), which means that the average mark-up charged is 48% over marginal cost. Moreover, our further primary analysis shows that none of the variables exhibits a strong correlation with each other, and the signs of the correlations are consistent with our expectations. Technological progress and product market power are negatively correlated with labour share, while a negligible positive correlation exists between *Union* and labour share. In addition, there is a negative correlation between labour share and pay inequality.

Table 3.1. Descriptive statistics of the sample

Variable	Obs.	Mean	S.D.	1st quartile	Median	3rd quartile
LabourShare	3,292	0.550	0.243	0.377	0.593	0.733
LnPayInequality	1,352	3.223	1.096	2.458	3.234	3.928
LnCapital/VA	3,292	0.000	1.305	-0.875	0.099	0.949
TFPOLS	3,292	0.034	0.656	-0.336	0.030	0.420
LnMarkupOLS	3,292	0.408	0.649	0.044	0.281	0.596
TFPOP	3,292	0.745	1.848	-0.433	0.739	2.022
LnMarkupOP	3,292	0.395	0.643	0.037	0.256	0.568
TFPWRDG	3,292	0.652	1.711	-0.354	0.600	1.857
LnMarkupWRDG	3,292	0.415	0.652	0.020	0.297	0.620
IndHHIEmp	3,292	0.181	0.134	0.099	0.150	0.190
Union	3,292	15.081	2.446	12.924	15.372	16.674
LnEmployeeNumber	3,292	6.433	2.079	5.187	6.460	7.770
BTM	3,292	0.825	0.763	0.375	0.629	1.053
LnAge	3,292	2.540	0.904	2.036	2.618	3.130
LnRevenue	3,292	5.729	1.886	4.474	5.677	6.977
Leverage	3,292	2.651	1.374	2.334	3.067	3.495
ROA	3,284	8.578	7.850	4.165	7.225	11.510
Ret	3,260	0.057	0.477	-0.185	0.086	0.322
STDRet	2,717	0.126	0.067	0.081	0.111	0.154
IsCEOChair	1,425	0.103	0.304	0.000	0.000	0.000
BoardTenure	1,413	6.684	3.168	4.560	6.130	8.050
IndCommittee	1,389	84.013	22.079	67.000	100.000	100.000
PPEIntensity	3,292	2.286	16.679	0.023	0.087	0.340
RDIntensity	3,292	0.447	2.461	0.000	0.000	0.000
IndConcentration	3,292	0.093	0.070	0.044	0.069	0.125
Education	3,292	18.509	3.224	16.124	18.107	20.831
Unemployment	3,292	5.174	0.728	4.761	5.143	5.747
VacantJob	3,292	1.898	1.084	1.143	1.516	2.282

Notes: Table 3.1 presents summary statistics for the main variables in our samples. Firm characteristic continuous variables are winsorised at 1% and 99% in each two-digit GICS.
All variables are defined in Appendix 3.2.

3.5 Empirical analysis

This section starts by examining the firm-level determinants of labour share. It then follows the relationship between labour share and pay inequality within firms.

3.5.1 Determinants of labour share

Table 3.2 illustrates the impact of three leading channels, technological progress, product market power and labour market power on labour share. In all columns, our dependent variable is the natural logarithm of labour share. The first three columns report the estimation of our regression model in Eq. 3-1 using SGMM including region, industry, firm and year-fixed effects with robust standard errors. For robustness check, we also estimate the static linear regression using the ordinary least squares (OLS) method, including region, industry, and year fixed effects. The result is shown in columns 4, 5, and 6. In all columns, robust standard errors clustered at the firm level are reported in parentheses.

Table 3.2 shows that technological progress has a significant and negative impact on labour share. The second row presents the estimated coefficient of *LnCapital/VA* which is economically and statistically significant across all columns. The coefficient indicates that a 10% increase in *Capital/VA decreases labour share* by 0.56% to 0.94% in the short run and 1.7% to 2.7% in the long run. The next three rows illustrate the estimated coefficient of *TFP*, calculated based on the estimation of the Cobb-Douglas production function by Olley and Pakes' (1996) method (*TFPOP*), the Ordinary Least Squares method (*TFPOLS*) and the one-step GMM (Wooldridge, 2009) method (*TFPWDRG*). Regardless of our estimation method, the result shows a statistically significant relationship between *TFP* and labour share, with a p-value less than 0.01. Economically, this finding is also significant. We find that a 10% increase in TFP is associated with a 1.6% to 2% rise in labour share in the short run and a 1.7% to 4.3% rise in labour share in the long run. Bentolila and Saint-Paul (2003) point out that the similar coefficient sign of *LnCapital/VA* and *TFP* shows that total factor productivity captures strictly capital-augmenting technological progress. Hence, Australian firms with higher capital-output ratios and capital-augmenting technological progress have lower labour share, consistent with our first hypothesis.

Turning to product market power, we investigate the relationship between *LnMarkup* and labour share. To calculate firm-level mark-up, we need to estimate the Cobb-Douglas production function for each two-digit GICS industry. Similar to *TFP* estimation, we employ three different methods of estimating a Cobb-Douglas production function. Hence, *LnMarkupOP*, *LnMarkupOLS* and *LnMarkupWRDG* present the natural logarithm of mark-up, in which the Cobb-Douglas production function is estimated by the methods of Olley and Pakes (1996), OLS, and Wooldridge (2009), respectively. Rows 6, 7 and 8 report a negative and significant association between mark-up and labour share across all columns. In other words, a 10% increase in the firm's mark-up decreases the labour share by 0.55% to 0.67% based on two-step *SGMM and* 2.1% to 2.4 % based on OLS estimation. Although the coefficient of the mark-up differs across our estimation method, the broad pattern is quite similar. In summary, we find firm-level evidence of a direct inverse relation between mark-up and labour share, consistent with our first hypothesis.

Table 3.2. Determinants of labour share

Variable	LnLabourShare					
	SGMM-OP (1)	SGMM-OLS (2)	SGMM-WDRG (3)	OP (4)	OLS (5)	WDRG (6)
Lag.LnLabourShare	0.608***	0.603***	0.609***			
	(0.044)	(0.043)	(0.043)			
LnCapital/VA	-0.056**	-0.094***	-0.062**	-0.173***	-0.273***	-0.186***
	(0.023)	(0.028)	(0.024)	(0.022)	(0.025)	(0.022)
TFPOP	-0.163***			-0.175***		
	(0.028)			(0.029)		
TFPOLS		-0.209***			-0.429***	
		(0.041)			(0.048)	
TFPWRDG			-0.180***			-0.214***
			(0.030)			(0.032)
LnMarkupOP	-0.066**			-0.245***		
	(0.031)			(0.036)		
LnMarkupOLS		-0.055**			-0.215***	
		(0.027)			(0.035)	
LnMarkupWRDG			-0.067**			-0.243***
			(0.028)			(0.035)
IndHHIEmp	0.086	0.171	0.193	0.225	0.288*	0.308*
	(0.145)	(0.159)	(0.149)	(0.156)	(0.159)	(0.164)
Union	0.001	-0.003	0.002	0.023	0.017	0.024
	(0.011)	(0.01)	(0.011)	(0.016)	(0.016)	(0.016)
D.LnEmployeeNumber	-0.029	-0.046	-0.029	-0.072***	-0.111***	-0.077***
	(0.038)	(0.035)	(0.039)	(0.028)	(0.028)	(0.027)
BTM	0.057**	0.061***	0.057**	0.111***	0.092***	0.107***
	(0.024)	(0.023)	(0.024)	(0.025)	(0.023)	(0.024)
LnAge	-0.039**	-0.043***	-0.042***	-0.033*	-0.049***	-0.034*
	(0.015)	(0.014)	(0.015)	(0.019)	(0.018)	(0.019)
LnRevenue	0.033**	0.021	0.035**	0.040***	0.053***	0.045***
	(0.015)	(0.014)	(0.015)	(0.015)	(0.012)	(0.014)
Leverage	-0.002	0.006	-0.002	0.020*	0.023**	0.019*
	(0.014)	(0.013)	(0.013)	(0.011)	(0.011)	(0.011)
Constant	-0.085	-0.306	-0.066	-1.151***	-1.422***	-1.082***
	(0.199)	(0.197)	(0.207)	(0.335)	(0.333)	(0.336)
Observation	3292	3292	3292	3292	3292	3292
Firm	659	659	659	659	659	659
Adjusted R2				0.45	0.495	0.455
Root MSE				0.523	0.501	0.52
Number of Instrument	576	576	576			
Hansen test of over-identification	0.387	0.369	0.371			
Arellano-Bond test for AR(1)	0	0	0			
Arellano-Bond test for AR(2)	0.093	0.081	0.093			
Arellano-Bond test for AR(3)	0.503	0.452	0.511			

Notes: Table 3.2 reports the determinants of labour share. Labour share is measured as labour cost divided by the sum of earnings before interest, tax, depreciation, and amortisation (*EBITDA*) and labour cost. Each regression includes region, industry, and year-fixed effects. Continuous variables are winsorised at 1% and 99%. Robust standard errors clustered at the firm level are reported in parentheses.
*, **, *** Indicate significance at the 10%, 5% and 1% levels, respectively. All variables are defined in Appendix 3.2.

We also examine the relationship between labour market power and labour share. Row 9 shows the impact of *IndHHIEmp* on labour share. We find that, while the coefficient of *IndHHIEmp* is positive as we expected, it is not statistically significant across all columns with a p-value less than 0.05. Although this finding is not consistent with our first hypothesis, it is close to the result achieved by Lipsius (2018) which shows that labour market concentration is an implausible driver of the falling labour share. Similarly, row 10 illustrates that labour market power measured by *Union* does not statistically significantly impact labour share. In all columns, we also control for the possible effect of other factors on labour share. Among them, *BTM* and *LnAge* are strongly related to labour share. Table 2 shows that labour share decreases with a decrease in *BTM* and an increase in *LnAge*. This is consistent with Donangelo et al. (2019), who assert that high labour share firms are more exposed to systematic risk and less productive.

As a preliminary robustness check, Table 3.3 shows the impact of each driver, including technological progress, product market power and labour market power, separately on labour share. The coefficients in all columns are estimated by two-step *SGMM* with robust standard errors in which labour share and all right-hand side variables except *Union* are treated as potentially endogenous variables. We use the first and second lagged first differences of endogenous variables as instruments for the level equation and the second and third lagged values of endogenous variables as instruments for the first differences equation. The first three columns show that technological progress, measured by *LnCapital/VA* and *TFP*, has an economically and statistically significant impact on labour share within firms. The next three columns provide evidence of a significantly negative relationship between *LnMarkup* and labour share. A 10% increase in mark-up leads to around a 0.8% decrease in the labour share across all the Cobb-Douglas production function estimation methods. The last column shows that labour market power, measured by *IndHHIEmp* or *Union*, does not have a statistically significant impact on firm-level labour share, at least in our sample. However, the coefficient is positive and consistent with our expectation. Overall, the Australian firm-level evidence on the potential drivers of labour share is in line with previous studies. Our result shows that technological progress and product market power are the most critical factors in explaining the level of labour share.

Table 3.3. Determinants of labour share

	LnLabourShare						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
L.LogLabourShare	0.604***	0.605***	0.604***	0.569***	0.568***	0.567***	0.599***
	(0.048)	(0.046)	(0.047)	(0.043)	(0.043)	(0.043)	(0.045)
LnCapital/VA	-0.075***	-0.111***	-0.078***				
	(0.023)	(0.029)	(0.023)				
TFPOP	-0.167***						
	(0.033)						
TFPOLS		-0.196***					
		(0.047)					
TFPWRDG			-0.180***				
			(0.037)				
LnMarkupOP				-0.083**			
				(0.037)			
LnMarkupOLS					-0.084**		
					(0.037)		
LnMarkupWRDG						-0.086**	
						(0.037)	
IndHHIEmp							0.123
							(0.135)
Union							0.007
							(0.009)
D.LnEmployeeNumber	-0.059	-0.074*	-0.059	-0.074	-0.075	-0.075	-0.088*
	(0.041)	(0.04)	(0.042)	(0.049)	(0.049)	(0.05)	(0.049)
BTM	0.073***	0.069***	0.072***	0.029	0.029	0.029	0.026
	(0.027)	(0.025)	(0.026)	(0.029)	(0.029)	(0.029)	(0.027)
LnAge	-0.033**	-0.028**	-0.032**	-0.043***	-0.043***	-0.043***	-0.024**
	(0.014)	(0.013)	(0.014)	(0.014)	(0.014)	(0.014)	(0.012)
LnRevenue	0.039**	0.024	0.042**	-0.007	-0.007	-0.007	-0.02
	(0.018)	(0.016)	(0.018)	(0.014)	(0.014)	(0.014)	(0.016)
Leverage2	-0.004	0.007	-0.004	-0.011	-0.011	-0.011	0.004
	(0.013)	(0.014)	(0.013)	(0.011)	(0.012)	(0.012)	(0.011)
_cons	-0.125	-0.427***	-0.125	-0.222*	-0.214*	-0.205*	-0.355*
	(0.120)	(0.122)	(0.113)	(0.123)	(0.123)	(0.124)	(0.189)
Observation	3443	3443	3443	3722	3722	3722	4175
Firm	681	681	681	715	715	715	775
Number of Instrument	467	467	467	444	444	444	422
Hansen test of over-	0.424	0.276	0.429	0.383	0.383	0.385	0.288
Arellano-Bond test for AR(1)	0	0	0	0	0	0	0
Arellano-Bond test for AR(2)	0.061	0.053	0.061	0.082	0.081	0.081	0.087
Arellano-Bond test for AR(3)	0.469	0.456	0.471	0.404	0.403	0.403	0.622

Notes: Table 3.3 reports the impact of each leading channel: technological progress, product market power and labour market power, on labour share. Labour share is measured as labour cost divided by the sum of earnings before interest, tax, depreciation, and amortisation (*EBITDA*) and labour cost. Each regression includes region, industry, and year-fixed effects. Continuous variables are winsorised at 1% and 99%. Robust standard errors clustered at the firm level are reported in parentheses.
*, **, *** Indicate significance at the 10%, 5% and 1% levels, respectively.
All variables are defined in Appendix 3.2.

3.5.1.1 Further Empirical Results

This section presents several robustness tests seeking to test the stability of our result among different subsamples.[6] First, the primary regression model, table 3.2, considers year heterogeneity by including year dummies and imposes a common coefficient for all three channels over time. Table 3.4 Panel A reports the regression coefficients that result from a separate period-by-period estimation of Eq. 3-1. All columns include region, industry, and year fixed effects and standard error are clustered at the firm level. In all periods, technological progress and product market power have a statistically significant and negative impact on labour share. However, the economic significance of their impacts is quite different. In addition, there is no evidence of a statistically significant relationship between labour market power and labour share. The sign of the coefficient estimation is in line with the total sample result (Table 3.2).

Second, the importance of industry heterogeneity in understanding declining labour share has been highlighted in several papers (e.g., Autor et al., 2020; Karabarbounis & Neiman, 2014). To explore this heterogeneity, we investigate sector differences by estimating Eq. 3-1 for 11 sectors, defined based on their one-digit GICS, including region, industry, and year fixed effects and clustered standard error at the firm level (Table 3.4 panel B). The result shows that the coefficients of *TFP* and *LnMarkup* are negative in all sectors with a significance level of less than 10% in 6 and 4 out of 11, respectively.[7] In addition, we do not find evidence of a statistically significant impact of technological progress, *LnCapital/VA* and *TFP*, on labour share in high-tech sectors, including health care, information technology and Communication services[8], except *LnCapital/VA* in the information technology sector. This result shows that firms operating in high-tech sectors are not significantly affected by technological progress. Since a high proportion of employees in high-tech firms are highly skilled, this result is consistent with a skilled-biased technological progress impact on labour share (e.g., Krusell et al., 2000). Moreover, our result shows that product market power has statistically insignificant or a low significant impact on declining labour share in high-tech sectors. However, this contrasts with the findings of Autor et al. (2020) who posit that firm concentration predicts a larger fall in the labour share in high-tech sectors. One explanation could be that there is insufficient variation in the data of this sub-sample of companies to identify the impact of the product market.

Table 3.4. The determinants of labour share across years and sectors

Panel A: The determinants of labour share over time

Period	LnCapital/VA	TFPOP	LnMarkupOP	IndHHIEmp	Union	Obs	Firm	Adjusted R2
2004-2007	-0.165***	-0.207***	-0.391***	0.247	0.007	711	350	0.419
	(0.041)	(0.046)	(0.103)	(0.917)	(0.041)			
2008-2010	-0.208***	-0.165***	-0.195***	0.208	0.009	771	372	0.438
	(0.031)	(0.043)	(0.05)	(0.145)	(0.02)			
2011-2013	-0.152***	-0.162***	-0.274***	-1.452	-0.015	787	362	0.475
	(0.031)	(0.039)	(0.067)	(1.137)	(0.045)			
2014-2016	-0.167***	-0.215***	-0.194***	-1.583	0.099	512	255	0.52
	(0.033)	(0.046)	(0.048)	(1.201)	(0.09)			
2017-2019	-0.208***	-0.179***	-0.210***	0.955	0.029	511	229	0.476
	(0.039)	(0.055)	(0.046)	(0.633)	(0.04)			

Panel B: The determinants of labour share across sectors

Sector	LnCapital/VA	TFPOP	LnMarkupOP	IndHHIEmp	Union	Obs	Firm	Adjusted R2
Communication Services	-0.104	-0.175*	-0.162***	0.701	0.049	251	44	0.358
	(0.063)	(0.099)	(0.057)	(0.821)	(0.038)			
Consumer Discretionary	-0.042	-0.002	-0.088	-0.046	0.076**	576	106	0.123
	(0.043)	(0.036)	(0.075)	(0.194)	(0.032)			
Consumer Staples	-0.283***	-0.209	-0.431**	2.327*	-0.015	175	32	0.262
	(0.083)	(0.167)	(0.21)	(1.242)	(0.055)			
Energy	-0.434***	-0.980***	-0.03	5.748**	0.096	131	35	0.65
	(0.065)	(0.18)	(0.169)	(2.397)	(0.067)			
Financials	0.009	-0.761***	-0.19	-0.758	0.006	119	28	0.724
	(0.044)	(0.094)	(0.121)	(1.591)	(0.058)			
Health Care	0.082	-0.009	-0.016	-2.403	-0.040*	215	39	0.445
	(0.052)	(0.039)	(0.063)	(2.495)	(0.022)			
Industrials	-0.172***	-0.087	-0.272***	0.736	0.012	794	139	0.337
	(0.036)	(0.055)	(0.071)	(0.848)	(0.023)			
Information Technology	-0.248***	-0.218	-0.017	-0.719	-0.002	283	75	0.242
	(0.059)	(0.153)	(0.045)	(3.323)	(0.031)			
Materials	-0.282***	-0.532***	-0.548***	-7.822	-0.011	526	123	0.368
	(0.062)	(0.145)	(0.161)	(7.866)	(0.058)			
Real Estate	-0.279***	-0.911***	-0.239	-46.673*	0.086	136	22	0.642
	(0.07)	(0.14)	(0.158)	(24.051)	(0.077)			
Utilities	-0.579***	-1.332***	0.001	0.106	-0.009	86	16	0.908
	(0.054)	(0.217)	(0.104)	(1.621)	(0.051)			

Notes: Table 3.4 presents the determinants of labour share over time and sectors. In each row, the dependent variable is the natural logarithm of labour share measured as the natural logarithm of labour cost divided by the sum of earnings before interest, tax, depreciation, and amortisation (*EBITDA*) and labour cost. Panel A reports the determinants of labour share in five periods between 2004 and 2019. Panel B reports the determinants of labour share across 11 sectors. Each regression includes control variables, region, industry, and year-fixed effects. Continuous variables are winsorised at 1% and 99%. Robust standard errors clustered at the firm level are reported in parentheses.
*, **, *** Indicate significance at the 10%, 5% and 1% levels, respectively.
All variables are defined in Appendix 3.2.

.

Third, technological progress allows businesses to automate their routine and well-defined tasks and substitute their low-skilled workers in production. Therefore, we expect that labour share is unaffected by technological progress in firms that show a higher probability of skilled employees or are less capital-intensive. To evaluate this hypothesis, we focus on two subsets of firms. The first subset is firms with R&D expenditure, based on the argument that firms investing in R&D require highly skilled employees to execute R&D projects and increase the likelihood of successful innovation (Faleye et al., 2013). The second subset consists of firms where the capital intensity, the ratio of PPE to the number of employees, is less than the first quartile in the corresponding sector, based on the intuition that capital has a less significant role in production in lower capital intensity firms. As the first and third columns of Table 3.5 reveal, while the coefficient of *LnCapital/VA* and *TFP* is negative and economically significant in both high R&D and low capital-intensive firms, they are not statistically significant. Thus, labour share does not significantly decline with technological progress when employees have higher skill levels or greater roles in production.

Lastly, it is possible that labour share in firms with higher levels of external funds, measured by the ratio of total debt to total asset, is impacted differently by technological progress and product market power. One might expect that better access to external funds encourages firms to invest more in new technologies and automate their tasks. At the same time, leverage may decrease firms' ability to make their payroll and be negatively associated with compensation. Hence, we expect a more considerable decline in labour share by increasing technological progress and mark-up in high-leverage firms. To test this hypothesis, we separate the subset of firms where the leverage is higher than the third quartile in the corresponding sector. Columns 5 and 6 in Table 3.5 show that technological progress and product market power have a larger significant negative impact on labour share in a high-leverage subsample compared to the rest of the observations.

Table 3.5. The determinants of labour share within different sub-groups

	LnLabourShare					
	R&D (1)	Excluding R&D (2)	PPE-Low (3)	Excluding PPE-Low (4)	Leverage-High (5)	Excluding Leverage-High (6)
LnCapital/VA	-0.064	-0.187***	-0.043	-0.105***	-0.146***	-0.161***
	(0.043)	(0.023)	(0.039)	(0.026)	(0.03)	(0.024)
TFPOP	-0.099	-0.206***	-0.037	-0.146***	-0.242***	-0.157***
	(0.061)	(0.032)	(0.048)	(0.034)	(0.062)	(0.027)
LnMarkupOP	-0.191**	-0.246***	-0.128**	-0.278***	-0.275***	-0.207***
	(0.087)	(0.038)	(0.049)	(0.045)	(0.066)	(0.036)
IndHHIEmp	-0.557	0.325*	-0.131	0.266	-0.191	0.174
	(0.499)	(0.166)	(0.206)	(0.186)	(0.284)	(0.183)
Union	0.002	0.027	0.018	0.017	0.023	0.033*
	(0.035)	(0.018)	(0.021)	(0.019)	(0.033)	(0.02)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Observation	540	2752	637	2655	776	2516
Firm	139	596	216	560	262	576
Adjusted R2	0.305	0.481	0.203	0.47	0.534	0.452
Root MSE	0.451	0.527	0.348	0.538	0.533	0.499

Notes: Table 3.5 presents the determinants of labour share between different groups. In all Columns, the dependent variable is labour share, measured as the natural logarithm of labour cost divided by the sum of earnings before interest, tax, depreciation, amortisation (*EBITDA*) and labour cost. The regression in the first column is estimated for firms with R&D investment. The second column is estimated for the total sample except for firms with R&D investment. The third column is estimated for firms where the ratio of PPE to the number of employees is less than the first quartile in the corresponding sector. The fourth column is estimated for firms where the ratio of PPE to the number of employees is greater than the first quartile in the corresponding sector. The fifth column is estimated for firms where the leverage is higher than the third quartile in the corresponding sector. The sixth column is estimated for firms where leverage is less than the third quartile in the corresponding sector. Each regression includes control variables, region, industry, and year-fixed effects. Continuous variables are winsorised at 1% and 99%. Robust standard errors clustered at the firm level are reported in parentheses.
*, **, *** Indicate significance at the 10%, 5% and 1% levels, respectively.
All variables are defined in Appendix 3.2.

3.5.2 The relationship between labour Share and pay inequality

This section estimates the regression of pay inequality on labour share Table 3.6, Column 1, reports the estimation result of the two-step *SGMM* method including region, industry, firm and year-fixed effects with robust standard errors. As shown, we find a negative and statistically significant relationship (p-value less than 0.01) between labour share and pay inequality. This coefficient in the log-log model can be interpreted as elasticities, thus suggesting that a 10% rise in labour share is associated with a 4.19% increase in the gap between CEO compensation and average employee pay in the short run. For a robustness check, we also estimate the static linear regression using the ordinary least squares (*OLS*) method, including region, industry, and year-fixed effects with robust standard errors clustered at the firm level. The estimation result is reported in column (2). Similarly, the result indicates that the coefficient for *LnPayInequality* is economically and statistically significant. In fact, a 10% rise in labour share decreases pay inequality by 4.8% in the long run. Hence, labour share appears to have a negative and significant impact on pay inequality in our sample, which is in line with our second hypothesis.

Furthermore, we examine whether the significant drivers of labour share, technological progress and product market power, are likely to affect the association between pay inequality and labour share. Technology allows businesses to automate their routine tasks, and it substitutes low-skilled employees in production. However, it benefits high-skill employees who are complementary to technological progress. Therefore, firms with higher technological progress employ more high-skill employees with higher average wages (Bessen, 2015). Hence, technological progress may weaken the negative association between labour share and pay inequality. With regard to product market power, previous research (e.g., Baker & Salop, 2015; Comanor & Smiley, 1975; Creedy & Dixon, 1999) has argued that increasing product market power contributes to greater inequality. For example, using country-level data, Ennis et al. (2019) and Han and Pyun (2021) show that an increase in mark-up is associated with rising income inequality. Therefore, the negative impact of labour share on pay inequality is expected to be stronger in firms with higher product market power.

To perform our examination, we interact *LnPayInequality* with *TFP* (Table 3.6, column 3) and mark-up (Table 3.6, column 4). The coefficient in both columns is estimated using two-step *SGMM* with robust standard errors. The *SGMM* equations are similar to column 1 with one more endogenous variable: in column 3 (column 4), the second lagged first differences in *TFP* (*LnMarkup*) and the third lagged values of *TFP* (*LnMarkup*) are used as an instrument in the level and differences equations, respectively. Column 3 reports a positive and significant coefficient for the interaction terms between labour share and *TFP* (0.075, $p<5\%$), suggesting that technological progress weakens the negative association between labour share and pay inequality. Conversely, column 4 shows a negative and significant coefficient for the interaction between labour share and *LnMarkup* (-0.179, p-value< 10%), indicating that a higher product market power strengthens the negative relationship between labour share and pay inequity. These results suggest higher negative relationships between labour share and pay inequality in firms with lower technological productivity and higher product market power. This may indicate that a lower labour share driven by higher product market power has a more substantial negative impact on pay inequality than a low labour share driven by technological progress.

Table 3.6. The impact of labour share on pay inequality

	LnPayInequality			
	(2)	(2)	(3)	(4)
Lag. LnPayInequality	0.571***		0.542***	0.629***
	(0.088)		(0.086)	(0.089)
LnLabourShare	-0.419***	-0.477***	-0.549***	-0.239**
	(0.139)	(0.078)	(0.103)	(0.114)
TFPOP			-0.237*	
			(0.123)	
LogLabourShare * TFPOP			0.075**	
			(0.036)	
LnMarkupOP				-0.294**
				(0.142)
LogLabourShare * LnMarkupOP				-0.179*
				(0.107)
LnRevenue	0.148***	0.297***	0.258***	0.122**
	(0.04)	(0.035)	(0.06)	(0.049)
BTM	0.031	-0.175***	-0.082	-0.003
	(0.101)	(0.065)	(0.092)	(0.09)
LnAge	0.068	0.210***	0.061	0.075
	(0.056)	(0.064)	(0.059)	(0.052)
ROA	0.008	-0.011**	0.004	0.007
	(0.009)	(0.005)	(0.009)	(0.01)
Ret	0.209	-0.012	0.147	0.136
	(0.131)	(0.067)	(0.099)	(0.103)
STDRet	0.199	1.466*	-0.033	0.26
	(0.656)	(0.747)	(0.64)	(0.749)
Leverage	0.008	0.003	0.024	0.008
	(0.023)	(0.025)	(0.019)	(0.022)
IsCEOChair	-0.181*	-0.064	-0.167*	-0.131
	(0.11)	(0.146)	(0.09)	(0.082)
BoardTenure	-0.008	-0.02	-0.008	-0.009
	(0.012)	(0.013)	(0.01)	(0.01)
IndCommittee	-0.001	-0.001	-0.002	-0.001
	(0.002)	(0.002)	(0.001)	(0.001)
PPEIntensity	-0.012***	-0.025***	-0.010***	-0.011***
	(0.004)	(0.006)	(0.002)	(0.003)
RDIntensity	-0.022*	-0.007	-0.003	-0.011
	(0.011)	(0.012)	(0.013)	(0.011)
IndConcentration	0.834	0.108	0.072	0.38
	(0.553)	(0.769)	(0.8)	(0.916)
Education	-0.114	-0.017	-0.057	-0.06
	(0.086)	(0.101)	(0.081)	(0.091)
Union	-0.043	-0.023	-0.021	-0.009
	(0.038)	(0.043)	(0.042)	(0.044)
Unemploymee	0.094**	0.150***	0.043	0.07
	(0.047)	(0.056)	(0.048)	(0.049)
VacantJobRatio	0.024	0.087*	0.022	-0.011
	(0.046)	(0.047)	(0.034)	(0.04)
Constant	2.442	0.368	1.415	1.109
	(2.156)	(1.912)	(2.004)	(2.337)
Observation	1247	1725	1031	1098
Firm	255	339	221	231
Adjusted R2		0.447		
Root MSE		0.826		
Number of Instrument	168		207	208
Hansen test of over-identification	0.634		0.823	0.727
Arellano-Bond test for AR(1)	0		0	0
Arellano-Bond test for AR(2)	0.051		0.168	0.054
Arellano-Bond test for AR(3)	0.739		0.577	0.969

Notes: Table 3.6 presents the relationship between labour share and income inequality. In all columns, the dependent variable is pay inequality measured as the natural log of the ratio of total CEO compensation to average employee pay. The first column estimates the coefficient of our model based on the OLS method. It includes region, industry, and year-fixed effects. The second column estimates the coefficients of our model based on a two-step *SGMM* with robust standard errors. The third column shows the moderation impact of TFP, and is estimated based on a two-step *SGMM* with robust standard errors. The fourth column shows the moderation impact of markup and is estimated based on a two-step *SGMM* with robust standard errors. Continuous variables are winsorised at 1% and 99%. Robust standard errors clustered at the firm level are reported in parentheses.
*, **, *** Indicate significance at the 10%, 5% and 1% levels, respectively.
All variables are defined in Appendix 3.2.

3.6 Conclusion

Following the fall in labour share and the rise in income inequality in recent decades in Australia, this article empirically examines the determinants of labour share and its impact on pay inequality using panel data from Australian listed firms between 2004 and 2019. First, we examine the impact of technological progress, product market power and labour market power on firms' labour share. We find that capital deepening and technological progress have a significant and negative impact on labour share. However, technological progress is not a significant driver of labour share in firms with highly skilled employees, such as firms with R&D investment, or those that are less capital intensive. In addition, firms with higher mark-up have significantly lower labour shares. Our findings do not support the hypothesis that labour market concentration and unionisation are associated with labour share. Our further analysis shows that technological progress and product market power have a more considerable negative impact on labour share in firms with a higher level of external funds, while they do not significantly affect labour share in high-tech sectors.

Second, we examine the impact of within-firm labour share on pay inequality between CEOs and employees. Our analysis shows that a decrease in a firm's labour share is significantly associated with increased pay inequality. In addition, our result asserts that the significant determinants of labour share, technological progress and product market power, can moderate the negative impact of labour share on pay inequality. We find that labour share has a larger negative impact on pay inequality in firms with lower technological productivity and higher product market power. In general, this study extends the current literature by documenting firm-level drivers of labour share in Australia, covering all sectors, and providing novel firm-level evidence on the relationship between labour share and pay inequality.

The findings from this study have several implications for policymakers who seek to mitigate the fall in labour shares and the rise in pay inequality in Australia. First, our study suggests that in the presence of highly skilled employees, technological progress does not have a significant negative impact on labour share. Therefore, investing in training and increasing the skill of workers may be the most important key for policymakers to prevent the further negative impact of technology on labour share. Second, the significant negative impact of product market power on Australian labour share recommends that the government imposes further policies to prevent the concentration of market power and increase competition in the market. Third, we find higher technological progress and lower product market power mitigate the negative impact of labour share on pay inequality. This finding recommends that policymakers should consider policies aimed at promoting innovation and deregulating the product market to prevent the further rise in pay inequality resulting from the decline in labour share.

Our research should be considered in the context of its limitations. First, our sample is limited to Australian listed firms, unlike the datasets commonly used in the micro-level analysis of labour share (e.g., Autor et al. 2020; Kehrig and Vincent 2021), while a proportion of economic activities take place in non-listed firms in Australia. Therefore, since listed and non-listed firms have different characteristics, one future avenue for research would be to investigate the determinant of labour share in non-listed firms. Second, a short-term data period (from 2004 to 2019) was employed for assessing the determinants and impact of labour share, which limits the possibility of grasping the underlying causes of the structural movements in Australian labour shares. Hence, another avenue for future research would be to investigate long-run underlying causes of declining labour share. A final limitation is the lack of publicly available data. Our study focuses on the impact of labour share on CEO-employee pay inequality. However, there are different types of pay inequality in organisations: pay differences between employees at the same level or pay differences across hierarchy levels. Therefore, future research might explore how labour share impacts different pay inequality types (i.e., vertical or horizontal pay disparity) rather than focusing on CEO-employee pay inequality. Considering these limitations, we believe that our study highlights the importance of firm-level analysis in understanding macroeconomic movements.

3.7 References

Abayadeera, N. (2010). Value relevance of information in hi-tech industries in Australia : Accounting information and intangible asset disclosures. [Doctoral dissertation, Victoria University]. https://vuir.vu.edu.au/id/eprint/15977

Acemoglu, D., & Autor, D. (2011). Chapter 12 - Skills, tasks and technologies: Implications for employment and earnings. In O. Ashenfelter & D. Card (Eds.), *Handbook of Labor Economics Vol. 4, Part B* (pp. 1043–1171). Elsevier. https://doi.org/10.1016/S0169-7218(11)02410-5

Alvarez-Cuadrado, F., Long, N. V, & Poschke, M. (2018). Capital-labor substitution, structural change and the labor income share. *Journal of Economic Dynamics and Control*, *87*, 206–231. https://doi.org/10.1016/J.JEDC.2017.12.010

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277–297. https://doi.org/10.2307/2297968

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*(1), 29–51. https://doi.org/10.1016/0304-4076(94)01642-D

Atkinson, A. B. (2009). Factor shares: the principal problem of political economy? *Oxford Review of Economic Policy*, *25*(1), 3–16. https://doi.org/10.1093/oxrep/grp007

Australian Bureau of Statistics. (2020, October 30). *Australian system of national accounts*. Australian Bureau of Statistics. https://www.abs.gov.au/statistics/economy/national-accounts/australian-system-national-accounts/2019-20

Autor, D., Dorn, D., Katz, L. F., Patterson, C., & Van Reenen, J. (2020). The fall of the labor share and the rise of superstar firms. *The Quarterly Journal of Economics*, *135*(2), 645–709. https://doi.org/10.1093/qje/qjaa004

Azar, J., Marinescu, I., & Steinbaum, M. (2020). Labor market concentration. *Journal of Human Resources*. https://doi.org/10.3368/jhr.monopsony.1218-9914R1

Baker, J. B., & Salop, S. C. (2015). *Antitrust, competition policy, and inequality*. Georgetown University Law Center. https://scholarship.law.georgetown.edu/facpub/1462/

Bakija, J., Cole, A., & Heim, B. (2012). *Jobs and income growth of top earners and the causes of changing income inequality: Evidence from U.S. tax return data* (Working Paper No. 2010–22). Williams College, Department of Economics. https://econpapers.repec.org/RePEc:wil:wileco:2010-22

Baqaee, D. R., & Farhi, E. (2020). Productivity and misallocation in general equilibrium. *The Quarterly Journal of Economics*, *135*(1), 105–163. https://doi.org/10.1093/qje/qjz030

Benmelech, E., Bergman, N. K., & Kim, H. (2020). Strong employers and weak employees: How does employer concentration affect wages? *Journal of Human Resources*. https://doi.org/10.3368/JHR.MONOPSONY.0119-10007R1

Bentolila, S., & Saint-Paul, G. (2003). Explaining movements in the labor share. *Contributions in Macroeconomics*, *3*(1). https://doi.org/doi:10.2202/1534-6005.1103

Bessen, J. (2015, April 29). *How technology has affected wages for the last 200 years*. Harvard Business Review. https://hbr.org/2015/04/how-technology-has-affected-wages-for-the-last-200-years

Bridgman, B. (2018). Is labour's loss capital's gain? Gross versus net labour shares. *Macroeconomic Dynamics*, *22*(8), 2070–2087. https://doi.org/10.1017/S1365100516001000

Cheffins, B. R., & Thomas, R. S. (2004). The globalization (americanization) of executive pay. *Berkeley Business Law Journal*, *1*(2), 233–290.

Chirinko, R. S. (2008). σ: The long and short of it. *Journal of Macroeconomics*, *30*(2), 671–686. https://doi.org/10.1016/J.JMACRO.2007.10.010

Chirinko, R. S., & Mallick, D. (2017). The substitution elasticity, factor shares, and the low-frequency panel model. *American Economic Journal: Macroeconomics*, *9*(4), 225–253. https://doi.org/10.1257/MAC.20140302

Comanor, W. S., & Smiley, R. H. (1975). Monopoly and the distribution of wealth. *The Quarterly Journal of Economics*, *89*(2), 177–194. https://doi.org/10.2307/1884423

Core, J. E., Holthausen, R. W., & Larcker, D. F. (1999). Corporate governance, chief executive officer compensation, and firm performance. *Journal of Financial Economics*, *51*(3), 371–406. https://doi.org/10.1016/S0304-405X(98)00058-0

Creedy, J., & Dixon, R. (1999). The distributional effects of monopoly. *Australian Economic Papers*, *38*(3), 223–237. https://doi.org/10.1111/1467-8454.00053

Dao, M. C., Das, M., & Koczan, Z. (2019). Why is labor receiving a smaller share of global income? Theory and empirical evidence. *Economic Policy*, *34*(100), 723–759. https://doi.org/10.1093/epolic/eiaa004

Dao, M. C., Das, M., Koczan, Z., & Lian, W. (2017). *Why is labor receiving a smaller share of global income? Theory and empirical evidence* (Working Paper No. 2017/169). IMF. https://www.imf.org/en/Publications/WP/Issues/2017/07/24/Why-Is-Labor-Receiving-a-Smaller-Share-of-Global-Income-Theory-and-Empirical-Evidence-45102

Daudey, E., & García-Peñalosa, C. (2007). The personal and the factor distributions of income in a cross-section of countries. *The Journal of Development Studies*, *43*(5), 812–829. https://doi.org/10.1080/00220380701384406

De Loecker, J., Eeckhout, J., & Unger, G. (2020). The rise of market power and the macroeconomic implications. *The Quarterly Journal of Economics*, *135*(2), 561–644. https://doi.org/10.1093/QJE/QJZ041

De Loecker, J., & Warzynski, F. (2012). Markups and firm-level export status. *American Economic Review*, *102*(6), 2437–2471. https://doi.org/10.1257/AER.102.6.2437

Donangelo, A. (2021). Untangling the value premium with labor shares. *The Review of Financial Studies*, *34*(1), 451–508. https://doi.org/10.1093/RFS/HHAA022

Donangelo, A., Gourio, F., Kehrig, M., & Palacios, M. (2019). The cross-section of labor leverage and equity returns. *Journal of Financial Economics*, *132*(2), 497–518. https://doi.org/10.1016/j.jfineco.2018.10.016

Eden, M., & Gaggl, P. (2019). *Capital composition and the declining labor share* (Working Paper No. 7996). CESifo. https://doi.org/10.2139/SSRN.3507267

Elsby, M. W. L., Hobijn, B., & Şahin, A. (2013). The decline of the U.S. labor share. *Brookings Papers on Economic Activity*, *2013*(2), 1–63. https://doi.org/10.1353/ECA.2013.0016

Ennis, S. F., Gonzaga, P., & Pike, C. (2019). Inequality: A hidden cost of market power. *Oxford Review of Economic Policy*, *35*(3), 518–549. https://doi.org/10.1093/OXREP/GRZ017

Erauskin, I. (2020). The labor share and income inequality: Some empirical evidence for the period 1990-2015. *Applied Economic Analysis*, *28*(84), 173–195. https://doi.org/10.1108/AEA-04-2020-0028/FULL/PDF

Faleye, O., Reis, E., & Venkateswaran, A. (2013). The determinants and effects of CEO-employee pay ratios. *Journal of Banking and Finance*, *37*(8), 3258–3272. https://doi.org/10.1016/j.jbankfin.2013.03.003

Farber, H. S., Herbst, D., Kuziemko, I., & Naidu, S. (2021). Unions and inequality over the twentieth century: New evidence from survey data. *The Quarterly Journal of Economics*, *136*(3), 1325–1385. https://doi.org/10.1093/QJE/QJAB012

Gianni, L. C. (2019). *The labour and capital shares of income in Australia*. Reserve Bank of Australia. https://www.rba.gov.au/publications/bulletin/2019/mar/the-labour-and-capital-shares-of-income-in-australia.html

Glyn, A. (2011). 5 Functional distribution and inequality. In B. Nolan, W. Salverda, & T. M. Smeeding (Eds.), *The Oxford Handbook of Economic Inequality* (pp. 101–126). Oxford University Press. https://doi.org/10.1093/OXFORDHB/9780199606061.013.0005

Gollin, D. (2002). Getting income shares right. *Journal of Political Economy*, *110*(2), 458–474. https://doi.org/10.1086/338747

Gouin-Bonenfant, E. (2022). Productivity dispersion, between-firm competition, and the labor share. *Econometrica*, *90*(6), 2755–2793. https://doi.org/10.3982/ECTA18612

Grossman, G. M., Helpman, E., Oberfield, E., & Sampson, T. (2021). Endogenous education and long-run factor shares. *American Economic Review: Insights*, *3*(2), 215–232. https://doi.org/10.1257/AERI.20200350

Grossman, G. M., & Oberfield, E. (2021). *The elusive explanation for the declining labor share* (Working Paper No. 29165). National Bureau of Economic Research. https://doi.org/10.3386/W29165

Growiec, J. (2012). Determinants of the labor share. *Eastern European Economics* , *50*(5), 23–65. https://doi.org/10.2753/EEE0012-8775500502

Guschanski, A., & Onaran, Ö. (2018). *The labour share and financialisation: Evidence from publicly listed firms* (Working Paper No. 19371). University of Greenwich, Greenwich Political Economy Research Centre. https://ideas.repec.org/p/gpe/wpaper/19371.html

Han, M., & Pyun, J. H. (2021). Markups and income inequality: Causal links, 1975-2011. *Journal of Comparative Economics*, *49*(2), 290–312. https://doi.org/10.1016/J.JCE.2020.12.002

Hartman-Glaser, B., Lustig, H., & Xiaolan, M. Z. (2019). Capital share dynamics when firms insure workers. *The Journal of Finance*, *74*(4), 1707–1751. https://doi.org/10.1111/JOFI.12773

Hogrefe, J., & Kappler, M. (2013). The labour share of income: Heterogeneous causes for parallel movements? *The Journal of Economic Inequality*, *11*(3), 303–319. https://doi.org/10.1007/s10888-012-9221-8

Hubmer, J., & Restrepo, P. (2021). *Not a typical firm: The joint dynamics of firms, labor shares, and capital–labor substitution* (Workign Paper No. w28579). National Bureau of Economic Research. https://doi.org/10.3386/W28579

Hutchinson, J., & Persyn, D. (2012). Globalisation, concentration and footloose firms: In search of the main cause of the declining labour share. *Review of World Economics*, *148*(1), 17–43. https://doi.org/10.1007/s10290-011-0112-z

Jacobson, M., & Occhino, F. (2012). Labor's declining share of income and rising inequality. *Economic Commentary, 2012–13,* 1–6. https://doi.org/10.26509/FRBC-EC-201213

Karabarbounis, L., & Neiman, B. (2014). The global decline of the labor share. *The Quarterly Journal of Economics*, *129*(1), 61–103. https://doi.org/10.1093/QJE/QJT032

Kehrig, M., & Vincent, N. (2021). The micro-level anatomy of the labor share decline. *The Quarterly Journal of Economics*, *136*(2), 1031–1087. https://doi.org/10.1093/QJE/QJAB002

Koh, D., Santaeulalia-Lopis, R., & Zheng, Y. (2020). Labor share decline and intellectual property products capital. *Econometrica, 88,* 2609–2628. https://doi.org/10.3982/ECTA17477

Krusell, P., Ohanian, L. E., Ríos-Rull, J. V., & Violante, G. L. (2000). Capital-skill complementarity and inequality: A macroeconomic analysis. *Econometrica*, *68*(5), 1029–1053. https://doi.org/10.1111/1468-0262.00150

Lipsius, B. (2018). *Labor market concentration does not explain the falling labor share*. (Job Market Paper). https://doi.org/10.2139/SSRN.3279007

Hamson, D., & Little, P. (2021). *Assessing executive remuneration in Australia: Perhaps performance does pay?* Plato Investment Management. https://plato.com.au/plato-research-assessing-executive-remuneration-in-australia/

Manjón, M., & Mañez, J. (2016). Production function estimation in Stata using the Ackerberg–Caves–Frazer method. *The Stata Journal*, *16*(4), 900–916. https://doi.org/10.1177/1536867X1601600406

Merhebi, R., Pattenden, K., Swan, P. L., & Zhou, X. (2006). Australian chief executive officer remuneration: Pay and performance. *Accounting & Finance*, *46*(3), 481–497. https://doi.org/10.1111/J.1467-629X.2006.00178.X

Morrisson, C. (2000). Chapter 4 Historical perspectives on income distribution: The case of Europe. In A. B. Atkinson, & F. Bourguignon (Eds.), *Handbook of Income Distribution Vol. 1* (pp. 217–260). Elsevier. https://doi.org/10.1016/S1574-0056(00)80007-X

Oberfield, E., & Raval, D. (2021). Micro data and macro technology. *Econometrica*, *89*(2), 703–732. https://doi.org/10.3982/ECTA12807

OECD (2015). *In it together: Why less inequality benefits all.* https://doi.org/10.1787/9789264235120-EN

Olley, G. S., & Pakes, A. (1996). The dynamics of productivity in the telecommunications equipment industry. *Econometrica, 64*(6), 1263–1297. https://doi.org/10.2307/2171831

Pianta, M., & Tancioni, M. (2008). Innovations, wages, and profits. *Journal of Post Keynesian Economics, 31*(1), 101–123. https://doi.org/10.2753/PKE0160-3477310105

Piketty, T. (2014). *Capital in the twenty-first century*. Harvard University Press. https://doi.org/10.4159/9780674982918/HTML

Sauer, P., Rao, N. D., & Pachauri, S. (2020). *Explaining income inequality trends: An integrated approach* (Working Paper No. 2020/65). UNU-WIDER. https://doi.org/10.35188/UNU-WIDER/2020/822-1

Siegenthaler, M., & Stucki, T. (2015). Dividing the pie: Firm-level determinants of the labor share. *ILR Review*, *68*(5), 1157–1194. https://doi.org/10.1177/0019793915593952

Sila, U., & Dugain, V. (2019). *Income, wealth and earnings inequality in Australia: Evidence from the HILDA survey* (Working Paper No.1538). OECD Economics Department Working Papers. https://doi.org/https://doi.org/10.1787/cab6789d-en

Smith, M., Yagan, D., Zidar, O., & Zwick, E. (2019). Capitalists in the twenty-first century. *The Quarterly Journal of Economics*, *134*(4), 1675–1745. https://doi.org/10.1093/QJE/QJZ020

Stansbury, A., & Summers, L. H. (2020). *The declining worker power hypothesis: An explanation for the recent evolution of the American economy* (Working Paper No. 27193). National Bureau of Economic Research. https://doi.org/10.3386/W27193

Taherifar, R., Holmes, M. J., & Hassan, G. M. (2021). *Is performance affected by the CEO-Employee pay gap? Evidence from Australia* (Working Paper No. 21/14). University of Waikato. https://ideas.repec.org/p/wai/econwp/21-14.html

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, *126*(1), 25–51. https://doi.org/10.1016/J.JECONOM.2004.02.005

Wolff, E. N. (2010). *Recent trends in household wealth in the United States: Rising debt and the middle-class squeeze - an update to 2007* (Working Papers No. 589). Levy Economics Institute of Bard College. https://doi.org/10.2139/SSRN.1585409

Wooldridge, J. M. (2009). On estimating firm-level production functions using proxy variables to control for unobservables. *Economics Letters*, *104*(3), 112–114. https://doi.org/10.1016/J.ECONLET.2009.04.026

Young, A. T., & Lawson, R. A. (2014). Capitalism and labor shares: A cross-country panel study. *European Journal of Political Economy*, *33*, 20–36. https://doi.org/10.1016/J.EJPOLECO.2013.11.006

Young, A. T., & Tackett, M. Y. (2018). Globalization and the decline in labor shares: Exploring the relationship beyond trade and financial flows. *European Journal of Political Economy*, *52*, 18–35. https://doi.org/10.1016/J.EJPOLECO.2017.04.003

Young, A. T., & Zuleta, H. (2017). Do unions increase labor shares? Evidence from US industry-level data. *Eastern Economic Journal*, *44*(4), 558–575. https://doi.org/10.1057/S41302-016-0086-6

3.8 Appendix

Appendix 3.1 Measurement

I. Technological progress:

As noted in the paper, we measure technological progress using two proxies: capital-output ratio (*LnCapital/VA*), and Total Factor Productivity (*TFP*). Following Bentolila and Saint-Paul (2003), *LnCapital/VA* is calculated as the ratio of gross capital stock to value-added. The gross capital stock is measured by the sum of net property, plant and equipment and accumulated depreciation.

TFP is calculated for each firm at time t in our sample based on the estimation of the Cobb-Douglas production function. Consider a log-linearised Cobb-Douglas production function for firm i in industry j:

$$y_{it} = \alpha_j + \theta_j^l l_{it} + \theta_j^k k_{it} + \epsilon_{it} \quad \text{i belongs to industry j} \qquad (3\text{-}4)$$

Where y_{it} is value-added, l_{it} is the number of employees, k_{it} is the gross capital stock of firm i in industry j at time t, in log form. To ensure that our conclusions are robust, we apply a variety of approaches for estimating the above equation.

One common approach to estimate the Cobb-Douglas production function is the Ordinary Least Squares (*OLS*) method. We estimate a separate regression for each two-digit *GICS* industry group to control industry heterogeneity. Following this approach, *TFP* based on *OLS* estimation (*TFPOLS*) is measured as the residual of Eq. 3-4. The challenge is that the *OLS* estimation suffers from simultaneity and selection biases. Simultaneity arises if firms decide the level of inputs consumed in the production process. In this case, inputs possibly are endogenous variables because the model's error term includes output determinants observed by the firm (Manjón & Mañez, 2016). Selection bias results from the relationship between productivity shocks and the probability of exit from the market. If a firm’s profitability is positively related to its capital stock, then a firm with a larger capital stock is more likely to stay in the market despite a low productivity shock than a firm with smaller capital stock because the firm with more capital can be expected to produce greater future profits. Therefore, we follow the literature by using a control function approach, which was first introduced by Olley and Pakes (1996) (*OP*), to overcome these challenges. Consider a log-linearised Cobb-Douglas production function for firm *i* in industry *j*

$$y_{it} = \alpha_j + \theta_j^l l_{it} + \theta_j^k k_{it} + \omega_{it} + \epsilon_{it} \quad \text{i belongs to industry j} \qquad (3\text{-}5)$$

ω_{it} is unobserved productivity shock which refers to *TFP* and ϵ_{it} is measurement error. It is assumed that ω_{it} follows a first-order Markov process as below:

$$\omega_{it} = E(\omega_{it} \mid \omega_{it-1}) + u_{it} = g(\omega_{it-1}) + u_{it} \quad (3\text{-}6)$$

u_{it} is a random shock component assumed to be uncorrelated with unobserved productivity shock, and our state variable k_{it}. In addition, the solution to the dynamic profit maximisation problem generates a demand function for the proxy variable (investment (i_{it}) in *OP*) that under certain assumptions can be inverted to define a firm's productivity as a function of observables as $\omega_{it} = h(i_{it}, k_{it})$. We measure investment as the per cent change in the capital; that is $i_{it} = k_{it} - k_{it-1}$. The estimation approach has two stages.

In the first stage, we plug the inverse of the demand function into the production function Eq. 3-5.

$$y_{it} = \alpha_j + \theta_j^l l_{it} + \theta_j^k k_{it} + h(i_{it}, k_{it}) + \epsilon_{it} = \theta_j^l l_{it} + \varphi(i_{it}, k_{it}) + \epsilon_{it} \quad (3\text{-}7)$$

We non-parametrically estimate Eq. 3-7. This stage provides the estimate $\hat{\theta}_j^l$. In the second stage, assuming the Markovian nature of productivity process gives rise to the relevant moment condition which can be used to estimate the production function parameters, we parametrise the function φ and g using second-order polynomials. These two stages then allow us to estimate *TFP* based on *OP* (*TFPOP*) as:

$$\hat{\omega}_{it} = y_{it} - \hat{\alpha}_j - \hat{\theta}_j^l l_{it} - \hat{\theta}_j^k k_{it} \quad (3\text{-}8)$$

In addition to *OP*, we employ one-step *GMM* Wooldridge (Wooldridge 2009). The Wooldridge method allows us to estimate the two stages of *OP* jointly in a system of two equations, which relies on the set of assumptions. After the estimation of the production function, *TFP* based on the Wooldridge method (*TFPWRDG*) is estimated using Eq. 3-7.

II. Firm-level mark-up:

In an imperfect competitive product market, mark-up is commonly defined as the output price divided by the marginal cost (De Loecker & Warzynski, 2012). Measuring mark-up is challenging since marginal cost data is not available. As recommended by De Loecker and Warzynski 2012, a measure of mark-up can be obtained for each firm at a given point in time as the wedge between inputs expenditure share in revenue (observed in data) and inputs output elasticity (obtained by estimating the associated production function). Their approach is based on the work of Hall (1988) to estimate the mark-up from the firm's cost minimisation decision and does not require any assumptions on demand and how firms compete. Therefore,

$$\mu_{it} = \frac{\theta_i^v}{s_{it}^v} \tag{3-9}$$

Where, θ_i^v is the output elasticity with respect to variable input v_{it} (labour, intermediate inputs, and materials) and s_{it}^v is the share of variable inputs in the firm's revenue. A crucial component to measure mark-up is θ_i^v which is not observable and must be estimated from firm-level data. We consider an industry-specific Cobb-Douglas production function, with variables input (v_{it}) and capital (k_{it}) as inputs.

$$y_{it} = \alpha_j + \theta_j^l v_{it} + \theta_j^k k_{it} + \omega_{it} + \epsilon_{it} \quad \text{i belongs to industry j} \tag{3-10}$$

Following De Loecker et al. (2020), y_{it} is revenue, v_{it} is measured by the cost of goods sold (*COGS*), which includes all expenses directly attributable to the production of goods sold by the firm and includes material, intermediate inputs, labour cost, and energy and so on,[1] and capital is measured by gross capital stock, in log form. ω_{it} is productivity shock, and ϵ_{it} captures measurement error in output. Following a similar approach for the estimation of *TFP*, we estimate θ_i^v using three methods – *OLS*, *OP* and Wooldridge, – and mark-up is calculated by substituting θ_i^v and s_{it}^v in Eq. 3-9.

III. Labour market concentration:

We define the labour market as employees who work in the same industries. This means that firms within a labour market (same industry) compete for labour. With a definition of the labour market, labour market concentration can be calculated as the industry's Herfindahl-Hirschman index based on the number of employees (*HHIEmp*). *HHIEmp* is the sum of the squared shares of the labour market each firm hires. Therefore, for a market with N firms:

$$HHI = \sum \left(\frac{l_{i,j}}{L_j}\right)^2 \tag{3-11}$$

where $l_{i,j}$ is the number of employees at firm i in industry j, and L_j is total employment in industry j.

[1] The sample does not directly report a breakdown of the expenditure on variable inputs, such as labour, intermediate inputs, electricity, and others, and therefore we prefer to rely on the reported total variable cost of production.

Appendix 3.2 Definition of variables

Table A.3.1 Definition of variables

Variables	**Definition**	**Source**
Income Distribution:		
LabourShare	"Staff expenses" divided by "earnings before interest, tax, depreciation, and amortisation (EBITDA) plus staff expenses (WL)"	Author's calculation
PayInequality	The natural logarithm of (CEO Compensation / average employee compensation) in which CEO and employee compensation include short-term pay (e.g. salary and fees, accrued bonus), post-employment benefits (e.g., superannuation) and share-based payment rights. Average employee compensation is calculated as Employee benefits minus CEO compensation divided by the number of employees minus one.	Author's calculation
Main Variables:		
LnCapital/VA	The natural logarithm of gross property, plant and equipment / Value-added	Author's calculation
TFPOLS	The residual of production function based on OLS	Author's calculation
TFPOP	$\ln \Omega_{it}$ productivity shocks based on Olly and Pakes (1996)	Author's calculation
TFPWRDG	$\ln \Omega_{it}$ productivity shocks based on Woordrige (2009)	Author's calculation
MarkupOLS	The output elasticity with respect to variables inputs (cost of goods sold) divided by "the share of variable inputs (cost of goods sold) in the firm's revenue". The production function is estimated using OLS for each industry	Author's calculation
MarkupOP	The output elasticity with respect to variables inputs (cost of goods sold) divided by "the share of variable inputs (cost of goods sold) in the firm's revenue". The production function is estimated using the Olly and Pakes (1996) method for each industry	Author's calculation
MarkupWRDG	The output elasticity with respect to variables inputs (cost of goods sold) divided by "the share of variable inputs (cost of goods sold) in the firm's revenue". The production function is estimated using the Wooldridge method for each industry	Author's calculation
IndHHIEmp	The industry's Herfindahl-Hirschman index based on the number of employees	Author's calculation
LnEmployeenum	The natural logarithm of the number of employees	Datastream
Control Variables:		
LnRevenue	The natural log of total sales in millions of dollars,	Datastream
BTM	Book value of equity /(share price * total shares outstanding)	Datastream
LnAge	Natural log of (current fiscal date – listing date) per year	Author's calculation
Ret	Log (return during the fiscal year)	Datastream
ROA	(Net Income + (Interest Expense on Debt-Interest Capitalized) * (1-Tax Rate)) / Average of Last Year's and Current Year's Total Assets * 100	Datastream
STDRet	Rolling 60-month standard deviation of returns	Author's calculation
Leverage	Total debt scaled by the total assets	Datastream
IsCEOChair	An indicator equal to 1 if the CEO is the chairman of the board and 0 otherwise	Datastream
BoardTenure	The average number of years that each board member has been on the board.	Datastream
IndCommittee	Percentage of independent board members on the compensation committee as stipulated by the company	Datastream
RDIntensity	Research and development expenses scaled by total asset, assumed equal to zero when R&D is missing in Datastream.	Datastream
PPTIntensity	Net property, plant, and equipment per employee in millions of dollars.	Datastream
Education	The percentage of the population with at least a bachelor's degree in each region in each year.	ASB
IndConcentration	The sales-based Herfindahl index is calculated based on all DataStream firms in the same industry. Revenue is trimmed at the 5^{th} and 95^{th} percentiles.	Author's calculation

Union	The percentage of employees who are members of trade unions in each region in each year.	ASB
UnemploymentRate	The percentage of those looking for a job in the labour force in each region in each year.	ASB
VacantJob	The ratio of vacant jobs to total jobs in each industry in each year.	ASB

Appendix 3.3 Industry map to join GICS to ANZSIC

Table A.3.2. Industry map to join GICS to ANZSIC

GICS Industry Group (two-digit)	ANZSIC code
Materials	Mining (B)
Energy	Oil & gas extraction (07)
Real Estate	Property operators & real estate services (67)
Software & Services	Computer system design & related services (70)
Capital Goods	Construction (E)
Diversified Financials	Finance (62)
Retailing	Retail trade (G)
Consumer Services	Accommodation and food services (H)
Commercial & Professional Services	Professional, scientific & technical services (except computer design) (69)
Health Care Equipment & Services	Health care and social assistance (Q)
Food, Beverage & Tobacco	Food product manufacturing (11)
Media & Entertainment	Information media and telecommunications (J)
Pharmaceuticals, Biotechnology & Life Sciences	Basic chemical & chemical product manufacturing (18)
Utilities	Electricity, gas, water, and waste services (D)
Transportation	Transport, postal and warehousing (I)
Banks	Finance (62)
Insurance	Insurance & superannuation funds (63)
Telecommunication Services	Telecommunications services (58)
Food & Staples Retailing	Food retailing (41)
Household & Personal Products	Other services (S)
Technology Hardware & Equipment	Information media and telecommunications (J)
Consumer Durables & Apparel	Textile, leather, clothing & footwear manufacturing (13)
Semiconductors & Semiconductor Equipment	Other services (S)
Automobiles & Components	Other services (S)

[1] The high CEO compensation relative to average employee at the firm level can eventually lead to higher income inequality at macro level. For example, (Bakija et al., 2012), using information reported on U.S. individual income tax returns, find that executives, managers, supervisors, and financial professionals account for about 60 percent of the top 0.1 percent of income earners in recent years, and can account for 70 percent of the increase in the share of national income going to the top 0.1 percent of the income distribution between 1979 and 2005.

[2] The effects of TFP and k on LS should have the same sign. If TFP shifts the Labour share-LnCapital/VA curve but violates that condition, it is neither labour- nor capital-augmenting (Bentolila and Saint-Paul (2003)).

[3] To our knowledge, TRD is the only data source that provides financial data for Australian firms which has been widely used in the literature on compensation, pay inequality, and labour share (e.g., Guschanski and Onaran 2018)

[4] CEO compensation, reported in TRD, is based on the US dollar. Therefore, we collect the USD/AUD currency rate from TRD and we calculate CEO compensation in AUD by multiplying CEO compensation in USD by the currency rate in the fiscal date of each firm-year

[5] If the number of employees is missing, we use the employee numbers from the previous year.

[6] In all subsamples, the coefficients are estimated using the OLS method. The low number of observations in some subsamples and high numbers of instruments provided by SGMM restrict us to estimate coefficients using the two-step SGMM method. However, it appears that the OLS bias is limited since estimated coefficients using *OLS* and the SGMM method (Table 2) show a similar sign.

[7] Except the coefficient of the mark-up in Utilities, which is almost equal to zero.

[8] By following Abayadeera (2010), we consider health care, information technology and telecommunication services as sectors including most Australian high-tech firms.

Chapter 4

Does economic openness matter in the impact of financial development on income inequality?

Abstract: Despite increasing academic attention on the income distributional impact of financial development, the debate has remained controversial. Hence, this study argues that economic openness to international trade and capital flows may impact the nexus between financial development and income inequality. Using a panel of 71 developing and developed countries for 1994–2017, we first use split sampling and interaction analyses to examine the role of the country's level of openness on the relationship between financial development and income inequality. However, these two approaches do not provide specific information on the threshold value, if any, at which the effect changes. For this reason, we also employ the dynamic panel threshold method to investigate whether a financial or trade openness threshold exists beyond which financial development worsens income inequality. We find evidence that financial development generally fosters income inequality, but the level of financial and trade openness impacts the inequality effect of financial development. Our results assert that a higher level of financial and trade openness strengthens the pro-inequality impact of financial development.

Keywords: Financial Development, Income Inequality, Trade Openness, Financial Openness
JEL Classification: D31, D63, F02, O11

4.1 Introduction

Although the development of financial systems boosts economic growth over the long run (Levine, 1997, 2005), its impact on the allocation of generated wealth remains under question. The World Income Inequality Report, 2022, highlights that income inequality has increased across most countries since the 1980s (Chancel et al., 2022). Hence, financial development (FD) has been accompanied by the debate of whether it comes at the cost of income inequality. According to the World Inequality Database and the World Bank's (2020) report, there are striking cross-country differences in the distribution of income and the level of FD. Among financially developed countries, some face high-income inequality (e.g., Brazil, India, and Chile), while others are relatively more equal (e.g., Australia, New Zealand, and Sweden). The same is true among less financially developed countries, with some exhibiting extreme income inequality (e.g., Peru and Indonesia) and some facing moderate to relatively low levels (e.g., Belarus and Kazakhstan). This ambiguity calls for more empirical and theoretical research on the relationship between FD and income inequality.

There is an inclusive literature on the FD and income inequality linkage, which can be classified into four groups. First, it is argued and illustrated that the development of the financial sector benefits upper-income individuals more than lower-income ones and thus widens income inequality (Gimet & Lagoarde-Segot, 2011; Jauch & Watzka, 2016; Rajan & Zingales, 2003a). Second, several studies (Beck et al., 2007; Clarke et al., 2006; Galor & Zeira, 1993; Kim et al., 2021) state that broader FD can help low-income individuals get easier access to external finance and earn more by investing and therefore, mitigate income inequality. Third, the inverted U-shaped hypothesis (Greenwood & Jovanovic, 1990) combines the two preceding outcomes, suggesting that income inequality increases at the early stage of FD and then decreases after a certain level of financial sector development. Fourth, a U-shaped nexus is also found (Park & Shin, 2017; Tan & Law, 2012), which implies that financial deepening can reduce income inequality in the early stages of FD while it increases income inequality after reaching a higher level of FD. Thus, the existing literature has not reached any consensus on the income inequality impact of FD.

However, our study goes beyond the FD-income inequality relationship and argues that a country's openness to trade market and capital flow can impact the nexus between FD and income inequality. The literature has emphasized the role of trade and financial openness in promoting FD and determining income inequality. On the one hand, Rajan and Zingales

(2003b) argue that a country's openness can weaken the power of established incumbent industrial and financial interest groups who oppose FD and provide incentives for them to develop the financial market. On the other hand, it is argued that the country's openness is one of the determinants of income inequality (Heimberger, 2020; Mills, 2009). Thus, it may be that a certain level of openness must be attained in a country before FD impacts income inequality. There is little direct evidence to confirm that openness makes a difference in how FD affects income inequality. The most relevant paper is by Kunieda et al. (2014), which argues the importance of financial openness in the FD-income inequality relationship. They theoretically and empirically show that FD increases income inequality under higher financial openness but reduces income inequality under lower financial openness. Despite their theoretical and empirical work, the empirical evidence on the impact of openness on the inequality impact of FD remains thin. Therefore, if we assume that an open economy provides fertile ground for the pro-inequality effects of FD, and the impact of FD on income inequality takes effect only after openness exceeds a threshold level, two questions are raised: (i) Would the relationship between FD and income inequality be uniform with the level of openness, including trade openness and financial openness? and (ii) To what extent can FD contribute to the rise in income inequality? The primary objective of this study is to shed light on these questions. This paper represents a first step in providing such empirical evidence by analysing the impact of both trade and financial openness on the FD-income inequality relationship.

For this purpose, first, we split the sample into subgroups by the level of financial openness and trade openness to assess whether the inequality impact of FD varies in different subgroups. In further examination, in the full sample dataset, we interact FD with either financial openness or trade openness to examine whether the impact of FD on income inequality depends on the degree of openness. To capture the persistence of income inequality, we allow for the dynamic behaviour of income inequality, which is estimated by the two-step Generalised Method of Moments (GMM), developed by Arellano and Bond (1991). However, these two approaches do not give us specific information on the threshold value, if any, at which the effect becomes different. For this reason, we employ the dynamic panel threshold method of Kremer et al. (2013), which extends the models of Hansen (1999) and Caner and Hansen (2004) to allow for endogenous regressors in a panel setup. We use a dynamic panel threshold mode with a GMM estimator to investigate whether a financial or trade openness threshold exists beyond which FD worsens income inequality. We find evidence that FD generally fosters income inequality, but the level of financial openness and trade openness influences the inequality effect of FD. This evidence suggests that a higher level of financial openness and trade openness strengthens the pro-inequality impact of FD.

This study's contribution is threefold. First, we depart from previous studies by considering the level of the country's openness to both financial and trade markets in the income inequality impact of FD. As a result, this study adds more dimensions – trade openness and financial openness – to the current literature concerning non-linearity in the link between FD and income inequality. Second, while previous empirical study on the moderation impact of financial openness on the FD-income inequality nexus supports a positive monotonic relationship by increasing financial openness, we examine whether a nonlinear relationship exists with a potential threshold effect, using dynamic panel threshold regression. Third, our findings call attention to the need for policymakers to consider the level of a country's openness when exploring possible outcomes from FD and provide insights into how changes in openness will affect those outcomes.

The paper is organised as follows. Section 2 reviews the relevant literature on this topic. Section 3 describes the dataset and provides some preliminary insights about the income inequality effect of FD at different levels of openness. Our estimation methods, including dynamic panel GMM and dynamic panel threshold estimation, are discussed in section 4, followed by our empirical findings and discussion in section 5. Finally, Section 6 provides concluding remarks and policy implications.

4.2 Related literature review

Economic theories and empirical findings have remained inclusive about the impact of FD on income inequality, as pointed out by Demirgüç-Kunt and Levine (2009). One set of theoretical models predicts a positive linear relationship between FD and income inequality, the inequality-widening hypothesis. According to this view, proposed by Rajan and Zingales (2003a), FD mainly benefits upper-level income individuals who can offer collateral and repay their loans, and excludes low-income individuals with collateral constraints, even when financial markets are well-developed. Thus, improving FD proportionally benefits high-income individuals and widens income inequality. Various studies have provided empirical support for the inequality-widening hypothesis. For example, using country-level data, de Haan and Sturm (2017), Denk and Cournede (2015), Gimet and Lagoarde-Segot, (2011), Jauch and Watzka (2016), and Seven and Coskun (2016) show the positive linkage between FD, either banking development or financial market development, and income inequality. In addition, further empirical support is provided by studies using regional data. For instance, Rodríguez-Pose and Tselios (2009), using a sample of 102 European regions for 1995–2000, find a positive linkage between the per capita added value of the private financial sector and income inequality.

Another set of theoretical models suggests that development in financial markets can mitigate income inequality (Banerjee & Newman, 1993; Galor & Zeira, 1993), inequality-narrowing hypothesis. From this perspective, capital market imperfections (e.g., information and transaction costs) may be especially binding on low-income individuals who lack collateral and credit histories, and any improvement on the imperfection (e.g., abating credit constraints) disproportionally benefits them (Beck et al., 2007). Furthermore, the capital constraint reduces the efficiency of capital allocation and prevents the flow of capital to less privileged and low-income individuals, worsening income inequality (Philippe Aghion & Bolton, 1997; Galor & Moav, 2004; Galor & Zeira, 1993). Thus, FD can reduce income inequality by alleviating credit constraints and improving capital allocation efficiency. Various cross-country and country-level studies have uncovered evidence favouring the inequality-narrowing hypothesis. For instance, using cross-country data, Beck et al. (2007), Clarke et al. (2006), Hamori and Hashiguchi (2012), Li et al. (1998), Mookerjee and Kalipioni (2010), and Naceur and Zhang (2016) report that FD benefits the poor and reduces income inequality. In addition, some country-level studies have found that FD is negatively associated with income inequality in India (Ang, 2010), Brazil (Meyer Bittencourt, 2006), China (Liang, 2006, 2008), Pakistan (Shahbaz & Islam, 2011), and Vietnam (Hoi & Hoi, 2012).

In addition to the linear relationship, recent theoretical and empirical studies reveal a nonlinear relationship between FD and income inequality, depending on the level of FD. According to this view, both the inequality-widening and inequality-narrowing hypotheses can be supported. This category can be classified into two distinct subcategories. First, an inverted U-shaped relationship between finance and inequality, developed by Greenwood and Jovanovic (1990), suggests that at the early stages of economic development, access to financial services is costly, and only high-income individuals can join financial intermediaries and profit from better financial markets. However, at a higher level of economic development and after a certain level of FD, a more significant proportion of society has access to financial services, which leads to a decrease in income inequality. By using a large sample of countries, some empirical studies (e.g., Kim and Lin, 2011; Nikoloski, 2013) have supported an inverted U-shape relationship hypothesis. Second, the U-shaped relationship between FD and income inequality has been reported in some research. For example, Tan and Law (2012) and Park and Shin (2017) show that FD reduces income inequality in the early stages of FD. However, if FD reaches a certain threshold, it will increase income inequality.

Some studies go a step further and argue that institutional quality is the main factor responsible for the nonlinear relationship. Rajan and Zingales (2003b) argue that de jure political representation is dominated by de facto political influence in the presence of weak institutional environments, which allows established interests (incumbent industrial and financial interest groups) to have privileged access to finance so that FD induced by captured direct controls is likely to hurt the poor. In contrast, in the presence of strong institutions, FD may reduce inequality, allowing the poor to invest in building their human and physical capitals (Law et al., 2014). Several studies have attempted to provide direct empirical evidence for the idea that the quality of institutions conditions the link between FD and inequality. Using the aggregate institutional quality measurement, Law et al. (2014) find that FD reduces income inequality only after achieving a certain threshold level of institutional quality. Until then, the effect of FD on income inequality is non-existent. By focusing on single components of governance indicators, some studies find that the positive link between FD and income inequality can be mitigated by low crisis frequency and good governance in the short run (W. Chen & Kinkyo, 2016), stricter control of corruption (Adams & Klobodu, 2016), and higher democratization (Kim et al., 2021).

In addition to institutional quality, the earlier studies provide a basis for the possible role of the country's openness to trade and financial market in capturing the nonlinear relationship between FD and income inequality. First, the literature has emphasized the role of trade and financial openness in promoting FD. The openness theory of FD, proposed by Rajan and Zingales (2003b), argues that the degree of openness to both international trade and financial flows can boost FD by reducing the power of interest groups and altering their hostile stance toward FD. To further explain this, Rajan and Zingales (2003b) argue that established incumbent industrial and financial interest groups oppose FD because it eases the entry of new firms into the market, increases competition and erodes the monopolistic rents of incumbent groups. However, trade and financial openness can weaken the incumbents' opposition to FD and limit the power of incumbents who oppose FD by introducing foreign competition outside the incumbents' control. It can also create incentives for them to promote FD, which will help them to face competition by providing sufficient finance. A handful of studies have empirically examined the arguments of openness theory (Baltagi et al., 2009; Law, 2009). For example, Baltagi et al. (2009) find that trade and financial openness individually have a significant impact on banking sector development.

Second, many scholars have reached a consensus that there is a relationship between a country's openness and income inequality (Heimberger (2020), and references cited therein). However, despite a wave of research, the sign of the relationship remains ambiguous. Regarding trade openness, the well-known Stolper–Samuelson theorem predicts that the inequality effect of trade openness varies depending on the relative factor abundance. This means that in advanced industrial countries, with an abundance of skilled labour, trade openness increases income inequality by raising the real return to abundant skilled labour and lowering the real rate of return to relatively scarce unskilled labour. The opposite is expected to happen in developing countries, with abundant unskilled labour. International trade will increase demand for unskilled workers, which will push up their real wages and lead to a decrease in income inequality. On an empirical level, the literature has not provided a general conclusion regarding the effect of trade globalisation: while several papers (Goldberg & Pavcnik, 2007; Meschi & Vivarelli, 2009) find a positive impact on income inequality, others (Asteriou et al., 2014; Furceri & Ostry, 2019; Gimet & Lagoarde-Segot, 2011; Jaumotte et al., 2013; Kim et al., 2021) conclude a negative relationship. Regarding financial openness, capital account openness may positively or negatively affect income inequality by fostering international risk-sharing and domestic-consumption smoothing (Kose et al., 2009), increasing the likelihood of financial crises (Furceri & Loungani, 2018; Ghosh et al., 2016) and affecting the bargaining power of labour (Harrison, 2002).[1] A robust positive link between financial openness and income inequality can be found (Asteriou et al., 2014; de Haan and Sturm, 2017; Furceri and Loungani, 2018; Furceri and Ostry, 2019; Jaumotte et al, 2013). In contrast, Kim et al. (2021) and Kunieda et al. (2014) show that financial openness is associated with a reduction in income inequality. All these imply that openness may matter for the nexus between FD and income inequality.

Existing research offers little clear guidance about the role of openness in FD-income inequality. There are two relevant studies in this area of research. Focusing on financial openness, Kunieda et al. (2014) investigate whether financial openness changes the income inequality effect of FD within an economy. Their theoretical model shows that in a financially closed economy, talented agents can borrow financial capital from less talented agents so that less talented agents can utilise the abilities of the talented agents and receive a higher interest rate as credit constraints relax. As a result, FD can narrow income inequality. In contrast, in a financially open economy, talented agents can borrow financial capital in the world market at a low-interest rate relative to their abilities. Therefore, the less talented agents cannot utilise the abilities of the talented agents even though credit constraints relax. Thus, inequality increases as the financial market matures. Their empirical results show that financial development increases income inequality under higher financial openness, whereas it reduces income inequality under lower financial openness. Focusing on trade openness, Ehrlich and Seidel (2019) theoretically show that the impact of FD on income inequality depends on the size distribution of firms by building a heterogeneous firms model. They argue that FD reduces wage inequality when there are many non-exporting firms and increases wage inequality when there are many large exporting firms. However, their study does not include any empirical investigation. The result of these two studies emphasises the importance of openness in the income inequality impact of FD.

This paper extends the limited literature on FD, openness, and income inequality in three ways. First, this study extends Kunieda et al.'s (2014) work by focusing on the moderation impact of both dimensions of openness, trade integration and financial integration, in the FD-income inequality relationship using a large country-level dataset. Second, this study broadly examines theoretical models developed by Ehrlich and Seidel (2019) at the macro level by considering trade openness. Third, this study for the first time investigates the threshold effect of openness at which the relationship between FD and income inequality changes.

4.3 Data and preliminary analysis

The dataset consists of a balanced panel of 71 countries (49 high and upper-middle-income and 22 low and lower-middle-income countries)[2] for which data is available from 1994 to 2017. Our primary dependent variable is income inequality measured using the Gini coefficient from Solt's (2020) Standardized World Income Inequality Database (SWIID). The Gini index is derived from the Lorenz curve and ranges between zero (perfect equality) and 100 (perfect inequality). This index is the most widely used measure of inequality in the literature (Delis et al., 2014; Hasan et al., 2021; Kim et al., 2021). Our preferred income inequality measure is the natural logarithm of the Gross Gini index (*LnGrossGini*), which represents household income before taxes since it shows inequality exclusive of the impact of redistribution via taxes and transfers (de Haan & Sturm, 2017; Hasan et al., 2021).

Regarding FD, our main focus is on banking development due to three main reasons explained by Law et al. (2014). First, bank credits are the only possible financing source for most developing countries in our sample. Second, the number of available observations for stock market indicators is insufficient to conduct sample-splitting regression. Third, some empirical studies (e.g., Gimet and Lagoarde-Segot, 2011; Naceur and Zhang, 2016) show that the banking sector exerts a more substantial influence on income inequality than the stock market. This may be because the poor have easier access to financial intermediaries (such as banks) than to stock markets, which mostly have stringent participation requirements (Isah, 2016). Following common practice, we used two proxies to measure banking development. Our first and preferred set is the natural logarithm of private credit by deposit money banks and other financial institutions as a share of GDP (*LnPrivateCredit*). As robustness checks, we also use the natural logarithm of liquid liabilities, also known as broad money, over GDP (*LnLiquidLiabilities*) to measure the respective size of the banking sector. All these data are sourced from the World Bank's Global Financial Development Database (*GFDD*).

Two main variables to measure economic openness (*Openness*) are trade openness and financial openness. Trade openness is measured as the natural logarithm of the total volume of imports and exports over the annual GDP of a country (*LnTO*) from the World Bank's World Development Indicators (WDI) database. Financial openness is measured based on a de facto index developed by Lane and Milesi-Ferretti (2007). This variable is defined as the natural logarithm of the volume of a country's foreign assets and liabilities as a percentage of GDP (*LnFO*). These foreign assets and liabilities include portfolio debt, foreign direct investment, and foreign indirect investment (portfolio investment). There are also other measurements of financial openness, such as the "de jure" index of Chinn and Ito (2006). However, they are not used in this study because they are noisy indicators of capital account openness (Bui & Bui, 2020).

Finally, we consider the various control variables used to explain income inequality by following the extensive literature on the determinants of income inequality (Beck et al., 2007; Delis et al., 2014). We use the natural logarithm of the changes in the log of GDP per capita (*LnGrowth*) to account for the impact of economic growth on income distribution, the CPI-based inflation rate (*Inf*) to control for monetary condition, and the natural logarithm of the population size (*LnPop*) to control for the demographics in each country. To account for the activity and growth of government over the sample period, we include the natural logarithm of the ratio of central government expenditures as a share of GDP (*LnGovExp*). Higher government spending may disproportionately help the poor if used efficiently, but it may be wasteful when institutions are weak (Delis et al., 2014). In addition, some measure of human capital is also included as a control variable in most inequality equations. Typically, education is a proxy for human capital. However, because there is an ongoing debate on quantity vs quality in education, the standard education data available via Barro and Lee (2001) may not be a good control (Hasan et al., 2021). Since Castelló-Climent and Doménech (2008) document that life expectancy is strongly linked to human capital accumulation, we use the natural logarithm of life expectancy (*LnLifExp*) as a proxy for human capital in our estimations. Because we use estimators based on fixed effects, we do not control for time-invariant variables. All control variables are obtained from the *WDI* database. Detailed variable descriptions are provided in Appendix 4.1.

We use data from 1994 to 2017 for 71 countries because of data availability for important variables such as FD and economic openness. Then, as is standard in the literature (de Haan & Sturm, 2017; Delis et al., 2014; Kim et al., 2021), we create 3-year averaged data for eight non-overlapping periods: 1994–1996, 1997–1999, 2000–2002, 2003–2005, 2006-2008, 2009-2011, 2012-2014, and 2015-2017, to mitigate any noise associated with short-run economic fluctuations. To maintain a balanced dataset, variables with missing values are imputed. Table 4.1 provides descriptive statistics for all variables in the sample of 568 observations. Our dependent variable is the *GrossGini* which has an average of 46.68 and ranges from a minimum of 24.23 (Ukraine for the period of 2000-2002) to 69.03 (South Africa for the period of 2000-2002). Turning to our main independent variable, private credit by deposit money banks and other financial institutions (*LnPrivateCredit*) and broad money (*LnLiquidLiabilities*) are, on average, 41.26 (3.7201) and 50.51 (3.9222) per cent of GDP, respectively. In addition, Table 4.2 reports the correlation coefficients among all dependent, independent, and control variables. Table 4.2 shows that none of the variables are highly correlated, with the largest correlation coefficient being 0.7065 between *LnLifeExp* and *LnPrivateCredit*.

Table 4.1. Descriptive statistics of the sample

Variable	N	mean	S.D.	min	p25	p50	p75	max
LnGrossGini	568	3.8434	0.1451	3.1877	3.7861	3.8498	3.9170	4.2346
LnPrivateCredit	568	3.7201	0.8745	1.3424	3.1444	3.8384	4.4302	5.1476
LnLiquidLiabilities	568	3.9222	0.6637	2.2696	3.5047	3.9207	4.3786	5.4277
LnFO	568	0.5057	0.8871	-0.9075	-0.1092	0.3260	0.9355	3.2035
LnTO	568	4.2374	0.5445	3.0739	3.8958	4.2018	4.5365	5.9108
LnGrowth	568	0.0726	0.0708	-0.1121	0.0315	0.0692	0.1098	0.2985
Inf	568	7.6298	12.9632	-0.4801	2.0283	4.1115	8.2910	93.2399
LnGovExp	568	2.6595	0.3544	1.5988	2.4222	2.6805	2.9355	3.5168
LnPop	568	16.7423	1.5819	12.5499	15.5669	16.6232	17.8993	20.9826
LnLifeExp	568	71.9344	8.9222	44.7493	69.0885	74.1557	78.2787	83.1480

Notes: Table 4.1 presents summary statistics for the main variables in our samples. All variables are winsorised at 1% and 99%.
All variables are defined in Appendix 4.1.

Table 4.2. Correlation matrix

	1	2	3	4	5	6	7	8	9
1-LnGrossGini	1								
2-LnPrivateCredit	0.0640	1							
3-LnLiquidLiabilities	-0.0097	0.8622*	1						
4-LnFO	0.1660*	0.6174*	0.5855*	1					
5-LnTO	-0.0133	0.2318*	0.2449*	0.5987*	1				
6-LnGrowth	-0.0898*	-0.0890*	-0.0509	-0.2016*	0.0464	1			
7-Inf	-0.1454*	-0.4223	-0.3666*	-0.2928*	-0.1073*	-0.1710*	1		
8-LnGovExp	0.2505*	0.3472*	0.2948*	0.3782*	0.1681*	-0.2185*	-0.1548*	1	
9-LnPop	-0.1765*	0.0600	0.1104*	-0.3142*	-0.5784	0.0706	0.02910	-0.2216*	1
10-LnLifeExp	-0.0730	0.7065*	0.6437*	0.5167*	0.1567*	-0.0491	-0.2388*	0.2345*	-0.0400

Notes: Table 4.2 presents Pearson correlations for the main variables in our samples. All variables are winsorised at 1% and 99%.
* Indicates significance at 5%.
All variables are defined in Appendix 4.1.

To provide further insight for our analysis, Fig. 4.1 shows the relationship between income inequality and FD controlling for country and year fixed effect. This figure suggests that more FD, measured by *LnPrivateCredit* or *LnLiquidLiabilities*, slightly increases income inequality, measured by *LnGiniGross*. To explore whether the impact of FD on income inequality changes by economic openness, which includes both financial and trade openness, we divide countries into four groups. The first two groups are countries whose average level of financial openness over the sample period is less (more) than the first quantile (equal to 0.97), denoted by LFO (HFO). Fig. 4.2 implies that the relationship between FD and income inequality varies according to the level of financial openness. There is a positive relationship between FD and income inequality among HFO countries (e.g., Netherlands, France, United Kingdom, etc.), while no relationship is observed among LFO countries (e.g., Brazil, Colombia, Bangladesh, etc.). The second two groups are countries whose average level of trade openness over the sample period is less (more) than the first quantile (equal to 50.25), denoted by LTO (HTO). Fig. 4.3 implies that the relationship between FD and income inequality varies according to the level of trade openness. There is a positive relationship between FD and income inequality among HTO countries (e.g., Thailand, Malaysia, Singapore, etc.), while this positive relationship is not observed among LTO countries (e.g., Japan, United States, Australia, etc.). This suggests that openness strengthens the pro-inequality impact of FD. Appendix 4.2 provides a list of LFO, HFO, LTO and HTO countries in our sample.

Figure 4.1. Relationship between FD and income inequality

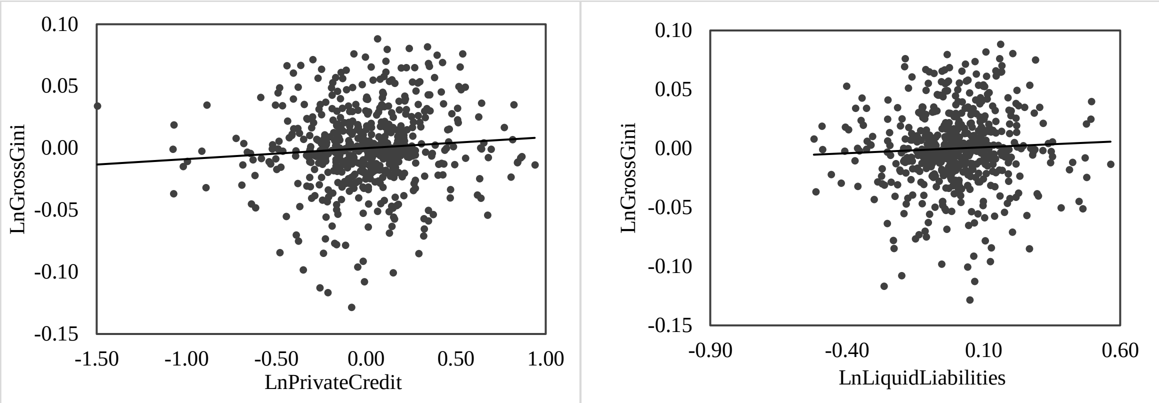


Figure 4.2. Relationship between FD and income inequality for LFO and HFO countries

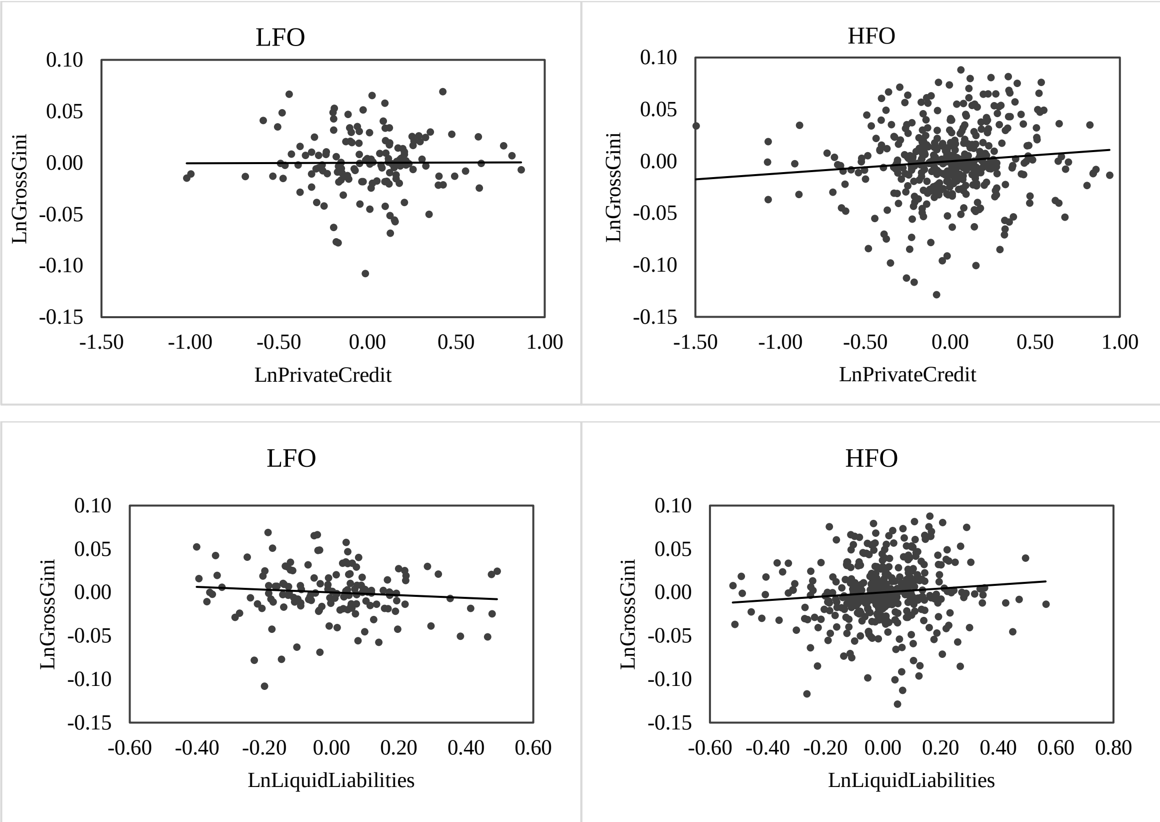
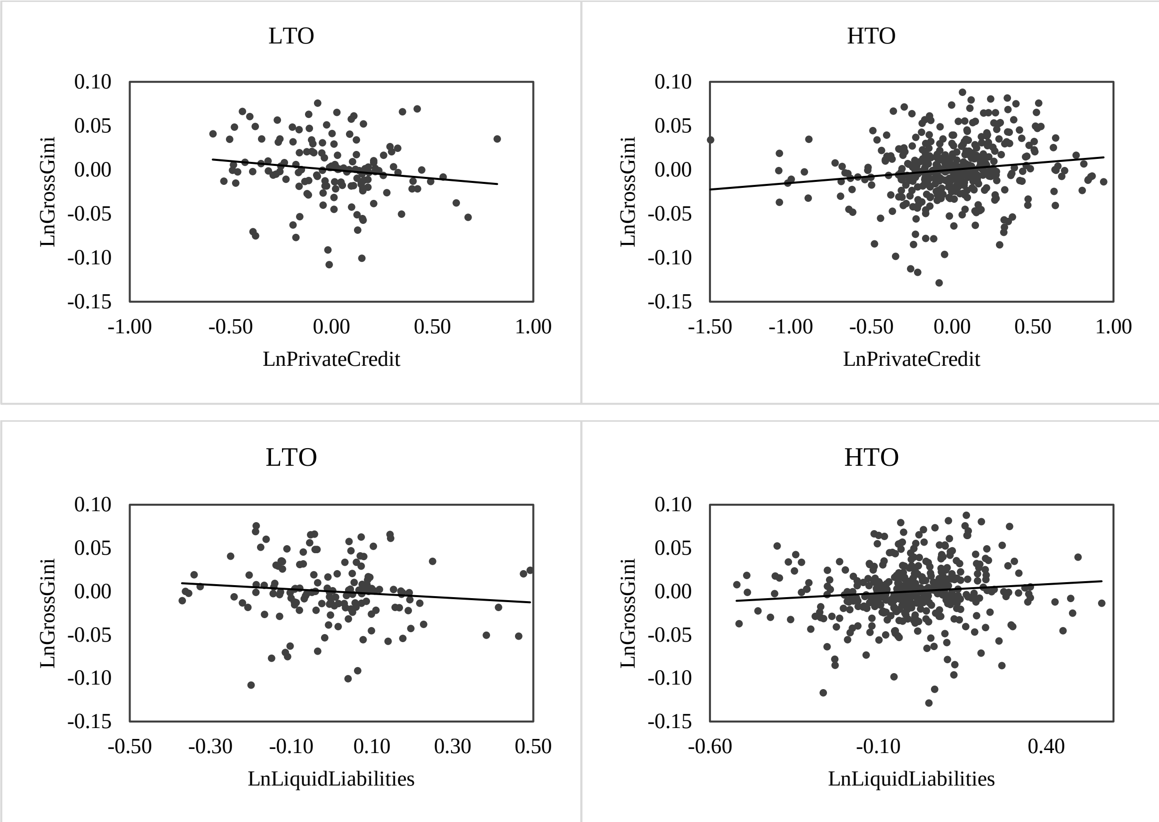


Figure 4.3. Relationship between FD and income inequality for LTO and HTO countries



4.4 Methodology

4.4.1 Dynamic panel GMM estimation

Our empirical analysis of the FD-income inequality nexus begins by using split sampling and interaction analyses to examine the extent to which income inequality and financial development relationship depends on the country's openness level. For split sampling analysis, we estimate the following dynamic equation for HTO, LTO, HFO and LFO subsamples:

$$\mathrm{LnGrossGini}_{i,t} = \beta_1 \mathrm{LnGrossGini}_{i,t-1} + \beta_2 \mathrm{FD}_{i,t} + \beta_3 \mathrm{LnFO}_{i,t} + \beta_4 \mathrm{LnTO}_{i,t} + \beta_5 \mathrm{LnGrowth}_{i,t} + \beta_6 \mathrm{Inf}_{i,t} + \beta_7 \mathrm{LnGovExp}_{i,t} + \beta_8 \mathrm{LnPop}_{i,t} + \beta_9 \mathrm{LnLifeExp}_{i,t} + \tau_t + \mu_i + \varepsilon_{i,t} \quad (4\text{-}1)$$

The subscript *i* is the country indicator, and *t* is the period index. τ indicates time-fixed effects, μ represents the time-invariant country-fixed effect, and ε is an error term assumed to be independent and identically distributed with mean zero and constant variance. *LnGrossGini* is the dependent variable, which is the indicator of income inequality. The model includes a lagged dependent variable to reflect the persistence of income inequality over time (Delis et al., 2014; Jauch & Watzka, 2016; Kim et al., 2021). FD, FO and TO are financial development, financial openness and trade openness, respectively. To strengthen our empirical results, we also include some other variables, such as the log of GDP per capita growth (*LnGrowth*), inflation rate (*Inf*), the log of government expenditures over GDP (*LnGovExp*), the log of the population (*LnPop*), and the log of life expectancy (*LnLifeExp*).

To address whether the effect of FD on income inequality differs along with the extent of financial and trade openness, the interaction terms between FD and FO and between FD and TO are included in Eq. 4-2 and 4-3, respectively.

$$\mathrm{LnGrossGini}_{i,t} = \beta_1 \mathrm{LnGrossGini}_{i,t-1} + \beta_2 \mathrm{FD}_{i,t} + \alpha_1 \mathrm{FD}_{i,t} \times \mathrm{LnFO}_{i,t} + \beta_3 \mathrm{LnFO}_{i,t} + \beta_4 \mathrm{LnTO}_{i,t} + \beta_5 \mathrm{LnGrowth}_{i,t} + \beta_6 \mathrm{Inf}_{i,t} + \beta_7 \mathrm{LnGovExp}_{i,t} + \beta_8 \mathrm{LnPop}_{i,t} + \beta_9 \mathrm{LnLifeExp}_{i,t} + \tau_t + \mu_i + \varepsilon_{i,t} \quad (4\text{-}2)$$

$$\mathrm{LnGrossGini}_{i,t} = \beta_1 \mathrm{LnGrossGini}_{i,t-1} + \beta_2 \mathrm{FD}_{i,t} + \alpha_2 \mathrm{FD}_{i,t} \times \mathrm{LnTO}_{i,t} + \beta_3 \mathrm{LnFO}_{i,t} + \beta_4 \mathrm{LnTO}_{i,t} + \beta_5 \mathrm{LnGrowth}_{i,t} + \beta_6 \mathrm{Inf}_{i,t} + \beta_7 \mathrm{LnGovExp}_{i,t} + \beta_8 \mathrm{LnPop}_{i,t} + \beta_9 \mathrm{LnLifeExp}_{i,t} + \tau_t + \mu_i + \varepsilon_{i,t} \quad (4\text{-}3)$$

At the margin, the total effect of increasing FD can be calculated by examining the partial derivatives of income inequality with respect to FD. We expect negative β_2 and positive α_1 and α_2, which implies that FD increases (decreases) inequality in an open (closed) economy to the world financial or trade market.

Some potential problems arise when estimating the above equations. The primary identification issue is the potential endogeneity of FD. As discussed in the literature (Beck et al., 2007; Jauch & Watzka, 2016; Law et al., 2014), FD is highly likely to be endogenous, possibly due to feedback from income inequality to FD (reverse causality). For example, reductions in income inequality may stimulate demand for financial services (Beck et al., 2007). Previous research used instruments for financial development. These instruments were similar to those in the literature on the FD–growth nexus, usually the origin of a country's legal system, which may not be good instruments for FD when investigating the inequality nexus (Jauch & Watzka, 2016). In addition, the inclusion of the lagged dependent variable in the empirical model implies a correlation between the regressors and the error term, which could bias the coefficient estimates (Baltagi et al., 2009). Besides these endogeneity considerations, even when using standard two-stage least squares regressions and instruments for financial development, this does not control for the endogeneity of other explanatory variables, which may bias the coefficient estimates on financial development (Beck et al., 2007).

Thus, the preferred estimator, in this case, is the two-step Generalised Method of Moments (GMM) suggested by Arellano and Bond (1991) with robust standard errors, which eliminates any endogeneity that may be due to the correlation of country-specific, time-invariant factors and right-hand side regressors (more details in Baltagi et al., 2009; Jauch and Watzka, 2016).[3] There is convincing evidence that too many moment conditions introduce bias while increasing efficiency. It is, therefore, suggested that a subset of these moment conditions be used to take advantage of the trade-off between the reduction in bias and the loss in efficiency.[4] We treat *GrossGini* and all right-hand side variables, except *Inf, GovExp, Pop and LifeExp,* as potentially endogenous variables, and we use their lagged values as instruments.[5] The specification is checked using the Hansen statistic, a test of overidentifying restrictions for the validity of the instrument set. In addition, two diagnostics are computed using the Arellano and Bond GMM procedure to test for first-order and second-order serial correlation in the disturbances. One should reject the null of the absence of first-order serial correlation and not reject the absence of second-order serial correlation.

4.4.2 Dynamic panel threshold estimation

We continue our empirical analysis by testing the existence of a threshold level of economic openness (*Openness*), either FO or TO, in the relationship between income inequality and FD. Thus, the dynamic panel threshold model of economic openness takes the following form:

$$\mathrm{LnGrossGini}_{i,t} = \beta_1 \mathrm{LnGrossGini}_{i,t-1} + \theta_1 \mathrm{FD}_{i,t}\ I(\mathrm{Openness}_{i,t} \leq \gamma) + \theta_2 \mathrm{FD}_{i,t}\ I(\mathrm{Openness}_{i,t} > \gamma) + \beta_3 \mathrm{LnFO}_{i,t} + \beta_4 \mathrm{LnTO}_{i,t} + \beta_5 \mathrm{LnGrowth}_{i,t} + \beta_6 \mathrm{Inf}_{i,t} + \beta_7 \mathrm{LnGovExp}_{i,t} + \beta_8 \mathrm{LnPop}_{i,t} + \beta_9\ \mathrm{LnLifeExp}_{i,t} + \tau_t + \mu_i + \varepsilon_{i,t} \quad (4\text{-}4)$$

where subscript *i* represents the country and *t* indicates the period. μ and τ are the time-fixed effect and country-fixed effect respectively, and the error term $\varepsilon_{i,t} \overset{iid}{\sim} (0, \sigma^2)$. γ is the threshold level, and *I*(·) is an indicator function taking a value of 1 if the argument in the indicator function holds and 0 otherwise. *Openness* is the threshold variable, which is measured by either *FO* or *TO*. FD is a regime-dependent variable, measured by *LnPrivateCredit* or *LnLiquidLiabilities*, with the slope parameter θ_1 if Openness is less than or equal to γ and θ_2 otherwise. In this model, the explanatory variables are partitioned into a subset of exogenous variables (*LnTO*, *LnFO*, *Inf*, *LnGovExp*, *LnPop*, and *LnLifeExp*) uncorrelated with $\varepsilon_{i,t}$, and a subset of endogenous variables ($LnGrossGini_{i,t-1}$, *FD* and *LnGrowth*) correlated with $\varepsilon_{i,t}$.

To estimate Eq. 4-4, we employ Kremer et al.'s (2013) estimation method, which allows estimating threshold effects with panel data in the case of endogenous regressors by extending Hansen's (1999) and Caner and Hansen's (2004) model. Following their method, we consider the forward orthogonal deviation transformation suggested by Arellano and Bover (1995) to eliminate the country-specific fixed effects and avoid the serial correlation of the transformed error terms. According to Kremer et al. (2013), first, we estimate a reduced-form regression of the endogenous variables on their instruments and then replace the endogenous variables in the structural equation with the predicted values. Second, we estimate Eq. 4-4 using least squares for a fixed threshold γ where the endogenous variables are replaced by their predicted values and define $S(\gamma)$ as the sum of squared residuals. We repeat this step for a strict subset of the threshold variable *Openness*. Finally, the estimator of the threshold value γ is selected as the one associated with the smallest sum of squared residuals, i.e., $\hat{\gamma} = \underset{\gamma}{\arg\min} S_n(\gamma)$. In addition, the 95% confidence interval of the threshold value is calculated by $\Gamma = \{\gamma: LR(\gamma) \leq C(\alpha)\}$, where $C(\alpha)$ is the 95th percentile of the asymptotic distribution of the likelihood ratio statistic $LR(\gamma)$ (Caner & Hansen, 2004; Hansen, 1999). Once the threshold value (γ) is obtained, the slope coefficients are estimated by the GMM for the previously used instruments and estimated threshold. Following Arellano and Bover (1995), we use lags of endogenous variables as instruments.

4.5 Empirical Results

This section starts by reporting the results of estimating the discussed equations on the dataset described before using dynamic GMM estimation and outlines their implications for the hypothesis of interest. It is followed by the results from the dynamic threshold regression estimation that test the existence of a threshold value of economic openness.

4.5.1 Dynamic panel GMM estimation results

Table 4.3 reports the result of estimating Eq. 4-1 for the entire sample of 71 countries using dynamic panel GMM as proposed by Arellano and Bond (1991), which presents the impact of FD, measured by either *LnPrivateCredit* or *LnLiquidLiabilities* on income inequality. All columns include country and time-fixed effects, and robust standard errors are reported in parentheses. In Columns 1 and 2, in which the primary determinants of income inequality are controlled, the estimated coefficient for both *LnPrivateCredit* and *LnLiquidLiabilities* is positive and statistically significant at 5%. The effect of banking development on inequality remains positively significant even if *LnPop* and *LnLifeExp* are controlled for in columns 3 and

4. Thus, the positive coefficient of banking development in all columns suggests that banking development will lead to an increase in income inequality. Economically this result is also significant. for example, according to the result in the first column, a 10% increase in *PrivateCredit* increases the *GrossGini* coefficient by 1.4% in the short run. This finding is in line with Gimet and Lagoarde-Segot (2011), Jauch and Watzka (2016), De Hann and Strum (2017), Blau (2018), Hsieh et al. (2019), and Kim et al. (2021). The identification tests show no overidentifying restrictions and no serial correlation between the instruments and the disturbance. A reason for this positive link between FD and income inequality might be, as argued by Rajan and Zingales (2003), that the rich can offer collateral and are more likely to repay their loans. The poor, who do not enjoy this benefit, might find it difficult to obtain loans even in a well-developed banking sector.

Table 4.3. The impact of financial development on income inequality

	LnGrossGini			
	(1)	(2)	(3)	(4)
Lag. LnGrossGini	0.6622***	0.6750***	0.6417***	0.6878***
	(0.1103)	(0.0976)	(0.1009)	(0.0703)
LnPrivateCredit	0.0149**		0.0095**	
	(0.0059)		(0.0043)	
LnLiquidLiabilities		0.0313**		0.0618***
		(0.0141)		(0.0230)
LnFO	0.0058	-0.0012	0.0111	-0.0444*
	(0.0161)	(0.0134)	(0.0196)	(0.0239)
LnTO	0.0192	0.0239	0.0302	0.0192
	(0.0259)	(0.0244)	(0.0270)	(0.0264)
LnGrowth	-0.0628	-0.0968	-0.0728	-0.1673**
	(0.0619)	(0.0620)	(0.0598)	(0.0667)
Inf	-0.0001	-0.0002	-0.0002	-0.0001
	(0.0002)	(0.0002)	(0.0003)	(0.0003)
LnGovExp	-0.005	-0.0135	-0.007	-0.0302**
	(0.0116)	(0.0111)	(0.0118)	(0.0141)
LnPop			0.0319	-0.0553
			(0.0597)	(0.0618)
LnLifeExp			-0.0000	-0.0010
			(0.0010)	(0.0012)
Country fixed effect	Yes	Yes	Yes	Yes
Time fixed effect	Yes	Yes	Yes	Yes
Robust Standard Errors	Yes	Yes	Yes	Yes
Observation	426	426	426	426
Instrument	35	35	33	32
Country	71	71	71	71
Hansen test of over-identification	0.1467	0.1622	0.1186	0.5457
AR(1)	0.5816	0.6883	0.6053	0.3453
AR(2)	0.1241	0.2375	0.1287	0.5201

Notes: Table 4.3 reports the impact of financial development on income inequality. Each regression includes country and time-fixed effects. Robust standard errors clustered at the country level are reported in parentheses.
*, **, *** indicate significance at the 10%, 5% and 1% levels, respectively.
All variables are defined in Appendix 4.1.

Financial Openness moderation effect:

In order to examine whether financial openness affects the relationship between financial development and income inequality, as suggested by Kunieda et al. (2014), Table 4.4 presents the result of split sampling and interaction analysis. First, we start with split sampling analysis, and we classify the sample into two groups: countries with strongly low levels of financial openness (FO < 1st Quantile) and Countries with high levels of financial openness (FO>1st Quantile). Then we estimate sub-sample regressions to compare the FD- income inequality relationship among LFO and HFO Countries. Columns 1 and 4 present the GMM estimation result for LFO countries. As shown, the coefficient of *LnPrivateCredit* and *LnLiqiuidLiablilities* is not statistically significant, suggesting that banking development has no statistically significant impact on income inequality in financially closed countries. Next, we examine the FD-income inequality relationship for financially open countries (HFO). As shown in columns 2 and 5 of Table 4.4, the GMM estimation results for these 53 open countries indicate that the coefficients of *LnPrivateCredit* and *LnLiqiuidLiablilities* are statistically significant and positive. This result suggests that a 10% increase in FD, measured by *LnPrivateCredit* and *LnLiqiuidLiablilities*, is associated with a 0.13% and 0.7% increase in Gross Gini in financially open countries, respectively.

As an alternative to split sampling, columns 3 and 6 report the estimation result of Eq. 4-2, in which the interaction of FD and financial openness is included. As shown in both columns, FD and its interaction with financial openness significantly and positively affect income inequality. This finding suggests that financial openness strengthens the positive association between banking development and income inequality. To better analyse the interaction result, Fig. 4.4 shows the marginal impact of FD on income inequality for different levels of financial openness, based on the estimates reported in columns 3 and 6. The whiskers in Fig. 4.4 show the 95% confidence band. Fig. 4.4 shows no significant relationship between FD and income inequality at the lower level of financial openness. However, by increasing financial openness, the impact of FD on the Gini coefficient is higher and more significant. This finding holds for both measures of FD. Considering *PrivateCredit* as a measure of FD, when financial openness increases from the lowest to the highest, FD's marginal impact on income inequality increases from -0.004 to 0.1156. To put these coefficient estimates into perspective, for each country, the average value of FO over 1994-2017 is calculated, and then the marginal impact of FD on income inequality for the top three financially open countries and the bottom three financially closed countries are measured. The result shows that in countries with the highest FO, including

Ireland, Hong Kong, and Singapore, 10% increases in *PrivateCredit* lead to 0.99%, 0.98% and 0.94% rises in income inequality, respectively. However, in countries with the lowest FO, such as Kenya, Iran, and Bangladesh, the FD-II relationship is statistically insignificant.

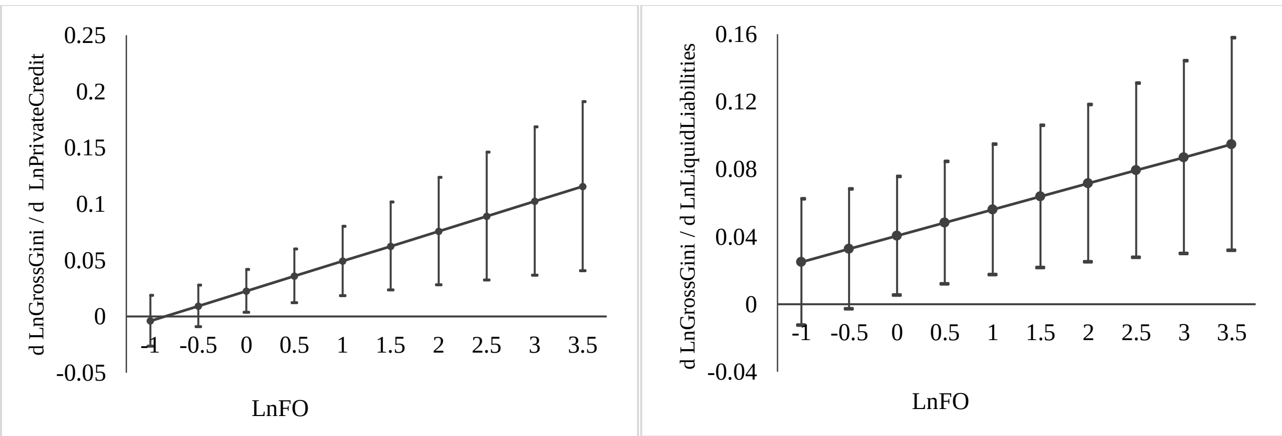
This finding is partially in line with Kunieda et al. (2014), who argue that financial openness changes the FD-income inequality relationship. In countries with higher financial openness, our result is consistent with their study asserting that the development of the financial system leads to a rise in income inequality in financially open countries. According to their theoretical model, when the domestic financial market develops and credit constraints relax in financially open countries, investors borrow financial capital in the world market with a constant interest rate that is low relative to their abilities. On the other hand, the lenders in the country do not benefit from the development of the domestic financial market since the interest rate does not increase. Therefore, inequality increases as the domestic financial market develops. In countries with lower financial openness, our results do not support their prediction asserting a negative relationship between income inequality and FD in financially closed countries. In fact, our findings show that there is no significant inequality impact of FD in countries with lower financial openness. Therefore, our results show that financial openness strengthens the pro-inequality impact of FD.

Table 4.4. Income inequality, FD and financial openness

	LnGrossGini					
	(1) FO<Q1	(2) FO>Q1	(3) Interaction	(4) FO<Q1	(5) FO>Q1	(6) Interaction
Lag.LnGrossGini	0.7720***	0.6422***	0.6642***	0.6985***	0.6492***	0.7040***
	(0.1018)	(0.0660)	(0.0614)	(0.0822)	(0.0638)	(0.0762)
LnPrivateCredit	0.066	0.0129**	0.0225**			
	(0.0439)	(0.0062)	(0.0097)			
LnPrivateCredit * LnFO			0.0266***			
			(0.0098)			
LnLiquidLiabilities				-0.0197	0.0699***	0.0405**
				(0.0529)	(0.0251)	(0.0179)
LnLiquidLiabilities *LnFO						0.0155**
						(0.0074)
LnFO	-0.0553	0.0196	-0.0613	-0.0468	-0.0546	-0.0678*
	(0.0357)	(0.0329)	(0.0436)	(0.0293)	(0.0459)	(0.0384)
LnTO	0.0198	0.0551*	0.0412	-0.0116	0.0113	0.0141
	(0.0491)	(0.0328)	(0.0281)	(0.0577)	(0.0246)	(0.0256)
LnGrowth	0.1028	-0.1287	0.0242	0.1013	-0.1700**	-0.1253**
	(0.2627)	(0.1043)	(0.0989)	(0.2283)	(0.0776)	(0.0490)
Inf	0.0005	-0.0005	-0.0002	0.0004	0.0002	-0.0003
	(0.0005)	(0.0005)	(0.0003)	(0.0005)	(0.0003)	(0.0003)
LnGovExp	-0.0111	-0.0298	-0.005	-0.0066	-0.0318**	-0.0279**
	(0.0256)	(0.0261)	(0.0169)	(0.0133)	(0.0154)	(0.0132)
LnPop	0.0811	0.1276	0.1296	-0.1063	-0.1005	0.0486
	(0.0850)	(0.1205)	(0.0872)	(0.1361)	(0.0746)	(0.0503)
LnLifeExp	-0.0063	-0.0005	-0.0016	0.0018	-0.0019	-0.0025
	(0.0052)	(0.0019)	(0.0013)	(0.0037)	(0.0020)	(0.0016)
Observation	108	318	426	108	318	426
Instrument	16	28	21	17	32	36
Country	18	53	71	18	53	71
Hansen test of over-identification	0.4774	0.4161	0.7003	0.1186	0.4342	0.1746
AR(1)	0.4595	0.9633	0.386	0.956	0.0643	0.9877
AR(2)	0.8228	0.0588	0.0715	0.2769	0.4476	0.0833

Notes: Table 4.4 reports the impact of financial openness on the FD and income inequality relationship. Each regression includes country and time-fixed effects. Robust standard errors clustered at the country level are reported in parentheses. *, **, *** indicate significance at the 10%, 5% and 1% levels, respectively.
All variables are defined in Appendix 4.1.

Figure 4.4. Marginal impact of FD on income inequality for different levels of FO



Trade Openness moderation effect:

This section reports how openness to the global trade market can change the relationship between FD and income inequality (Table 4.5). In the split sampling analysis, the sample is broken down into two groups: countries with strongly low-level trade openness (TO < 1st Quantile) and countries with high-level trade openness (TO>1st Quantile). Then Eq. 1 is estimated for each sub-sample to compare the FD–income inequality relationship in LTO and HTO Countries. For LTO countries, columns 1 and 4 of Table 4.5 show that banking development, measured by *LnPrivateCredit* or *LnLiquidLiabilities*, does not have a statistically significant impact on the Gini Coefficient. However, turning to HTO countries, columns 2 and 5 indicate that FD worsens income inequality in countries open to the trade market. This finding suggests that similar to financial openness, trade openness also strengthens the positive relationship between FD and income inequality.

With regard to the interaction analysis, we estimate Eq. 4-3 in which the interaction of FD and trade openness is included to examine whether trade openness influences the impact of FD on income inequality. Columns 3 and 6 show that the estimated coefficients of banking development and its interaction with trade openness are statistically significantly negative and positive, respectively. This means that banking development, measured by either *LnPrivateCredit* or *LnLiquidLiabilities*, tends to significantly increase income inequality in countries with higher trade openness. Corresponding to columns 3 and 6, Fig. 4.5 shows the marginal impact of FD on income inequality for different levels of financial openness with a 95% confidence band. Fig. 4.5 suggests that trade openness changes the relationship between FD and income inequality. In fact, the estimated marginal effect of FD on income inequality is statistically non-significantly negative but turns statistically significantly positive when trade openness is increasing. Considering *LnPrivateCredit* as a measure of FD, by increasing trade openness from the lowest to the highest level, FD's marginal impact on income inequality increases from -0.039 to 0.083%. Focusing on high trade openness countries, based on the average value of trade openness over 1994-2017, a 10% increase in *LnPrivateCredit* leads to a significant rise in the Gini index of 0.77% in Singapore, 0.74% in Hong Kong and 0.5% in Malaysia.

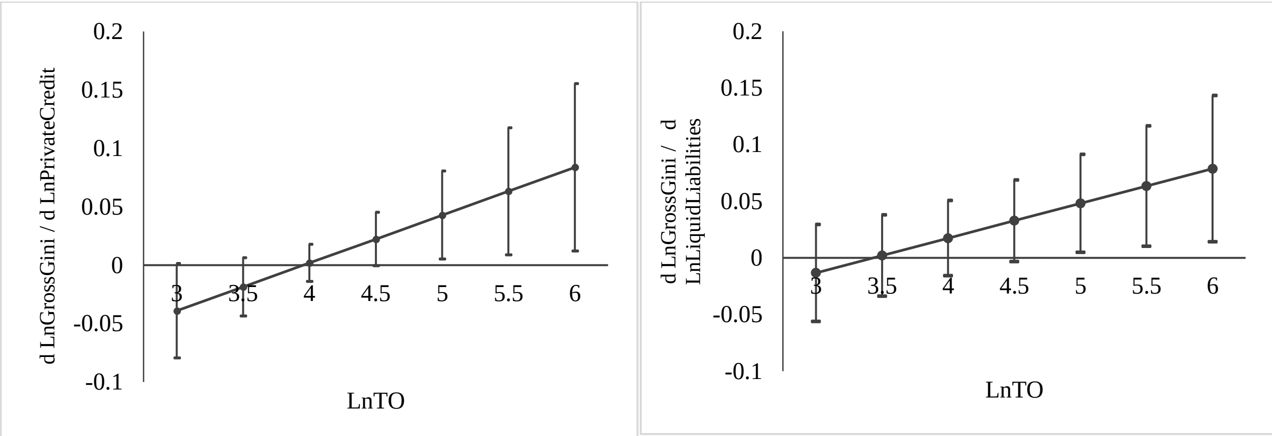
This result provides broad empirical support at the macro level for the prediction of Ehrlich and Seidel (2019), who argue that the FD–income inequality relationship depends on the number of exporting firms. In fact, they assert that FD increases income inequality in countries with a high percentage of exporting firms, while it decreases income inequality in countries with a high percentage of non-exporting firms. Consistent with their argument, at the macro level, our results show that the development of financial markets significantly increases income inequality in countries with higher trade openness. However, we do not find a negative relationship between FD and income inequality in countries with lower trade openness.

Table 4.5. Income inequality, FD, and trade openness

	LnGrossGini					
	(1)	(2)	(3)	(4)	(5)	(6)
	TO<Q1	TO>Q1	Interaction	TO<Q1	TO>Q1	Interaction
Lag.LnGrossGini	0.8980***	0.6320***	0.6527***	0.9784***	0.6480***	0.6456***
	(0.1235)	(0.0707)	(0.0670)	(0.2391)	(0.0679)	(0.0658)
LnPrivateCredit	0.0178	0.0166**	-0.1618**			
	(0.0159)	(0.0079)	(0.0740)			
LnPrivateCredit * LnTO			0.0409**			
			(0.0182)			
LnLiquidLiabilities				0.1031	0.0259**	-0.1053*
				(0.0988)	(0.0117)	(0.0584)
LnLiquidLiabilities *LnTO						0.0307**
						(0.0140)
LnTO	0.0277	0.0401	-0.0922*	0.0558	0.0161	-0.0745
	(0.0351)	(0.0336)	(0.0468)	(0.0596)	(0.0253)	(0.0457)
LnFO	-0.0204	0.0076	-0.0087	-0.077	0.007	0.0046
	(0.0410)	(0.0158)	(0.0316)	(0.0660)	(0.0165)	(0.0188)
LnGrowth	-0.0458	-0.0036	-0.092	0.0629	-0.0302	-0.0433
	(0.1381)	(0.0508)	(0.1122)	(0.2263)	(0.0464)	(0.1005)
Inf	-0.0002	-0.0002	-0.0003	-0.0006	-0.0003	-0.0002
	(0.0002)	(0.0003)	(0.0003)	(0.0004)	(0.0003)	(0.0003)
LnGovExp	-0.0054	0.0064	-0.0012	-0.0695	0.0045	-0.0041
	(0.0262)	(0.0213)	(0.0215)	(0.0554)	(0.0174)	(0.0141)
LnPop	0.0969	0.0546	0.0813	0.0313	0.0169	0.051
	(0.0646)	(0.0699)	(0.0727)	(0.1223)	(0.0539)	(0.0439)
LnLifeExp	-0.0057*	-0.001	-0.0015	-0.0081	-0.0005	-0.0011
	(0.0030)	(0.0013)	(0.0011)	(0.0053)	(0.0010)	(0.0009)
Observation	108	318	426	108	318	426
Instrument	16	26	24	16	29	24
Country	18	53	71	18	53	71
Hansen test of over-identification	0.657	0.7072	0.4025	0.9084	0.673	0.3166
AR(1)	0.3823	0.1117	0.4999	0.7276	0.1958	0.512
AR(2)	0.1179	0.2846	0.0512	0.3752	0.2923	0.0905

Notes: Table 4.5 reports the impact of financial openness on the FD and income inequality relationship.
Each regression includes country and time-fixed effects. Robust standard errors clustered at the country level are reported in parentheses.
*, **, *** indicate significance at the 10%, 5% and 1% levels, respectively.
All variables are defined in Appendix 4.1.

Figure 4.5. Marginal impact of FD on income inequality for different levels of TO



4.5.2 Dynamic threshold regression

Although the split sampling and interaction analysis provide informative results, each approach has its limitations. In the split sampling regression, the result may be sensitive to the arbitrary cut-off value. With regard to the interaction analysis, it is assumed that the impact of banking development on the Gini coefficient grows monotonically with the increase in financial or trade openness. To overcome these limitations, we perform a dynamic panel threshold model to test the existence of a threshold level of financial or trade openness in the relationship between FD and income inequality. Table 4.6 presents the estimation result of the dynamic panel threshold model in Eq. 4-4, where the threshold variable is either financial openness (columns 1 and 3) or trade openness (columns 2 and 4) and *LnPrivateCredit* or *LnLiquidLiabilities* measure FD. The first and second rows display the estimated FD threshold values and the 95% confidence intervals, respectively. The below-threshold and above-threshold slope parameter estimates illustrate the regime-dependent marginal effects of FD on income inequality.

Columns 1 and 3 of Table 4.6 present the threshold impact of financial openness in the FD-income inequality relationship. Regardless of the FD measurement, the threshold value (financial openness) point estimate is 1.58 with a corresponding 95% confidence interval [-0.1, 1.75], which means that observations with financial openness of less than 1.58 are classified into the low financial openness regime, while those with greater values are classified into the high financial openness regime, which includes approximately 13% of observations. With regard to the regime-dependent marginal effects, FD appears to have a statistically significantly positive effect on income inequality if financial openness is greater than the threshold value of 1.58. In contrast, the coefficient estimate of FD is statistically insignificant when observations fall below the threshold level. Regarding the control variables, in both columns, the estimated coefficient of *LnFO* is significant and negative, suggesting that an increase in financial openness reduces income inequality. In addition, consistent with the Kuznets hypothesis, economic growth alleviates income inequality. However, the effect of *growth* on income inequality diminishes when a country's financial openness increases. Furthermore, *LnGovExp* increases income inequality. A previous study by Kunieda et al. (2014) has examined the impact of financial openness on FD-income inequality, although, to the best of our knowledge, the dynamic panel threshold method has not been used to examine the FD-FO-income inequality nexus.

Turning to the threshold effect of trade openness, columns 2 and 4 illustrate the estimates from the dynamic panel threshold model where trade openness is used as the threshold variable and FD is measured by *LnPrivateCredit* and *LnLiquidLiabilities,* respectively. The point estimate of the threshold value in both columns is 3.938, and approximately 73% of the observations in the sample are above this threshold value. The result shows that FD appears to have a statistically significantly positive effect on income inequality if FD is greater than the threshold. Below the threshold, however, the effect of FD is statistically insignificant. This result is consistent with the GMM analysis, suggesting that improving FD increases income inequality at a higher level of trade openness. With regard to the control variable, greater trade openness corresponds to lower income inequality. According to standard Heckscher–Ohlin trade theory, the inequality effect of openness varies depending on relative factor abundance and productivity differences as well as on the extent to which individuals earn income from wages or capital. In addition, the coefficient of *LifeExp,* as a proxy for human capital, is negative and significant in both columns, consistent with the previous research (Furceri & Ostry, 2019).

Overall, our findings, based on all three approaches – split sampling, interaction and threshold analysis – emphasise the role of openness in the FD and income inequality linkage. The data suggest that with increased financial openness and trade openness, banking development benefits the richer segments of society more than the poorer ones and hence significantly increases income inequality. In other words, the widening income inequality effect of FD tends to become more significant as a country becomes more open to financial or trade markets. This finding supports the theoretical models of Kunieda et al. (2014) and Ehrlich and Seidel (2019) in countries open to trade and financial markets. In contrast to their prediction, it does not provide any evidence of a negative relationship between FD and income inequality in countries with low financial openness or trade openness.

Table 4.6. Income inequality, FD and openness (dynamic panel threshold model)

	LnPrivateCredit		LnLiquidLiabilities	
	(1) FO	(2) TO	(3) FO	(4) FO
Threshold	1.5798	3.9382	1.5798	3.9382
95% confidence interval	[-0.0979,1.7466]	[3.6001,4.9366]	[-0.0979,1.7466]	[3.6001,4.9366]
Impact of FD:				
Below threshold	-0.0014	0.0058	0.0056	0.017
	(0.0067)	(0.0054)	(0.0131)	(0.0110)
Above threshold	0.0396***	0.0110**	0.0326**	0.0227**
	(0.0115)	(0.0055)	(0.0146)	(0.0106)
Impact of covariates:				
Lag.LnGrossGini	0.9100***	0.8859***	0.9559***	0.9068***
	(0.0393)	(0.0560)	(0.0337)	(0.0598)
LnFO	-0.0581***	0.0067	-0.0380**	0.0019
	(0.0161)	(0.0041)	(0.0149)	(0.0051)
LnTO	-0.0058	-0.0173*	-0.0142	-0.0224*
	(0.0120)	(0.0098)	(0.0102)	(0.0124)
LnGrowth	-0.0868*	-0.0293	-0.0051	-0.0726
	(0.0490)	(0.0401)	(0.0811)	(0.0701)
Inf	-0.0004*	0.0001	0.0001	0.0001
	(0.0002)	(0.0002)	(0.0004)	(0.0002)
LnGovExp	0.0444***	0.0079	0.0241*	0.0058
	(0.0143)	(0.0085)	(0.0125)	(0.0079)
LnPop	-0.0042	-0.0003	-0.0050*	-0.0014
	(0.0032)	(0.0025)	(0.0028)	(0.0024)
LnLifeExp	0.0003	-0.0012***	-0.0002	-0.0013***
	(0.0007)	(0.0004)	(0.0005)	(0.0005)
Cons	0.3282	0.5442**	0.2506	0.4771**
	(0.2132)	(0.2207)	(0.1846)	(0.2419)
Observation	497	497	497	497
Country	71	71	71	71
Instrument	64	67	50	57

Notes: Table 4.6 reports the impact of financial openness on the FD-income inequality relationship. In all columns, the dependent variable is *LnGrossGini*. FD is measured by *LnPrivateCredit*, columns 1 and 2, and LnLiquidLiabilities, columns 3 and 4. Financial openness (FO), columns 1 and 3, and trade openness (TO), columns 2 and 4, are used as the threshold variable. The point estimates of the thresholds and the corresponding 95% confidence intervals (C.I.) are reported in the first two rows respectively. The regime-dependent marginal effects of FD on income inequality are shown by 'below threshold' and 'above threshold'. Each regression includes country and time fixed effects. Robust standard errors clustered at the country level are reported in parentheses.
*, **, *** indicate significance at the 10%, 5% and 1% levels, respectively.
All variables are defined in Appendix 4.1.

4.6 Conclusion

This study examines whether the combination of a country's degree of integration into the world economy, trade integration or financial integration, and FD increases or decreases inequality within a country. If economic openness is an important determinant of income inequality and if it leads to higher FD, it raises the question of to what extent it can moderate the relationship between FD and income inequality. Accordingly, we investigate whether the income inequality effect of FD is monotonic with the level of economic openness and whether a certain economic openness threshold exists beyond which FD increases income inequality.

For this purpose, we employ two different methodologies to investigate the possible non-linearities. Initially, we split the sample into different subgroups by the level of either financial openness or trade openness and use GMM to estimate the effect of FD on income inequality for each group. While GMM helps us use the lagged dependent variable and regressors to address potential endogeneity issues, this method does not give us specific information on the threshold value at which the effect changes, if at all. For this reason, we use the dynamic panel threshold method of Kremer et al. (2013) with a GMM estimator to investigate whether there is an economic openness threshold. Using a panel of developing and developed countries for 1994–2017, our empirical result shows that in an economy closed to the world financial or trade market, growing FD does not significantly impact income inequality. However, if an economy is open to the world financial and trade market, inequality within the economy increases as its financial market develops. This finding is consistent across different econometric methods, subsamples and interaction analyses, and distinct FD indicators. In general, this study extends the current literature by providing empirical evidence on the role of openness in the FD-income inequality relationship covering both developed and developing countries. In addition, evidence of the pro-inequality impact of FD in open countries informs policymakers about the importance of redistribution policies. In fact, open countries that desire to decrease inequality resulting from having open markets should consider implementing redistribution policies to mitigate the inequality-increasing effect of FD, such as progressive tax policies, targeted subsidies, or tax credits to low-income households.

Clearly, more research is necessary. First and foremost, if data quality concerns are dropped, researchers should study the effect of FD on the incomes of individuals at the top and bottom of the income distribution at different levels of economic openness. This is important because the Gini coefficient measures deviations from perfect income equality regardless of where in the distribution these deviations arise. In particular, the finding that finance increases inequality does not necessarily imply that finance ignores the poor. Another exciting extension relates to the question of whether the threshold effect of economic openness on the FD–income inequality relationship varies across different levels of institutional quality, and how and what level of institutional quality can change the nonlinear income inequality effect of FD. We leave these avenues of exploration for future research.

4.7 References

Adams, S., & Klobodu, E. K. M. (2016). Financial development, control of corruption and income inequality. *International Review of Applied Economics*, *30*(6), 790–808. https://doi.org/10.1080/02692171.2016.1208740

Aghion, P., & Bolton, P. (1997). A theory of trickle-down growth and development. *Review of Economic Studies*, *64*(2), 151–172. https://doi.org/10.2307/2971707

Ang, J. B. (2010). Finance and inequality: The case of India. *Southern Economic Journal*, *76*(3), 738–761. https://doi.org/10.4284/SEJ.2010.76.3.738

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277–297. https://doi.org/10.2307/2297968

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, *68*(1), 29–51. https://doi.org/10.1016/0304-4076(94)01642-D

Asteriou, D., Dimelis, S., & Moudatsou, A. (2014). Globalization and income inequality: A panel data econometric approach for the EU27 countries. *Economic Modelling*, *36*, 592–599. https://doi.org/10.1016/J.ECONMOD.2013.09.051

Baltagi, B. H. (2005). *Econometric Analysis of Panel Data*. John Wiley & Sons.

Baltagi, B. H., Demetriades, P. O., & Law, S. H. (2009). Financial development and openness: Evidence from panel data. *Journal of Development Economics*, *89*(2), 285–296. https://doi.org/10.1016/J.JDEVECO.2008.06.006

Banerjee, A., & Newman, A. (1993). Occupational choice and the process of development. *Journal of Political Economy*, *101*(2), 298. https://doi.org/10.1086/261876

Barro, R. J., & Lee, J. W. (2001). International data on educational attainment: Updates and implications. *Oxford Economic Papers*, *53*(3), 541–563. https://doi.org/10.1093/OEP/53.3.541

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2007). Finance, inequality and the poor. *Journal of Economic Growth*, *12*(1), 27–49. https://doi.org/10.1007/S10887-007-9010-6

Blau, B. M. (2018). Income inequality, poverty, and the liquidity of stock markets. *Journal of Development Economics*, *130*, 113–126. https://doi.org/10.1016/J.JDEVECO.2017.10.006

Bui, T. D., & Bui, H. T. M. (2020). Threshold effect of economic openness on bank risk-taking: Evidence from emerging markets. *Economic Modelling*, *91*, 790–803. https://doi.org/10.1016/J.ECONMOD.2019.11.013

Caner, M., & Hansen, B. E. (2004). Instrumental variable estimation of a threshold model. *Econometric Theory*, *20*(5), 813–843. https://doi.org/10.1017/S0266466604205011

Castelló-Climent, A., & Doménech, R. (2008). Human capital inequality, life expectancy and economic growth. *The Economic Journal*, *118*(528), 653–677. https://doi.org/10.1111/J.1468-0297.2008.02136.X

Chen, W., & Kinkyo, T. (2016). Financial development and income inequality: Long-run relationship and short-run heterogeneity. *Emerging Markets Finance and Trade*, *52*(3), 733–742. https://doi.org/10.1080/1540496X.2016.1116281

Chinn, M. D., & Ito, H. (2006). What matters for financial development? Capital controls, institutions, and interactions. *Journal of Development Economics*, *81*(1), 163–192. https://doi.org/10.1016/J.JDEVECO.2005.05.010

Clarke, G. R. G., Xu, L. C., & Zou, H. (2006). Finance and income inequality: What do the data tell us? *Southern Economic Journal*, *72*(3), 578–596. https://doi.org/10.1002/J.2325-8012.2006.TB00721.X

de Haan, J., & Sturm, J. E. (2017). Finance and income inequality: A review and new evidence. *European Journal of Political Economy*, *50*, 171–195. https://doi.org/10.1016/J.EJPOLECO.2017.04.007

Delis, M. D., Hasan, I., & Kazakis, P. (2014). Bank regulations and income inequality: Empirical evidence. *Review of Finance*, *18*(5), 1811–1846. https://doi.org/10.1093/ROF/RFT039

Demirgüç-Kunt, A., & Levine, R. (2009). Finance and inequality: Theory and evidence. *Annual Review of Financial Economics*, *1*(1), 287–318. https://doi.org/https://doi.org/10.1146/annurev.financial.050808.114334

Denk, O., & Cournede, B. (2015). *Finance and income inequality in OECD countries* (Working Paper N. 1224). OECD Economics Department Working Papers. https://doi.org/10.1787/5js04v5jm2hl-en

Ehrlich, M. v., & Seidel, T. (2019). Financial development and inequality in the global economy. *The Scandinavian Journal of Economics*, *121*(4), 1533–1560. https://doi.org/10.1111/SJOE.12312

Furceri, D., & Loungani, P. (2018). The distributional effects of capital account liberalization. *Journal of Development Economics*, *130*, 127–144. https://doi.org/10.1016/J.JDEVECO.2017.09.007

Furceri, D., & Ostry, J. D. (2019). Robust determinants of income inequality. *Oxford Review of Economic Policy*, *35*(3), 490–517. https://doi.org/10.1093/OXREP/GRZ014

Galor, O., & Moav, O. (2004). From physical to human capital accumulation: Inequality and the process of development. *The Review of Economic Studies*, *71*(4), 1001–1026. https://doi.org/10.1111/0034-6527.00312

Galor, O., & Zeira, J. (1993). Income distribution and macroeconomics. *The Review of Economic Studies*, *60*(1), 35–52. https://doi.org/10.2307/2297811

Ghosh, A. R., Ostry, J. D., & Qureshi, M. S. (2016). When do capital inflow surges end in tears? *American Economic Review*, *106*(5), 581–585. https://doi.org/10.1257/AER.P20161015

Gimet, C., & Lagoarde-Segot, T. (2011). A closer look at financial development and income distribution. *Journal of Banking & Finance*, *35*(7), 1698–1713. https://doi.org/10.1016/J.JBANKFIN.2010.11.011

Goldberg, P. K., & Pavcnik, N. (2007). Distributional effects of globalization in developing countries. *Journal of Economic Literature*, *45*(1), 39–82. https://doi.org/10.1257/JEL.45.1.39

Greenwood, J., & Jovanovic, B. (1990). Financial development, growth, and the distribution of income. *Journal of Political Economy*, *98*, 1076–1107. https://doi.org/10.1086/261720

Hamori, S., & Hashiguchi, Y. (2012). The effect of financial deepening on inequality: Some international evidence. *Journal of Asian Economics*, *23*(4), 353–359.

https://doi.org/10.1016/J.ASIECO.2011.12.001

Hansen, B. E. (1999). Threshold effects in non-dynamic panels: Estimation, testing, and inference. *Journal of Econometrics*, *93*(2), 345–368. https://doi.org/10.1016/S0304-4076(99)00025-1

Harrison, A. E. (2002). *Has globalization eroded labour's share? Some cross-country evidence* (Working Paper No. 39649). Munich Personal RePEc Archive. https://mpra.ub.uni-muenchen.de/39649/

Hasan, I., Hassan, G., Kim, S. J., & Wu, E. (2021). The impact of risk-based capital rules for international lending on income inequality: Global evidence. *Economic Modelling*, *98*, 136–153. https://doi.org/10.1016/J.ECONMOD.2021.01.003

Heimberger, P. (2020). Does economic globalisation affect income inequality? A meta-analysis. *The World Economy*, *43*(11), 2960–2982. https://doi.org/10.1111/TWEC.13007

Hoi, C. M., & Hoi, L. Q. (2012). Financial development and income inequality in Vietnam: An empirical analysis. *Journal of Economics and Development*, *15*(2), 5–25.

Hsieh, J., Chen, T. C., & Lin, S. C. (2019). Financial structure, bank competition and income inequality. *The North American Journal of Economics and Finance*, *48*, 450–466. https://doi.org/10.1016/J.NAJEF.2019.03.006

Isah, A. (2016). *Financial development and income inequality: A review of literature*. 2nd International Conference on Social Science and Law, Nile University of Nigeria, Abuja. https://www.researchgate.net/publication/328981319

Jauch, S., & Watzka, S. (2016). Financial development and income inequality: A panel data approach. *Empirical Economics*, *51*(1), 291–314. https://doi.org/10.1007/S00181-015-1008-X/TABLES/7

Jaumotte, F., Lall, S., & Papageorgiou, C. (2013). Rising income inequality: Technology, or trade and financial globalization? *IMF Economic Review*, *61*(2), 271–309. https://doi.org/10.1057/IMFER.2013.7/FIGURES/7

Kim, D. H., Hsieh, J., & Lin, S. C. (2021). Financial liberalization, political institutions, and income inequality. *Empirical Economics*, *60*(3), 1245–1281. https://doi.org/10.1007/S00181-019-01808-Z/TABLES/9

Kim, D. H., & Lin, S. C. (2011). Nonlinearity in the financial development–income inequality nexus. *Journal of Comparative Economics*, *39*(3), 310–325. https://doi.org/10.1016/J.JCE.2011.07.002

Kose, M. A., Prasad, E. S., & Terrones, M. E. (2009). Does financial globalization promote risk sharing? *Journal of Development Economics*, *89*(2), 258–270. https://doi.org/10.1016/J.JDEVECO.2008.09.001

Kremer, S., Bick, A., & Nautz, D. (2013). Inflation and growth: New evidence from a dynamic panel threshold analysis. *Empirical Economics 2012 44:2*, *44*(2), 861–878. https://doi.org/10.1007/S00181-012-0553-9

Kunieda, T., Okada, K., & Shibata, A. (2014). Finance and inequality: How does globalization change their relationship? *Macroeconomic Dynamics*, *18*(5), 1091–1128. https://doi.org/10.1017/S1365100512000843

Lane, P. R., & Milesi-Ferretti, G. M. (2007). The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970–2004. *Journal of*

International Economics, *73*(2), 223–250. https://doi.org/10.1016/J.JINTECO.2007.02.003

Law, S. H. (2009). Trade openness, capital flows and financial development in developing economies. *International Economic Journal*, *23*(3), 409–426. https://doi.org/10.1080/10168730903268398

Law, S. H., Tan, H. B., & Azman-Saini, W. N. W. (2014). Financial development and income inequality at different levels of institutional quality. *Emerging Markets Finance and Trade*, *50*, 21–33. https://doi.org/10.2753/REE1540-496X5001S102

Levine, R. (1997). Financial development and economic growth: Views and agenda. *Journal of Economic Literature*, *35*(2), 688–726. https://doi.org/http://www.jstor.org/stable/2729790

Levine, R. (2005). Chapter 12 Finance and growth: Theory and evidence. In P. Aghion & S. Durlauf (Eds.), *Handbook of Economic Growth Vol. 1, Part A* (pp. 865–934). Elsevier. https://doi.org/10.1016/S1574-0684(05)01012-9

Li, H., Squire, L., & Zou, H. F. (1998). Explaining international and intertemporal variations in income inequality. *The Economic Journal*, *108*(446), 26–43. https://doi.org/10.1111/1468-0297.00271

Liang, Z. (2006). Financial development and income distribution: A system GMM panel analysis with application to urban China. *Journal of Economic Development*, *31*(2). https://core.ac.uk/download/pdf/6338713.pdf

Liang, Z. (2008). Financial development and income inequality in rural China 1991–2000. In G. Wan (Eds.), *Understanding Inequality and Poverty in China* (pp. 72-88). Palgrave Macmillan. https://doi.org/10.1057/9780230584259_3

Meschi, E., & Vivarelli, M. (2009). Trade and income inequality in developing countries. *World Development*, *37*(2), 287–302. https://doi.org/10.1016/J.WORLDDEV.2008.06.002

Meyer B., M. F. (2006). *Financial development and inequality: Brazil 1985-99*. Proceedings of the German Development Economics Conference, Berlin. https://www.econstor.eu/handle/10419/19833

Mills, M. (2009). Globalization and inequality. *European Sociological Review*, *25*(1), 1–8. https://doi.org/10.1093/ESR/JCN046

Mookerjee, R., & Kalipioni, P. (2010). Availability of financial services and income inequality: The evidence from many countries. *Emerging Markets Review*, *11*(4), 404–408. https://doi.org/10.1016/J.EMEMAR.2010.07.001

Naceur, M., & Zhang, R. (2016). *Financial development, inequality and poverty: Some international evidence* (Working Paper No. 2016/032). IMF, Institute for Capacity Development. https://www.imf.org/en/Publications/WP/Issues/2016/12/31/Financial-Development-Inequality-and-Poverty-Some-International-Evidence-43718

Nikoloski, Z. (2013). Financial sector development and inequality : Is there a financial Kuznets curve? *Journal of International Development* , *25*(7), 897–911.

Park, D., & Shin, K. (2017). Economic growth, financial development, and income inequality. *Emerging Markets Finance and Trade*, *53*(12), 2794–2825. https://doi.org/10.1080/1540496X.2017.1333958

Rajan, R., & Zingales, L. (2003a). *Saving capitalism from the capitalists : Unleashing the* *power of financial markets to create wealth and spread opportunity*. Princeton University Press.

Rajan, R., & Zingales, L. (2003b). The great reversals: The politics of financial development in the twentieth century. *Journal of Financial Economics*, *69*(1), 5–50. https://doi.org/10.1016/S0304-405X(03)00125-9

Rodríguez-Pose, A., & Tselios, V. (2009). Education and income inequality in the regions of the European union. *Journal of Regional Science*, *49*(3), 411–437. https://doi.org/10.1111/J.1467-9787.2008.00602.X

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal*, *9*(1), 86–136. https://10.1177/1536867X0900900106

Seven, U., & Coskun, Y. (2016). Does financial development reduce income inequality and poverty? Evidence from emerging countries. *Emerging Markets Review*, *26*, 34–63. https://doi.org/10.1016/J.EMEMAR.2016.02.002

Shahbaz, M., & Islam, F. (2011). *Financial development and income inequality in Pakistan: An application of ARDL approach* (Working Paper No. 28222). Munich Personal RePEc Archive. https://mpra.ub.uni-muenchen.de/28222/

Solt, F. (2020). Measuring income inequality across countries and over time: The standardized world income inequality database. *Social Science Quarterly*, *101*(3), 1183–1199. https://doi.org/10.1111/SSQU.12795

Tan, H. B., & Law, S. H. (2012). Nonlinear dynamics of the finance-inequality nexus in developing countries. *Journal of Economic Inequality*, *10*(4), 551–563. https://doi.org/10.1007/S10888-011-9174-3

World *Bank (2020). Global financial development report 2019/2020: Bank regulation and supervision a decade after the global financial crisis*. http://hdl.handle.net/10986/32595

.

4.8 Appendix

Appendix 4.1 Definition of variables

Table A.4.1. Definition of variables

Variable Name	Definition	Source
Income Inequality:		
GrossGini	The Standardized World Income Inequality Database	SWIID
Financial Development:		
PrivateCredit	The financial resources provided to the private sector by domestic money banks as a share of GDP. Domestic money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits.	GFDD
LiquidLiabilities	The ratio of liquid liabilities to GDP. Liquid liabilities are also known as broad money or M3.	GFDD
Economic Openness:		
TO	The sum of exports and imports of goods and services measured as a share of GDP.	WDI
FO	the sum of external assets and liabilities as a share of GDP (These foreign assets and liabilities include foreign debt, foreign direct investment, and foreign indirect investment (portfolio investment))	Author calculation based on Lane and Milesi-Ferretti (2007)
Control variables:		
Growth	Changes in Log GDP per capita (constant 2015 US$)	WDI
GovExp	General government final consumption expenditure (% of GDP)	WDI
Inf	Inflation, consumer prices (annual %)	WDI
Pop	Population, total	WDI
LifeExp	Life expectancy at birth, total (years)	WDI

Appendix 4.2 Country list based on LFO, HFO, LTO and HTO

Table A.4.2. Country list based on LFO, HFO, LTO and HTO

LFO	HFO		LTO	HTO	
Albania	Armenia	Jamaica	Australia	Albania	Germany
Bangladesh	Bolivia	Japan	Bangladesh	Bolivia	Ghana
Brazil	Costa Rica	Lesotho	Brazil	Chile	Jamaica
China	Cote d'Ivoire	Malaysia	China	Cote d'Ivoire	Korea, Rep.
Colombia	Ecuador	Mongolia	Colombia	Dominican Rep	Norway
Dominican Rep	El Salvador	New Zealand	Egypt	Ecuador	Paraguay
Egypt	Eswatini	South Africa	India	France	Philippines
Ghana	Georgia	Ukraine	Iran	Greece	Poland
India	Honduras	United States	Italy	Indonesia	Sweden
Indonesia	Korea, Rep.	Uruguay	Japan	Kenya	Tunisia
Iran	Mexico	Austria	Nigeria	Mexico	Belgium
Kenya	Paraguay	Belgium	Pakistan	New Zealand	Bulgaria
Nigeria	Peru	Finland	Peru	Portugal	Czech Republic
Pakistan	Philippines	France	Tanzania	Romania	Eswatini
Sri Lanka	Poland	Germany	Turkey	South Africa	Honduras
Tanzania	Romania	Hong Kong, China	Uganda	Spain	Hong Kong, China
Turkey	Thailand	Hungary	United States	Sri Lanka	Hungary
Uganda	Tunisia	Ireland	Uruguay	United Kingdom	Ireland
	Australia	Netherlands		Armenia	Lesotho
	Barbados	Norway		Austria	Malaysia
	Botswana	Panama		Barbados	Mongolia
	Bulgaria	Portugal		Botswana	Netherlands
	Chile	Singapore		Costa Rica	Panama
	Czech Republic	Spain		El Salvador	Singapore
	Greece	Sweden		Finland	Switzerland
	Italy	Switzerland		Georgia	Thailand
		United Kingdom			Ukraine

[1] See Furceri & Loungani, (2018) for further details. (Mills 2009) (Harrison 2011 for trade openness)
[2] High and upper-middle income countries include Albania, Armenia, Australia, Austria, Barbados, Belgium, Botswana, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Czech Republic, Dominican Rep, Ecuador, Finland France, Georgia, Germany, Greece, Hong Kong, , Hungary, Ireland, Italy, Jamaica, Japan, Korea Rep., Malaysia, Mexico, Netherlands, New Zealand, Norway, Panama, Paraguay, Peru, Poland, Portugal , Romania, Singapore, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, United Kingdom, United States, and Uruguay. Low and lower-middle income countries include Bangladesh, Bolivia, Cote d'Ivoire, Egypt, El Salvador, Eswatini, Ghana, Honduras, India, Indonesia, Iran, Kenya, Lesotho, Mongolia, Nigeria, Pakistan, Philippines, Sri Lanka, Tanzania, Tunisia, Uganda, and Ukraine.
[3] An additional advantage of the GMM estimator is that by differencing it helps to ensure that all the regressors are stationary.
[4] See Baltagi (2005), and the references cited there
[5] To reduce the instrument proliferation problem that can result in biased parameter estimates, we used the “collapse” option in the xtabond2 STATA command to collapse the instrument matrix. We kept the number of instruments below the number of countries. See Roodman (2009) for details.

Chapter 5
Conclusion

This chapter provides a general conclusion to this thesis, including key findings, followed by implications, caveats and future research areas. The first section summarises the main findings of this thesis stemming from the three main essays. This is followed by policy recommendations aimed at alleviating the impacts of pay inequality, labour share and income inequality. Finally, this chapter discusses the limitations of the three papers and proposes avenues for further investigation.

5.1 Main findings

Income distribution is an important issue in many countries as it has significant impacts on the economy and society, including economic and social stability, economic growth, and social mobility. Understanding the factors that drive income distribution and its impact can have important implications for policymakers. While there is extensive literature on determinants and impact of income distribution, there are some gaps and controversial topics in this stream of literature. Therefore, this thesis attempted to empirically contribute to the income distribution literature by considering three scopes of income distribution: pay inequality and labour share at the firm level and income inequality at the macro level. In each scope of income distribution, this study attempted to address the issues relating to their determinants or their impact.

The first essay conducts empirical research to investigate the impact of CEO-employee pay inequality on employee performance, since existing research offers contradictory findings. To provide a clear picture, we follow a stream of literature that argues that contradictory findings in prior studies stem from overlooking the determinants of pay inequality (e.g., employees' skill, and effort). Therefore, this study first breaks down pay inequality into two parts: pay inequality explained by CEOs' and employee skills, company characteristics and the labour market (*Pay Equity*), and the difference between pay inequality and Pay Equity, which represents the deviation from expected pay inequality (*Pay Inequity*). Then we examine the impact of key pay ratios (Pay Equity and Pay Inequity) on employee performance. Employee performance is measured by total factor productivity and the natural logarithm of revenue per employee. Using an unbalanced sample of 385 Australian listed firms over the period 2004-2019, this study shows that *Pay Equity*, which is pay inequality attributed to individual skills, company characteristics, and the labour market, is positively associated with employee performance. However, this positive impact on employee performance declines at high levels of such pay inequality. In fact, we find an inverted U-shaped relationship between *Pay Equity* and employee performance. However, we also find that *Pay Inequity*, which is the unexplained part of pay inequality, is negatively related to employee performance. Overall, our findings suggest that the seemingly contradictory predictions of behavioural and economic perspectives about the impact of pay inequality are more complementary than contradictory. Pay inequality related to these factors may motivate employees to perform better, consistent with economic perspectives. In contrast, pay inequality attributed to other factors may lead to detrimental outcomes such as lower performance, consistent with the behavioural perspective.

The second essay investigates the drivers of declining Australian labour share and its impact on pay inequality using firm-level data. Despite a surge of interest in this stream of literature, existing research relies heavily on country or industry aggregate macro data and undervalues the importance of firm-level data. Therefore, there is little clear guidance about the determinants of functional income distribution and its link to personal income distribution within firms. Using panel data from Australian listed firms between 2004 and 2019, we first examine the impact of three leading factors – technological progress, product market power and labour market power – on labour share inside firms. Our results show that capital deepening and technological progress have a significant and negative impact on labour share. Further analysis highlights the importance of employees' skill level. In fact, technological progress is not a significant driver of labour share in firms with highly skilled employees, such as those investing in R&D or less capital-intensive firms. Furthermore, our study reveals that firms with higher mark-ups have significantly lower labour shares. Our findings do not support the hypothesis that labour market concentration and unionisation are associated with labour share. Additionally, our further investigation illustrates that technological progress and product market power have a considerable negative impact on labour share in firms with a higher level of external funds, while they do not significantly affect labour share in high-tech sectors. Second, we examine the impact of within-firm labour share on pay inequality between CEOs and employees. Our analysis shows that a decrease in a firm's labour share is significantly associated with increased pay inequality. In addition, our results indicate that the significant determinants of labour share, technological progress, and product market power, can moderate the negative impact of labour share on pay inequality. We find that labour share has a larger negative impact on pay inequality in firms with lower technological productivity and higher product market power.

While the previous two essays focus on functional and personal income distribution within firms, the final paper deals with personal income distribution at the macro level. The existing literature has identified several potential determinants of income inequality. However, the income distributional impact of financial development remains unclear. With this in mind, the third essay investigates the impact of financial development on income inequality and argues that a country's openness to trade and financial markets may affect the nexus between financial development and income inequality. To explore whether the effect of financial development on income inequality differs with the extent of financial and trade openness, we employ three different econometric methods, split sampling, interaction analyses, and dynamic panel threshold modelling. Using a panel of developing and developed countries for the period 1994–2017, our empirical results show that financial openness and trade openness change the relationship between financial development and income inequality. With regard to financial openness, our results show that the development of the financial system leads to a rise in income inequality in financially open countries while financial development does not have a significant impact on income inequality in financially closed countries. With regard to trade openness, our results show that the development of financial markets significantly increases income inequality in countries with higher trade openness. However, there is no significant relationship between financial development and income inequality in countries with lower trade openness.

5.2 Implications

As mentioned in the introduction, gaining a thorough understanding of the determinants of income distribution and its impact can aid in developing interventions to alter the distribution of income while also considering the potential consequences of such changes. Thus, this section outlines the policy implications derived from this thesis. Although there is a lot more to be done (as we will discuss in the next section), this thesis has provided three main implications.

The first implication is related to our finding in Chapter 2, which suggests that CEO-employee pay inequity *per se* is not a sufficient proxy for examining its effect on employee performance. To reiterate, our findings highlight that pay inequality predicted by individuals' skills, company characteristics, and labour market (*Pay Equity*) has a positive impact on employee performance, but this positive impact declines at high levels of such pay inequality. However, pay inequality based on other factors (*Pay Inequity*) has a negative impact on employee performance. This finding has important implications for managers and regulators. First, this finding can help managers identify instances of excessive executive pay, evaluate companies' compensation structures and redesign those compensation structures. In fact, if *Pay Inequity* is significantly high and *Pay Equity* is significantly low, it may indicate that executives are paid more than they deserve relative to the company's employees. This suggests that the company has an inequitable reward system that will eventually decrease employee performance. Thus, in light of our findings in Chapter 2, managers may adjust the remuneration system toward a lower level of *Pay Inequity* and a higher level of *Pay Equity* since we believe that a pay system based on individual input into the workplace can effectively motivate employees and increase their performance. Managers should first consider the current level of pay equity in their company before deciding whether to increase it. This is because increasing pay equity beyond a specific threshold tends to decrease employee performance. Second, our findings have policy implications for regulators insofar as CEO pay ratio disclosure rules *per se*, without putting such disclosures into an equity context, may lead to misinterpretation. Financial statements do not provide sufficient information about employees and CEOs, so financial statements may not enable readers to fully understand and interpret CEO pay ratios. We believe disclosure of relevant information about workforces can help financial statement users and employees to evaluate the firm's compensation structure more accurately.

The second implication of this study is linked to the findings presented in Chapter 3. This chapter highlights the factors that drive labour share in Australia across all sectors and provides new insights into the relationship between labour share and CEO-employee pay inequality within firms. The findings of this study have several implications for policymakers who seek to mitigate the fall in labour share and the rise in pay inequality in Australia. First, our findings show that the Australian labour share has significantly declined due to technological progress and an increase in product market power; however, the negative impact of technological progress on labour share has been mitigated by the presence of highly skilled employees. As a result, policymakers are advised to prioritise investing in education and skills training programs to prevent further negative impacts of technological progress on labour share. Such investments would enable workers to acquire and develop the skills necessary to better engage with automation and other technological advancements. Furthermore, policymakers are encouraged to implement additional regulations to prevent the concentration of market power and promote competition in the market, to mitigate further declines in labour share. Second, this study provides empirical evidence indicating a significant association between declining labour share and increasing CEO-employee pay inequality within firms. However, higher technological progress and lower product market power mitigate the negative impact of labour share on pay inequality. These findings have significant policy implications since they suggest that policymakers should consider policies aimed at fostering innovation and deregulating the product market to prevent further rises in pay inequality resulting from the decline in labour share.

The final implication relates to findings from Chapter 4, which provide evidence on the role of openness in the income inequality impact of financial development, covering both developed and developing countries. Our findings indicate that the widening income inequality effect of FD tends to become more significant as a country becomes more open to financial or trade markets. This finding has significant policy implications for countries open to financial and trade markets. The degree of financial openness varies greatly between countries. As shown in Appendix 4.2, the group of strongly open countries in our empirical exercise consisted of not only highly developed countries but also less developed countries. These countries with higher levels of openness experienced increasing inequality as their financial markets developed. Thus, policymakers may need to carefully consider the potential impact of financial development on income inequality in countries that are more open to international financial and goods market trade. They may need to consider implementing redistribution policies aimed at mitigating the rise in income inequality, such as progressive tax policies, targeted subsidies, or tax credits to low-income households.

5.3 Further research

The findings of this thesis should be interpreted in light of potential limitations that are not fully addressed in the core research papers and may require further investigation. Thus, future research is important to provide further insights for policymakers to address issues related to the distribution of income.

In Chapter 2, one prominent assumption is that employees use CEO compensation as a reference to evaluate their own compensation. While there is ample support in the literature for this assumption, individuals may determine the fairness of their compensation by comparing it to different reference points, such as individuals doing the same job, individuals in higher or lower positions within the company or all individuals in an organisation. Therefore, a potential future avenue for research is to compare the impact of different types of pay inequality on employee performance and to investigate the overall effect of pay inequality. Another assumption made is that all employees in different workplaces react homogeneously to pay inequality. The extent to which individuals with different characteristics in various jobs and working environments have the same reaction to pay differences is unknown. Therefore, future research might develop appropriate conceptual models for investigating how different employees react to pay inequality.

The third important assumption in Chapter 2 relates to individuals' perceptions of their inputs into the workplace and their outcomes, which eventually leads to their reactions. Following the literature, we assume individuals' skill level, company characteristics and labour market are the determinants of their pay and monetary rewards are their outcome. Although this thesis has endeavoured to make the best use of the data available at the time to investigate the link between pay inequality and employee performance, improved data availability for researchers will provide opportunities for future research. In other words, as more firm-level data about workforces and companies become available in the future, there will be additional avenues for future studies to provide a complete picture of the impact of pay inequality on employee performance. With increased data availability, future research can consider more individual factors (such as level of experience, effort and age) as determinants of pay inequality. Their measures of Pay Equity and Pay Inequity will thus be more accurate. In addition, future research could consider other perceived outcomes beyond monetary price. For instance, an interesting direction for further research may involve exploring how perceived outcomes (such as a high-quality working environment) moderate the effect of pay inequality on employee performance.

In Chapter 3, a limitation is the lack of publicly available data. Our study focuses on the impact of labour share on CEO-employee pay inequality. However, there are different types of pay inequality in organisations. Future research might explore how labour share is related to overall personal income distribution inside firms, or pay inequality between different hierarchies, rather than focusing on CEO-employee pay inequality. Considering these limitations, we believe that our study highlights the importance of firm-level analysis in understanding macroeconomic movements.

In Chapters 2 and 3, our empirical investigation is based on Australian listed firms. Our sample is limited to listed firms, unlike the datasets commonly used in the micro-level analysis of labour share and pay inequality. However, a significant proportion of economic activity takes place in non-listed firms that have different characteristics than listed firms. Hence, if data become available, one future avenue for research would be to re-examine research questions in Chapters 2 and 3 to assess how these results apply to both listed and non-listed firms. A further consideration is that our findings from these two essays are limited to the Australian context. Looking across countries, there is expected to be variation in social, economic, and political contexts, as well as cultural factors that can affect income distribution. For example, differences in tax policies, labour laws, social welfare systems, attitudes towards work, education, and social mobility can result in significant differences between national income distributions. An avenue for future research is to investigate the extent to which our findings are different across countries. For example, do cultural views on compensation influence the relationship between pay inequality and employee performance?

The period of data availability for Australian firms imposes another limitation. In Chapters 2 and 3, a short-term data period (from 2004 to 2019) is employed. A short-term study may not capture the broader trends or factors that influence income distribution over time. For example, this may limit the possibility of determining the underlying causes of the structural movements in Australian labour shares. Future research could investigate the long-term relationship between pay inequality and employee performance or the long-term underlying causes of declining labour shares.

Finally, in Chapter 4 we examine the income inequality impact of financial development. In doing so, we focus on the Gini coefficient as a measurement of income inequality. While the Gini coefficient measures deviations from perfect income equality, little is said about how such deviations arise. Moreover, a rising Gini coefficient does not necessarily indicate that the low-income share has decreased. Further research might also consider alternative inequality measures, such as the effect of financial development on the incomes of individuals at the top and bottom of the income distribution at different levels of economic openness. In particular, the finding that financial development increases inequality does not necessarily imply that the poor are ignored.

Funding

The author, Roya Taherifar, is grateful for financial support from The University of Waikato, New Zealand.

Thesis appendix

Postgraduate Studies Office
Student and Academic Services Division
Wahanga Ratonga Matauranga Akonga
The University of Waikato
Private Bag 3105
Hamilton 3240, New Zealand
Phone +64 7 838 4439
Website: http://www.waikato.ac.nz/sasd/postgraduate/

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Co-Authorship Form

This form is to accompany the submission of any PhD that contains research reported in published or unpublished co-authored work. **Please include one copy of this form for each co-authored work.** Completed forms should be included in your appendices for all the copies of your thesis submitted for examination and library deposit (including digital deposit).

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 2: Is performance affected by the CEO-Employee pay gap? Evidence from Australia

Nature of contribution by PhD candidate	Conceptualising the study, designing the empirical methodology, collecting, cleaning, and analysing data, writing the initial draft, and finalising and submitting the paper.
Extent of contribution by PhD candidate (%)	70

CO-AUTHORS

Name	Nature of Contribution
Mark J Holmes	Providing guidance, offering critical feedback on research questions, methodology, result interpretation and conclusion, revising and editing the draft, advising on targeted conferences and journals, and submitting the paper.
Gazi Hassan	Providing feedback on research questions, methodology and initial results, and advising on targeted conferences and journals.

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

Name	Signature	Date
Roya Taherifar	[signature]	20/05/2023
Mark J Holmes	[signature]	22 May 2023
Gazi Hassan	Gazi hassan	23 May 2023

July 2015

THE UNIVERSITY OF
WAIKATO
Te Whare Wānanga o Waikato

Co-Authorship Form

Postgraduate Studies Office
Student and Academic Services Division
Wahanga Ratonga Matauranga Akonga
The University of Waikato
Private Bag 3105
Hamilton 3240, New Zealand
Phone +64 7 838 4439
Website: http://www.waikato.ac.nz/sasd/postgraduate/

This form is to accompany the submission of any PhD that contains research reported in published or unpublished co-authored work. **Please include one copy of this form for each co-authored work**. Completed forms should be included in your appendices for all the copies of your thesis submitted for examination and library deposit (including digital deposit).

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 3: The drivers of labour share and impact on pay inequality: A firm-level investigation

Nature of contribution by PhD candidate	Conceptualising the study, designing the empirical methodology, collecting, cleaning, and analysing data, writing the initial draft, and finalising and submitting the paper.
Extent of contribution by PhD candidate (%)	70

CO-AUTHORS

Name	Nature of Contribution
Mark J Holmes	Providing guidance, offering critical feedback on research questions, methodology, result interpretation and conclusion, revising and editing the draft, and advising on targeted conferences and journals.
Gazi Hassan	Providing feedback on the methodology and initial results, and advising on targeted conferences and journals.

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

Name	Signature	Date
Roya Taherifar	[signature]	20/05/2023
Mark J Holmes	[signature]	22 May 2023
Gazi Hassan	Gazi hassan	23 May 2023

July 2015

Postgraduate Studies Office
Student and Academic Services Division
Wahanga Ratonga Matauranga Akonga
The University of Waikato
Private Bag 3105
Hamilton 3240, New Zealand
Phone +64 7 838 4439
Website: http://www.waikato.ac.nz/sasd/postgraduate/

THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Co-Authorship Form

This form is to accompany the submission of any PhD that contains research reported in published or unpublished co-authored work. **Please include one copy of this form for each co-authored work**. Completed forms should be included in your appendices for all the copies of your thesis submitted for examination and library deposit (including digital deposit).

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: Does economic openness matter in the impact of financial development on income inequality?

Nature of contribution by PhD candidate	Conceptualising the study, designing the empirical methodology, collecting, cleaning, and analysing data, writing the initial draft, and finalising and submitting the paper to a conference.
Extent of contribution by PhD candidate (%)	70

CO-AUTHORS

Name	Nature of Contribution
Mark J Holmes	Providing guidance, offering critical feedback on research questions, methodology, result interpretation and conclusion, revising and editing the draft, and advising on targeted conferences and journals.
Gazi Hassan	Providing feedback on the methodology and initial results, and advising on targeted conferences and journals.

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

Name	Signature	Date
Roya Taherifar	[signature]	20/05/2023
Mark J Holmes	[signature]	22 May 2023
Gazi Hassan	Gazi hassan	23 May 2023

July 2015