# Three Essays on CEO Compensation

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# Declaration

I, **Yulin Li**, certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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"*Veritas lux mea*"

*--From a Latin voice, for the reason I started my PhD journey*

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*"Agnosco veteris vestigia flammae"*

*--From a Latin voice, for the moment I finished my PhD journey*

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# Abstract

This thesis presents three essays on CEO compensation. The first essay studies the disagreement between shareholders' Say-on-Pay voting results and ISS (Institutional Shareholder Service) recommendations on CEO compensation packages. Shareholders are expected to follow ISS "Against" recommendations if CEOs' compensation packages are inappropriate for the firm. However, around 8% of shareholders overlook ISS "Against" recommendations despite these recommendations being deemed informative (Albuquerque et al., 2020). Based on my findings, the cause of the disagreement is institutional shareholders' investment horizon. When CEO compensation packages include a high proportion of option grants and salary payments, firms with higher short-term institutional shareholder ownership are more likely to disagree with ISS. These findings reveal that the disagreements are caused by short-term institutional shareholders strategically making decisions that align with their interests. I observe no effect of long-term institutional shareholder ownership on the disagreement. These results remain constant after addressing possible endogeneity concerns through firm fixed effects, two-stage regressions with instrumental variables, falsification tests and entropy balancing. These findings provide the first explanation for the cause of the disagreement and additional evidence of short-term institutional shareholder voting behaviour.

The second essay explores how the CEO-employee pay ratio (a proxy of within-firm pay disparity) affects firms' labour investment efficiency. The results in this essay reveal a negative association between the pay ratio and labour investment efficiency, indicating that firms with a larger CEO-employee pay ratio tend to have lower labour investment efficiency. Further tests demonstrate that this association is more profound when firms over-invest in labour. This essay

adds to the literature by offering additional evidence to support the Rent Extraction Theory, which posits that CEOs tend to recruit excess employees to "build their empire" to extract rent, leading to over-investment in labour (Stein, 2003, Williamson, 1963). Again, I employ firm fixed effects, falsification tests and entropy balancing to address potential endogeneity concerns. The results remain robust to these tests. This essay identifies the CEO-employee pay ratio as an essential determinant for labour investment efficiency, which may help firms' stakeholders make informed decisions.

The third essay examines how the CEO-employee pay ratio influences firms' stock price crash risk. The stock price crash risk is a major concern for shareholder welfare. In this essay, I document a significant and positive association between the CEO-employee pay ratio and the stock price crash risk, revealing that firms with a more significant pay ratio have a higher stock price crash risk. This result remains robust after addressing plausible endogeneity concerns using tests including firm fixed effects, two-stage regressions with instrument variables, change of specifications and entropy balancing. To further boost robustness, I include additional control variables and an alternative measure of the pay ratio in my baseline estimations, and again my results remain constant. In cross-sectional analysis, I find that firms granting more stocks to CEOs have a lower chance of stock crashes when the pay ratio is larger. Based on these findings, shareholders can make better investment decisions, especially concerning the risk of a stock price crash.

# Chapter 1: Introduction

## 1.1 Overview of the Thesis

This thesis includes three essays on CEO compensation. First, I investigate the disagreement between shareholders' voting results and ISS (Institutional Shareholder Service) recommendations on CEO compensation packages (Say-on-Pay), second the effect of the pay gap between CEO compensation and median employee on firms' labour investment efficiency, and thirdly, the same pay gap on stock price crash risk.

The first essay identifies the cause of the disagreements between shareholders' voting results and ISS recommendations in Say-on-Pay. It is expected that shareholders will vote in line with ISS "Against" recommendations when a CEO's compensation package is inappropriate for the firm. However, around 8% of shareholders do not follow ISS "Against" recommendations even when these recommendations are deemed informative (Albuquerque et al., 2020). My results reveal that the cause of the disagreement hinges on the investment horizon of institutional shareholders. I demonstrate that firms with larger proportions of short-term institutional shareholder ownership are more likely to disagree with ISS when a CEO compensation package includes more option grants and a more significant salary payment. This finding indicates that the disagreement is driven by short-term institutional shareholders strategically choosing option grants and salary payments as preferable forms of executive compensation. However, long-term shareholder ownership generally has no impact on disagreements. These results remain robust after addressing possible endogeneity concerns using a two-stage estimation with instrumental variables, falsification tests and entropy balancing.

The second essay examines the effect of the CEO-employee pay ratio (a proxy of within-firm pay disparity) on firms' labour investment efficiency. I find that firms with a larger CEO-employee pay ratio tend to over-invest in labour leading to lower labour investment efficiency. This finding offers additional evidence supporting the Rent Extraction Theory, which contends that CEOs tend to recruit excess employees to "build their empire", resulting in overinvestment in labour (Stein, 2003, Williamson, 1963). To address possible endogeneity concerns, I test my baseline Model with firm fixed effects, falsification tests and entropy balancing; my results remain robust. These empirical results provide a useful insight into firms' investment decisions for board members governing firms' labour investment efficiency.

The third essay explores the association between the CEO-employee pay ratio and a firm's stock price crash risk. I provide evidence that firms with a larger CEO-employee pay ratio are more likely to experience stock price crashes in the following year. This result supports the Rent Extract Theory that to satisfy incentive compensation requirements (e.g., improving firms' return on assets to a certain level), CEOs are eager to invest in risky projects to extract rent (Chalmers et al., 2006, Hutton et al., 2009). Some of these high-risk investments inevitably fail, driving CEOs to hoard bad news leading to a stock price crash (Armstrong et al., 2013b, Callen and Fang, 2015a). I use firm fixed effects, two-stage regressions with instrumental variables, change of specifications and entropy balancing to mitigate possible endogeneity concerns. My results remain robust to a series of additional controls and an alternative measurement of the pay ratio. Cross-sectional estimates reveal that, given a large pay ratio, firms that grant more stocks to CEOs are less likely to have stock crashes. However, corporate governance does not affect the relationship between the pay ratio and stock price crash risk. In light of these findings,

shareholders can make better investment decisions if they want to avoid investing in firms with a higher risk of stock price crashes.

## 1.2 Disagreements between shareholder Say-on-Pay voting results and ISS recommendations

Corporate voting is a key way institutional shareholders exert their influence over firms' management decisions. Since the mandatory Say-on-Pay law was enacted, institutional shareholder voting has become even more vital in corporate governance (Malenko and Shen, 2016). To gather sufficient information to vote at a low cost, institutional shareholders seek advice from proxy advisory firms (e.g., ISS) on major corporate decisions, such as executive compensation. As a result of enormous market demand, the number of ISS's clients increased by over 100% in 2022 compared with 2018 (Copland et al., 2018). The increasing influence of ISS raised concern among regulators and academia, creating doubt regarding the quality of ISS recommendations (McCahery et al., 2016, Larcker and Tayan, 2011). A recent empirical study by Albuquerque et al. (2020) finds a positive relationship between ISS "Against" recommendations and worsening firm future performance, indicating that "Against" recommendations have identified suboptimal executive compensation packages. All parties are expected to vote congruently–favourably if compensation is appropriate and unfavourably if compensation is not. Shareholder voting results generally support this argument, with around 92% of votes in line with the ISS recommendation. However, 8% of votes still do not align with the ISS recommendations, resulting in disagreements. Interestingly, nearly all of these disagreements occur when ISS recommends "Against" and shareholders vote "Yes". If ISS "Against" recommendations have informed institutional shareholders about suboptimal compensation packages, what causes institutional shareholders to vote against them?

The literature on institutional shareholders' investment horizon may offer an answer (Gillan and Starks, 2000, Kim et al., 2019a). Since institutional shareholders have different investment horizons (long- or short-term), they follow ISS recommendations only if the associated benefits outweigh the costs (Kahn and Winton, 1998). If each party (i.e., ISS, short-term and long-term institutional shareholder) evaluates executive compensation packages differently, they may have distinct views on what is appropriate or inappropriate, leading to disagreements. ISS claims to "…empower investors and companies to build for…sustainable growth…"[1], so it believes sufficient but not excessive compensation can better align shareholders' and executives' interests. Therefore, ISS recommends a "For" vote for compensation packages that offer adequate pay to executives to maintain firms' sustainable growth. Generally, short-term institutional shareholders should follow ISS recommendations to avoid costly monitoring. However, empirical studies suggest that short-term institutional shareholders may actively vote for compensation packages that better align with their interests (Stathopoulos and Voulgaris, 2016). For example, short-term institutional shareholders prefer compensation packages with a greater cash component (i.e., salary and bonus) because executives are incentivised by cash compensation to boost short-term profit, which may reward them with higher compensation in the next year (Iatridis, 2018). Analogously, since short-term institutional shareholders have expertise and preference in trading firms with high uncertainty (Yan and Zhang, 2009), they may favour compensation packages that increase firms' volatility, such as option grants (Fich and Shivdasani, 2005). Although short-term institutional shareholders vote in favour of more cash/option components that better link to their interests, ISS may recognise that these cash components or option grants are excessive and recommend "Against", resulting in a

[1] See ISS front page "About ISS". https://www.issgovernance.com/about/about-iss/

disagreement. Research shows that long-term institutional shareholders tend to conduct independent research to gather firm-specific information because they can minimise the research cost by spreading it over the long run, reusing the information in the following years (Iliev and Lowry, 2015, Ertimur et al., 2013, Larcker et al., 2015). Malenko and Shen (2016) provide evidence that if long-term institutional shareholders' votes rely on their independent research, then ISS recommendations are uncorrelated with long-term institutional shareholders' decisions.

In this essay, I use the logit regression Model to test the relationship between disagreement and institutional shareholders' investment horizon, conditional on the different components of compensation packages. The dependent variable is the disagreement, measured as a dummy variable equals to one if Say-on-Pay voting result against the ISS recommendation. The main test variable is the ownership by institutional shareholders with different investment horizons. Institutional shareholders' investment horizon is measured by an investor turnover ratio (Nguyen et al., 2020, Pathan et al., 2021). To evaluate the effect of distinct compensation components, I generate several dummy variables equal to one for firms with top 10% CEO option grants, stock grants, salary and bonus payments. I then interact them with the main test variable. I hypothesise that a disagreement between shareholders and ISS is positively associated with the proportion of short-term institutional shareholders when compensation packages contain excessive cash payments or/and option grants. The results from the baseline regressions support my hypothesis that short-term institutional shareholder ownership is significantly positively associated with the disagreement when firms grant excessive options and salary to the CEO. These results indicate that short-term institutional shareholders strategically choose option grants and salary payments as preferable forms of executive compensation, which causes the disagreement with ISS.

My results hold when I address possible endogeneity concerns in a two-stage estimation with an instrumental variable. Short-term institutional shareholder ownership continues to significantly drive the disagreement after being instructed by the instrument variable. I then apply falsification tests and entropy balancing to further mitigate missing variable bias and selection bias; my findings remain unchanged. These robustness tests demonstrate that the relationship between the disagreement and institutional shareholder investment horizon is causal.

### 1.3 CEO-employee pay ratio and labour investment efficiency

Firms' ability to compete in the modern marketplace depends heavily on their labour cost. This is because of the demand for sufficient, creative employees not only in conventional manufacturing industries but also in the emerging service sectors (Ghaly et al., 2020). Whether firms can efficiently invest in labour demonstrates their operating and financial performance (Jung et al., 2014). As a result of this significance, extant research has been searching for determinants that can boost firms' labour investment efficiency, including executive compensation. For example, Sualihu et al. (2021a) provide evidence that labour investment efficiency is negatively associated with executive option grants. They argue that options incentivise executives to take extra risks when making investment decisions, resulting in suboptimal labour investment. Despite studies identifying the driving factors of labour investment efficiency, they direct their investigation toward either employees (treatment) or executives (compensation). However, the CEO-employee pay ratio, a potential determinant that can affect employees and executives simultaneously, has been overlooked. The CEO-employee pay ratio measures the difference between a CEO's total compensation and a median

employee's pay. In the U.S., after the enactment of the Dodd-Frank Act (Section 935 b), firms have been mandated to disclose the pay ratio in their financial statements since 2018. Given the ratio connects the salaries of employees to those of the CEO, the size of the pay gap may impact employee behaviour, affecting labour investment efficiency.

Three disparate theories provide distinct explanations and predictions regarding how the pay ratio affects labour investment efficiency. The Talent Assignment Theory posits that a more significant pay gap between a CEO and rank-and-file employees is because of firms' strategy to secure CEO talent (Cheng et al., 2017a). Modern firms have complex governance frameworks across incremental work levels to maintain a higher state of effective functioning; such a framework then requires a commensurate level of ability and talent to fill positions within the hierarchy. As a result, employees within the hierarchy should be rewarded on an escalating scale congruent with their talents, position and responsibilities. Since CEOs are at the top of the hierarchy, they should be compensated proportionately more for their talents, resulting in a larger pay gap. If this theory is valid, I expect CEOs with a more significant pay gap to have superior talent and the ability to make better labour investment decisions, leading to higher labour investment efficiency.

The Rent Extraction Theory suggests that CEOs tend to extract rent in larger firms where more rent is available (Bebchuk et al., 2011, Mueller et al., 2017, Rouen, 2020). Since rank-and-file employees are less likely to extract rent, the more rent a CEO captures, the larger the pay ratio. Stein (2003) argues that the "efficient" way for CEOs to extract rent from a firm is to "build their empire". A simple method to successfully build an empire is to increase employee numbers to enlarge the firm (Williamson, 1963). Consequently, hiring employees beyond the

optimal level reduces labour investment efficiency. Under this argument, I expect that firms with a larger CEO-employee pay ratio have lower labour investment efficiency because of over-investment in labour.

The Equity Theory states that rank-and-file employees perceive unfairness from a larger pay gap (Akerlof and Yellen, 1990). Because of the perceived inequity, these employees undertake costly behaviours, including shirking and quitting harming firms' operations (Adams, 1965, Cowherd and Levine, 1992, Faleye et al., 2013). As a result, the shortage of labour led by the perceived inequity from a large pay ratio causes under-investment in labour. Along with this argument, I predict that firms with larger CEO-employee pay ratios have lower labour investment efficiency because of under-investment in labour.

I employ the ordinary least squares regression Model to identify the effect of the CEO-employee pay ratio on labour investment efficiency. My dependent variable is the absolute value of a firm's abnormal net hiring, which is the residual from a regression of a firm's net hiring over several firm fundamental economic variables (Ben-Nasr and Alshwer, 2016, Jung et al., 2014, Khedmati et al., 2020). In further analysis, I include over-/under-investment in labour as dependent variables, the positive/negative value of a firm's abnormal net hiring. The primary test variable is the CEO-employee pay ratio calculated from a firm's financial data (Faleye et al., 2013, Przychodzen and Gómez-Bezares, 2021). The baseline results show that the CEO-employee pay ratio is negatively associated with labour investment efficiency, supporting the Rent Extraction and Equity Theories.

Further analysis finds that the CEO-employee pay ratio drives over-investment in labour but has no effect on under-investment in labour. This result supports the Rent Extraction Theory but rules out the Equity Theory. These results remain constant after applying several tests to address potential endogeneity concerns, including firm fixed effects, falsification tests and entropy balancing. I include ten additional controls from recent research in my baseline regressions to alleviate concerns about missing variables and alternative explanations. My results remain robust.

This essay identifies that the CEO-employee pay ratio significantly determines labour investment efficiency. Further tests support the prediction from the Rent Extraction Theory that a larger CEO-employee pay ratio represents the rent captured by the CEO. These findings can help stakeholders make informed investment decisions, especially when a firm suffers from low labour investment efficiency.

## 1.4 CEO-employee pay ratio and stock price crash risk

A large strand of studies has identified the economic consequences of the CEO-employee pay ratio, a representative of within-firm pay disparity, especially after Section 953 (b) of the Dodd-Frank Act took effect in 2018. These studies offer additional evidence that helps debate whether mandatory disclosure of the pay ratio informs stakeholders. These studies link the pay ratio with firm performance and shareholder reactions. For instance, Mueller et al. (2017) demonstrate that a larger pay ratio links to better firm performance, but Rouen (2020) finds no significant relationship between the pay ratio and firm performance. Pan et al. (2020) investigate U.S. market reactions to the first-time disclosure of the pay ratio and reveal that

firms announcing higher pay ratios suffer lower abnormal market returns. In particular, firms' seven days cumulative abnormal returns are lower by roughly 42 basis points on average if they announce a pay ratio one standard deviation higher than the industry average. That study shows that stock markets react quickly to a large CEO-employee pay ratio. The question remains: "Does the stock market react to the pay ratio in the short-term only, or are there long-term effects on share prices?" This essay aims to address this gap and provide new evidence on the economic consequences of the pay ratio and its effect on shareholder value.

Stock price crash risk significantly affects shareholders' investment return in the long run. It is even more meaningful for retail shareholders because they could have salient losses for their highly concentrated portfolio when share prices crash (Barber and Odean, 2013). Therefore, identifying the determinants of a stock price crash risk is essential to protect shareholder value in the long run. Theory suggests that bad news hoarding by executives is a reason that firms experience stock price crashes (Jin and Myers, 2006, Callen and Fang, 2015a, Habib et al., 2018). The rationale is that executives are keen on withholding bad news from shareholders for personal interest, such as achieving a promotion (Jin and Myers, 2006) or fulfilling incentive compensation requirements (Kim et al., 2011a). However, once executives realise they cannot withhold the accumulated bad news, they give up withholding and releasing them to the market (Callen and Fang, 2015a). Consequently, a sudden drop of substantial bad news in the stock market leads to a significant drop in stock prices. A series of driving factors of stock price crash risk has been demonstrated (Hutton et al., 2009, Kim et al., 2011b, Andreou et al., 2017), but the CEO-employee pay ratio that could potentially affect stock price risk has been overlooked.

Regarding how the pay ratio affects the stock price crash risk, two competing theories (the Talent Assignment Theory and the Rent Extraction Theory) offer distinct predictions. As elaborated in essay two, the Talent Assignment Theory posits that within-firm pay disparity represents executives' talent and ability to manage a complex firm at the top of the organisational hierarchy. Therefore, I expect that firms with larger pay ratios have lower stock price crash risk since talented CEOs are supposed to accomplish better-operating results; thus, there is less bad news to hide. The Rent Extraction Theory states that a larger CEO-employee pay ratio reflects managerial rent extraction. Since it is unlikely for rank-and-file employees to extract significant rent, managers' rent-seeking behaviour potentially increases their compensation leading to a larger pay ratio. For example, Chalmers et al. (2006) reveal that managers utilise the channel of incentive compensation to extract rent. To fulfil specific criteria in the compensation packages, managers intend to boost firms' short-term profits by investing in short-sighted and risky projects (Hutton et al., 2009). When some of these high-risk projects inevitably fail, managers are keen to hide the bad news to minimise their negative effects on stock price (Armstrong et al., 2013b). In light of this theory, I expect firms with a larger pay gap between the CEO and rank-and-file employees to have a higher stock price crash risk.

I employ the ordinary least squares regression model to estimate the effect of the CEO-employee pay ratio on stock price crash risk. My dependent variables are three different proxies of stock price crash risk extracted from recent studies: (1) the negative coefficient of skewness of firm-specific daily returns (NCSKEW); (2) the down-to-up volatility of firm-specific daily returns (DUVOL); and (3) the difference between the number of days with and without negative extreme firm-specific daily returns (CRASH_COUNT). The key test variable is the CEO-employee pay ratio calculated from the firm's financial data (Faleye et al., 2013, Przychodzen and Gómez-Bezares, 2021). My baseline results show that the CEO-employee

pay ratio is positively associated with stock price cash risk, indicating that a large pay gap between the CEO and the median employee increases the risk of future price crashes. This finding supports the Rent Extraction Theory that predicts a positive association between the pay ratio and stock price crash risk. To address possible concerns that these results are driven by missing variable bias or selection bias, I use several tests to ensure their robustness: firm fixed effects; change of specification; two-stage estimation with instrumental variables; and entropy balancing. My baseline findings remain in these tests. To further test the robustness of my results, I include an additional control variable and replace the pay ratio with hand-collected data in baseline regressions. Again, my results hold.

In further analyses, I use cross-sectional tests to investigate the possible economic mechanism that could drive the effect of the pay ratio on stock price crash risk. In particular, I explore how the association between the pay ratio and stock price varies with the design of the CEOs' incentive compensation contracts and the quality of corporate governance. The results show that given a large pay ratio, more CEO stock grants in the compensation packages can reduce future stock price crash risk, while option grants and cash payments have no such effect. Corporate governance plays no role in the effect of the pay ratio on the stock price crash risk, which agrees with Faleye et al. (2013) findings.

## 1.5 Contributions

This study contributes to the corporate finance literature in several different fields. First, it introduces the investor investment horizon as an essential determinant of the disagreement between shareholder Say-on-Pay voting results and ISS recommendations. Previous studies mostly focus on investigating the general effect of ISS recommendations on shareholder voting, assuming an alignment between them (Iliev and Lowry, 2015, Ertimur et al., 2013, Larcker et al., 2015). To the best of my knowledge, this is the first study to explore the cause of the disagreement; it shows that short-term institutional shareholders vote against ISS recommendations when option grants and salary payments are excessive.

Second, this study offers new evidence on shareholder governance behaviour. The literature states that if short-term institutional shareholders are not satisfied with executives or firm governance, they prefer to sell their shares in the market rather than actively engage in voting because the former has a lower cost (Duan and Jiao, 2016). Nevertheless, this study shows that short-term institutional shareholders make strategic voting decisions that are more in line with their requirement for short-term profits, such as choosing excessive option grants and salary payments.

Third, this study provides new evidence that contributes to the debate on whether mandatory disclosure of the CEO-employee pay ratio adds value to firms' stakeholders' information about executive compensation and firm performance. The results highlight the information provided by the CEO-employee pay ratio by showing that a large pay gap in the firm reduces labour investment efficiency.

Fourth, this study incorporates an in-depth analysis of the economic consequences of the CEO-employee pay ratio. A series of research has evaluated the effect of the pay ratio on firm performance, but these studies provide conflicting results that are ambiguous to advance decision-making as they rely on general firm performance proxies like Tobin's Q or ROA (Cheng et al., 2017a, Elkins, 2016). This study, however, suggests a clear relationship between the pay ratio and labour investment efficiency. Firms' stakeholders benefit from these findings to make informed decisions if they are concerned about labour investment efficiency.

Fifth, this study provides novel evidence that can help shareholders protect their investments by wisely managing stock price crash risk in the long run. The study's results reveal that firms with a larger CEO-employee pay ratio have a higher chance of experiencing a stock price crash risk. However, given a large pay ratio, more stock grants for CEOs could significantly reduce the chance of a stock price crash.

Sixth, the study adds to the literature by extending the determinants of stock price crash risk, especially with respect to top executives' compensation. Few studies offer insights into the effect of executive compensation on stock price crash risk (Jia, 2018b). However, this study indicates that the CEO-employee pay ratio is a significant determinant of managers' bad news hoarding behaviour, leading to a higher chance of a stock crash.

## 1.6 Thesis structure

The remainder of this thesis is organised as follows. Chapter 2 explores the cause of the disagreement between ISS recommendations and shareholder Say-on-Pay voting results. Chapter 3 examines the effect of the CEO-employee pay ratio on labour investment efficiency. Chapter 4 investigates the role of the CEO-employee pay ratio in worsening firms' stock price crash risk. Chapter 5 concludes the thesis by summarising the findings and discussing the contributions to knowledge.

# Chapter 2: Disagreements between shareholder Say-on-Pay voting results and ISS recommendations


## Abstract

This essay investigates the cause of disagreements between shareholder Say-on-Pay voting results and ISS recommendations. My results suggest that investor investment horizon is the key determinant. On considering compensation, the results show that short-term institutional shareholders strategically choose option grants and salary payments as preferable forms of executive compensation even when they are excessive, which causes a disagreement with ISS recommendations. However, long-term institutional shareholders' ownership generally does not affect the disagreement. I employ a two-stage estimation with instrumental variables, falsification tests and entropy balancing to address endogeneity concerns. My results remain robust to an alternative proxy for investor investment horizon. The findings imply that the disagreements are caused by short-term institutional shareholders strategically making decisions that align with their interests.

## 2.1 Introduction

Corporate voting is an important way for institutional shareholders to voice their opinions and exert influence over firms' management decisions. Institutional shareholder voting plays a key role in corporate governance and even more so since the increase in institutional ownership, the rise of shareholder activism, the shift to majority voting for director elections, and mandatory Say-on-Pay (Malenko and Shen, 2016). The Dodd-Frank Consumer Protection Act governs Say-on-Pay in the United States (here forward, "The Act") since it was enacted in January 2011. The legislation requires all public, listed companies to give their shareholders a Say-on-Pay on executive compensation. Even though the Say-on-Pay vote is officially non-binding, evidence suggests many parties, such as politicians, corporations, and shareholder advocates, take the vote very seriously (Bach and Metzger, 2019, Iliev and Lowry, 2015).

Given that gathering information is costly for institutional shareholders, shareholders seek advice from proxy advisory firms advising investors on how to vote their shares on major corporate decisions, including executive compensation. Institutional Shareholder Services (ISS), the largest proxy advisor in the U.S., is used as a proxy for institutional shareholders' opinions because of its increasing influence. In 2018, ISS hired over 1,000 employees and operated in 13 countries, serving over 1,700 institutional shareholders at 40,000 meetings (Copland et al., 2018). In 2022, ISS's website showed its client number had increased by 100% to over 3,400 of the world's leading institutional shareholders, with 2,600 employees in 15 countries.

The increase in the influence of ISS has raised concerns among regulators and academia. According to SEC commissioner Michael Piwowar at the 2013 SEC roundtable on proxy advisors, "proxy advisory firms may exercise outsized influence on shareholder voting", and the "Dodd-Frank provisions, such as mandatory Say-on-Pay votes, make proxy advisory firms potentially even more influential". Michael Piwowar worries that shareholders may over-rely on proxy advisor firms to make decisions. Consequently, after several discussions, the SEC published Staff Legal Bulletin No. 20 in June 2014, which guides the use of proxy advisors in terms of responsibilities and conflicts of interest. However, as SEC commissioner Daniel Gallagher documents, though these reforms are much-needed, he is concerned that the guidance does not go far enough. In academia, concerns raised include recommendations are inaccurate (McCahery et al., 2016), a one-size-fits-all approach to governance matters (Larcker and Tayan, 2011), and conflicts of interest stemming from providing recommendations to shareholders and consulting services to managers at the same time (Malenko and Shen, 2016).

Though the quality of ISS recommendations has long been debated, a recent empirical study by Albuquerque et al. (2020) provides evidence of the informativeness of ISS recommendations in executive compensation. They find that ISS “Against” recommendations identify suboptimal executive pay packages, evidenced by a negative relationship between ISS “Against” recommendations and worsening firms’ future long-run accounting performance. Albuquerque et al. (2020) also find that the relationship between ISS “Against” recommendations and firms’ future accounting performance is independent of whether shareholders “agree” or “disagree” with the “Against” recommendations. It is expected that all parties involved in voting on compensation should vote consistently, i.e., favourably if compensation is appropriate, and unfavourably if compensation is not. If ISS “Against”

recommendations are indicative of inappropriate compensation practices, then why do shareholders vote “For”?

Empirical studies support the argument that ISS recommendations are a significant determinant of shareholder Say-on-Pay voting results, with around 92% of votes following ISS recommendations (Collins et al., 2019, Alissa, 2015, Kimbro and Xu, 2016). But I also observe that around 8% of votes do not follow ISS recommendations, resulting in disagreements. Disagreements between shareholders and ISS recommendations remain stable, with a minimum of 6.77% and a maximum of 8.55% of total votes annually during my sample period (2011-2020). The data reveals that most disagreements occur when ISS recommends an “Against” vote, but shareholders cast “Yes” passing the Say-on-Pay vote. Why do shareholders pass a vote when ISS recommends “Against”?

The literature indicates that institutional shareholders' investment horizon may provide an answer (Kim et al., 2019a, Gillan and Starks, 2000). Institutional shareholders, which hold around 70% of outstanding U.S. shares, have different investment horizons (long- or short-term) and distinct effects on voting results (Kahn and Winton, 1998, Shleifer and Vishny, 1986). For example, Gillan and Starks (2000) find that proposals sponsored by long-term institutional shareholders in annual general meetings (AGMs) gain substantially more support than those sponsored by individuals. Kim et al. (2019b) find that short-term institutional shareholders worsen agency conflicts between debt holders and shareholders because short-term institutional shareholders will force executives to implement myopic investments. This chapter examines whether institutional shareholders’ investment horizons lead to voting disagreements.

I focus on voting in Say-on-Pay to identify the effect of the institutional shareholders' investment horizons on disagreements. The U.S. Dodd-Frank Consumer Protection Act (2010) mandates all public-listed firms to give shareholders a Say-on-Pay vote on executive compensation. It is expected that all parties involved in voting on compensation should vote consistently, i.e., favourably if compensation is appropriate and unfavourably if it is not. Research shows that excessively paid executives harm firm performance (Brick et al., 2006, Chung et al., 2015); thus, if acting in shareholders' interests, ISS should recommend an "Against" vote, as should long-term and short-term institutional shareholders. Following ISS recommendations to vote "No" for over-paid executives is in institutional shareholders' interests. Empirical studies support this argument, revealing that excessive pay packages tend to be rejected in Say-on-Pay votes (Armstrong et al., 2013a, Balsam et al., 2016, Cai and Walkling, 2011), thus providing an appropriate vehicle for analysing disagreements.

To investigate disagreements in Say-on-Pay, I explore how each party (i.e., ISS, short-term and long-term institutional shareholders) evaluates compensation contracts. If each party considers compensation contracts differently, they may have distinct views on what is appropriate or inappropriate for executive compensation, leading to disagreements. ISS claims to "*…empower investors and companies to build for … sustainable growth …*"[2]. For example, the ISS publication "2013 Comprehensive U.S. Compensation Policy" states that ISS is concerned about whether a new CEO's incentive compensation is excessive, especially when there is an insufficient rationale[3]. ISS believes adequate but not excessive compensation can reduce firms' risk and better align shareholders' and managers' interests. Thus, ISS recommends a "For" vote

[2] See ISS front page "About ISS". https://www.issgovernance.com/about/about-iss/
[3] See ISS official website. https://www.issgovernance.com/policy-gateway/2013-comprehensive-us-compensation-policy/

for compensation contracts that provide executives sufficient pay to maintain firms' sustainable development. However, research finds that managerial short-termism incentivised by excessive compensation harms firms' sustainable development (Bushee, 1998, Graham et al., 2005). For example, Mizik (2010) finds that managers with excessive option grants close to expiry may manipulate the information they send to the market to inflate the stock price. To do so, managers will conduct myopic management, such as discretionary accruals manipulation, to report better results in accounting reports (Mizik, 2010). Consequently, the stock price will fall once shareholders discover these myopic behaviours (Bushee, 1998). As a result, if ISS believes compensation contracts contain excessive incentives that harm firms' sustainable development, they recommend an "Against" vote.

Theory suggests that different components of compensation contracts can lead executives to make investment decisions that could affect firm value in different ways. For example, research shows that cash components in compensation contracts (e.g., salary or bonus) are less effective in enhancing firms' long-term returns because they do not provide executives with incentives linked to future firm performance (Chakraborty et al., 1999, Basuroy et al., 2014). Iatridis (2018) finds that cash is negatively associated with firm value in the long run but positively related to firms' short-term growth rate (i.e., a higher one-year lagged operating income). Iatridis (2018) further reveals that cash is positively related to discretionary accruals, indicating that firms that pay more cash are more likely to engage in earnings manipulation and, therefore, have a higher short-term growth rate.

On the other hand, equity compensation, which includes option grants and stock grants, incentivises executives to increase firm value by investing more in value-enhancing and risky

projects (Chakraborty et al., 1999, Larcker, 1983, Guay, 1999). But the literature also suggests that option and stock grants lead executives to choose investment projects with different risk profiles. Bettis et al. (2018) argue that option grants can incentivise executives to take excessive risks because options provide zero payoffs below the performance threshold but increase payoffs above the threshold without a limit. For example, executives can benefit from potentially higher returns of risky projects but suffer no consequences if they fail. Empirically, Shue and Townsend (2017) find that option grants significantly increase equity volatility, indicating that executives take more risks in their investment decisions. Although riskier investments lead firms to potentially better market performance and higher market-to-book ratios (Fich and Shivdasani, 2005), they can also lead to higher losses. Conversely, stock grants restrict executives from choosing too-risky projects because they expose executives to downside risk (Mehran, 1995, Basuroy et al., 2014). Subsequently, firms with more stock grants have more stable but relatively lower performance (Ryan Jr and Wiggins III, 2001).

The literature reveals that short-term institutional shareholders prefer to monitor firms through their "exit" threat (e.g., selling shares), given their expertise gained from their frequent trading on open markets (McCahery et al., 2016). Thus, monitoring firms through "voice" (e.g., direct intervention in voting) is of no interest to short-term institutional shareholders (Duan and Jiao, 2016). But, short-term institutional shareholders are required to vote in Say-on-Pay. Institutional shareholders, like mutual funds, have a fiduciary duty to disclose how they vote their shares to protect their customers' interests. Thus, the most cost-effective course of action is for short-term institutional shareholders to follow ISS recommendations (Iliev and Lowry, 2015, Malenko and Shen, 2016).

Empirical studies demonstrate that short-term institutional shareholders may not simply follow ISS recommendations to vote for compensation contracts that affect their interests if the monitoring cost is low. For instance, Stathopoulos and Voulgaris (2016) find that short-term institutional shareholders vote against CEO excess compensation if the compensation contracts are "clearly excessive" (e.g., excess pay in the top 10% of the distribution). Thus, when monitoring costs are low, short-term institutional shareholders may ignore ISS recommendations to vote if it affects their interests. For example, compensation contracts' cash components (e.g., salary and bonus) are positively associated with a firm's short-term operating income but negatively related to a firm's long-term value because executives are incentivised to boost short-term profit (Iatridis, 2018). Thus, short-term institutional shareholders benefit from a higher short-term growth rate that links to positive short-term market returns (Lewellen, 1999, Agnes Cheng et al., 1993, Black, 2016).

On the other hand, option grants incentivise executives to choose riskier projects which simultaneously bring uncertainty to firms (Fich and Shivdasani, 2005). Research finds that short-term institutional shareholders prefer to trade and specialise in firms with more uncertainty (e.g., higher stock volatility) because such firms enable them to build up profitable trading strategies (Yan and Zhang, 2009). Thus, short-term institutional shareholders may favour compensation contracts that increase firms' volatility. As a result, when such incentives (e.g., option grants) become high, it is more likely that short-term institutional shareholders will vote "Yes" to such compensation contracts. Conversely, short-term institutional shareholders may vote "No" to high stock grants in compensation contracts because higher stock grants expose executives to downside risk and restrict them from choosing risky investments that increase firm volatility (Basuroy et al., 2014). ISS may correctly identify these incentives as excessive, harming the firm's sustainable development and, therefore,

recommend an "Against" vote. Thus, I expect to observe disagreements between short-term institutional shareholders and ISS when firms grant excessive options and cash to executives, but not so with excessive stock grants.

For long-term institutional shareholders, theory suggests that they favour choosing "voice" (e.g., engaging in voting) to monitor firms directly (Duan and Jiao, 2016). To cast a meaningful vote with a manageable cost, long-term institutional shareholders can purchase a report from ISS or conduct their own research (Iliev and Lowry, 2015). It is cost-effective for long-term institutional shareholders to use ISS recommendations avoiding the costs of gathering and processing the necessary information to vote (Malenko and Malenko, 2019).

However, research also shows that long-term institutional shareholders are keen to do their research. Unlike short-term institutional shareholders, long-term institutional shareholders can significantly reduce their research costs by spreading them over the long run (Iliev and Lowry, 2015). Secondly, because of long holding periods, long-term institutional shareholders can gather unique private information from individual firms, which could arguably be more precise than ISS recommendations (Iliev and Lowry, 2015, Malenko and Shen, 2016). As a result, if long-term institutional shareholders obtain more accurate information at a relatively low cost, they are highly likely to conduct their research. Empirical research supports this argument (for example, Ertimur et al. (2013) and Larcker et al. (2015)). Further, Malenko and Shen (2016) find that if long-term institutional shareholders vote based on their independent governance research, then ISS recommendations are uncorrelated with long-term institutional shareholders' decisions. Thus, I expect that, in general, long-term institutional shareholders' decisions will be uncorrelated with disagreements.

Using a sample of S&P 1500 firms from 2011 to 2020 (10,004 firm-year observations), I find that short-term institutional shareholders are less likely to cause disagreements. This result supports my expectation that, in general, short-term institutional shareholders are keen to follow ISS recommendations to fulfil their fiduciary duties and avoid high monitoring costs. However, I also find that various designs of compensation packages attenuate this association between short-term institutional shareholders' investment horizon and disagreements. To study the effect of different compensation packages, I generate several dummy variables equal to one for firms with excess CEO option grants, stock grants, salary and bonus payments. I then interact these dummy variables with the long- and short-term ownership and rerun my baseline tests. As expected, the results reveal that short-term institutional shareholders have strategic choices in the form of compensation contracts that cause disagreements with ISS. Short-term institutional shareholders are more likely to disagree with ISS when firms grant executives more options and higher salaries. This result indicates that short-term institutional shareholders favour a package design that boosts firms' short-term profits, despite if ISS believes it might harm firms' long-term performance and recommend an "Against" vote. The results are robust after addressing endogeneity concerns using several identification techniques, such as firm fixed effects, two-stage instrumental variables, falsification tests and entropy balancing.

I also find that long-term institutional shareholders have no significant relationship with disagreements, indicating that they are likely to conduct independent research to acquire firm-specific information for voting. If long-term institutional shareholders have more private information than ISS, their research is deemed more precise (Ertimur et al., 2013, Larcker et al., 2015). If long-term institutional shareholders significantly disagree with ISS, concern about

the quality of ISS recommendations may arise. However, the results show long-term institutional shareholders' decisions are independent of ISS recommendations.

The contributions of this chapter are two-fold. First, it introduces investor investment horizon as a determinant of disagreement between ISS recommendations and shareholder Say-on-Pay voting results. Previous research focused on the general effect of ISS recommendations on Say-on-Pay voting, assuming alignment with in-between them (Iliev and Lowry, 2015, Ertimur et al., 2013, Larcker et al., 2015). No study has explored disagreements between shareholders and ISS recommendations. This chapter fills this gap by providing the first evidence that short-term institutional shareholders vote against ISS recommendations when option grants and salary payments are excessive. However, long-term institutional shareholders are not the cause of disagreements. Identification tests confirm that this effect is incremental to other possible driving factors that might be correlated with disagreements found in prior research.

Second, the chapter provides new evidence on shareholder governance behaviour. Previous studies suggest that short-term institutional shareholders are prone to choose "exit" over "voice"/vote to monitor firms, as "voice" is costly and, therefore, not aligned with their short-term interests (Duan and Jiao, 2016). However, I find that short-term institutional shareholders do strategically choose option grants and salary payments as preferable forms of executive compensation even when they are excessive, which aligns with their desire for short-term profits (Basuroy et al., 2014). Therefore, short-term institutional shareholders are more likely to vote against ISS recommendations when firms pay excessive salaries and option grants.

This chapter is structured as follows: Section 2.2 outlines the background of relevant theory and a summary of empirical findings in the literature. Section 2.3 develops the hypothesis of the chapter. Section 2.4 provides the sample selection and methodology, followed by section 2.5, which presents the baseline results. Section 2.6 details the identification tests, Section 2.7 offers a robustness test, and Section 8 concludes the chapter.

## 2.2 Literature review

### 2.2.1 Agency conflicts

Agency Theory states that agency conflicts arise because of the principal-agent relationship that emerges when executives (the agent) manage the firm and make decisions on behalf of the shareholders (the principals), which can subsequently lead to conflict between the agent and the principals (Eisenhardt, 1989). For example, Holmström (1979) argues that managers have different motives from shareholders because of moral hazards based on their interests rather than shareholders'. For example, asymmetric information allows managers to control the release of information that may affect shareholders' performance judgements (Bebchuk and Fried, 2005).

Two theories have been suggested to mitigate these conflicts. First, Holmström (1979) argues that managers should receive incentives that bind their payment to easily observable operation outcomes, leading to better alignment with shareholders' interests. Second, Gillan and Starks (2000) argue that shareholder governance could significantly control agency conflicts. Unlike incentive theories (Holmström, 1979), shareholder governance does not provide interest alignment. Instead, it uses an "inherent monitoring function" of the stock market (threat to sell the share) or direct intervention by law (voting) to discipline managers (Gillan and Starks, 2000).

Since institutional shareholders hold around 70% of outstanding U.S. corporate stocks (Aggarwal et al., 2019), they can potentially play a pivotal role in corporate governance. After the U.S. Securities and Exchange Commission (SEC) ruled that institutional shareholders must vote in AGMs to protect their customers' interests, their significant influence on corporate

governance became more noticeable (Cremers and Romano, 2011, Ng et al., 2009). Therefore, I focus on investigating how institutional shareholders affect disagreements in this chapter.

### 2.2.2 Institutional shareholder governance

#### *2.2.2.1 Institutional shareholders govern firms through "voice" or "exit"*

Hirschman (1970) argues that there are two mechanisms through which institutional shareholders can voice their opinions if they disagree with managers' actions. They can either sell their shares on the market ("exiting" or "voting with their feet") or participate in some form of management ("voice" or "direct intervention") to exert their power. Hirschman (1970) also argues that these two mechanisms are efficient when direct control is unavailable or too costly for institutional shareholders. Theoretical Models argue that firms have better governance when they receive institutional shareholders' "voice" because this "voice" provides corrective suggestions (McCahery et al., 2016). For example, by presenting a theoretical Model, Shleifer and Vishny (1986) document that institutional shareholders' "voice" can discipline inefficient management. Currently, as a representative of "voice", shareholder voting is increasingly being identified by scholars as one of the most important mechanisms to govern a firm (Bebchuk and Fried, 2005, Mallin and Melis, 2012).

A question raised by concern over "voice" governance is: "What happens if managers do not listen to institutional shareholders' "voices"?" There are two possible channels through which to enforce governance. First, institutional shareholders can threaten to "exit" (McCahery et al., 2016), leading to a reduction in agency costs (Admati and Pfleiderer (2009). Institutional shareholders with significant shareholdings can threaten (actual or imply) to sell their shares on the public market, profoundly affecting the company's share price. If managers'

compensation is closely linked to share performance, those managers must listen (Palmiter, 2001).

Secondly, managerial reputation is essential in ensuring that managers listen to shareholders. Though institutional shareholder governance (e.g., proposals and votes) is only advisory in current corporations, managers tend to implement a proposal if the majority supports it (Bach and Metzger, 2019). Managers are concerned about reputation loss if they were not to follow institutional shareholders' opinions, especially after implementing the Sarbanes Oxley Act and several accounting scandals (Ertimur et al., 2010, Del Guercio et al., 2008).

#### *2.2.2.2 Institutional shareholders' willingness to choose "voice" or "exit"*

As elaborated above, "voice" and "exit" are two mechanisms institutional shareholders can exert their power to govern firms when they disagree with the managers. However, the question of whether institutional shareholders have the same willingness to engage in "voice" or "exit" to govern firms still exists. In other words, are there any characteristics of institutional shareholders that will inevitably lead to a different preference between "voice" and "exit"? Empirical studies provide some answers to this question based on the costs and benefits of each choice.

In choosing "voice" or voting in proxies, significant ownership rights of a firm owned by institutional shareholders with long-term investment horizons could play a vital role for two reasons. On the one hand, a large ownership block can create greater liquidity constraints for institutional shareholders, which makes it costly to "exit" by selling shares in the open market

(Maug, 1998, Edmans, 2009, Edmans and Manso, 2011). On the other hand, a large ownership block can help incentivise institutional shareholders to engage in corporate governance through "voice". If a firm's performance can be enhanced by more robust corporate governance, institutional shareholders with significant ownership would benefit (Shleifer and Vishny, 1986, Maug, 1998, Kahn and Winton, 1998). Empirically, Duan and Jiao (2016) find a negative association between institutional shareholders' ownership and their "exiting" behaviour, indicating that a large ownership block deters governance through "exit".

The literature suggests that, in general, institutional shareholders with short-term horizons prefer to choose "exit" as a mechanism to govern firms. Duan and Jiao (2016) argue that institutional shareholders with short-term investment horizons do not have incentives to actively participate in direct intervention because direct intervention through "voice" is not aligned with their short-term investment horizons. However, Stathopoulos and Voulgaris (2016) find that institutional shareholders with short-term investment horizons actively vote when monitoring costs are low. Thus, if compensation is excessive in that it incentivises short-term profits at the expense of long-term profits, then institutional shareholders with short-term investment horizons vote, and possibly against ISS recommendations.

#### *2.2.2.3 The economic consequences of institutional shareholder governance*

Studies on whether institutional shareholder governance can create value provide conflicting results. Appel et al. (2016) and Edmans and Holderness (2017) find that once institutional shareholders can "voice" their opinion in voting, they significantly influence and discipline managers. Harris and Raviv (2010) find that institutional shareholder governance ensures

managers do their best to maximise shareholder value. In terms of market returns, Cuñat et al. (2016) use a discontinuity regression design and find that informed institutional shareholders' Say-on-Pay proposals, if passed by voters, lead, on average, to a 5% increase in share value as well as improvements in long-term profitability.

However, other research shows that institutional shareholders' direct intervention through "voice" does not significantly affect firm value. Karpoff et al. (1996) find no improvement in operating returns after an institutional shareholder proposal gains majority support in a meeting. They also find that the stock market reaction to shareholder proposals is negligible. Like them, Gillan and Starks (2000) find that the stock market reaction is typically small regarding shareholder activism. But market reactions are stronger if proposals are led by informed institutional shareholders., Gillan and Starks (2000) find that institutional shareholders' proposals generally have more voting support and better market reactions than individual shareholders. Gantchev et al. (2019) find that, on average, institutional shareholder proposals are value-enhancing and informed.

### 2.2.3 Proxy advisors

#### *2.2.3.1 How can institutional shareholders provide a meaningful "voice"?*

Adequate, accurate, and up-to-date information is paramount for shareholders when using corporate governance mechanisms to discipline managers (Hopt, 1998). Poorly informed shareholders clearly cannot have a meaningful say on firm issues (Ferran, 2003). Bainbridge (2008) argues that a lack of real-time information about a firm is the core reason shareholders cannot make knowledgeable decisions. Thus, how shareholders can effectively obtain sufficient information before making any decision has been questioned by scholars. Two

channels exist through which shareholders can obtain information to make an informed vote: do their own research or seek advice from a proxy advisor.

Ertimur et al. (2013) argue that shareholders may do their research, such as generally justifying corporate issues by comparing a firm to industry averages or obtaining related information from financial press reports. However, it may be too costly for some shareholders (e.g., institutional shareholders) to research every company they hold in their portfolio (Malenko and Malenko, 2019). If shareholders do not have enough information to make a judgement, they can follow proxy advisors' recommendations (Ertimur et al., 2013, Hayne and Vance, 2019). In practice, Iliev and Lowry (2015) find that nearly every institutional shareholder relies on proxy advisors to obtain some information, indicating proxy advisors play a vital role in informing shareholders. More details on this issue are discussed in the following sections.

#### *2.2.3.2 The role and influence of proxy advisors*

The literature argues that shareholders benefit from proxy advisors' research and recommendations on how to vote at annual general meetings (AGMs) to better govern a firm or fulfil its fiduciary duty. Since a considerable amount of expertise in proxy advisor firms is used to collect, monitor and analyse reliable information efficiently (Ertimur et al., 2013), such firms are better able to examine firm governance issues and provide recommendations for shareholders (Larcker and Tayan, 2011). This initiative prompted a demand for proxy advisory services because it is unrealistic for institutional shareholders to investigate all firms in their portfolios (Malenko and Malenko, 2019). There are five proxy advisor firms in the U.S., with Institutional Shareholder Services (ISS, the largest) and Glass Lewis occupying 97% of the market (Copland et al., 2018). Proxy advisors have recently experienced significant growth. In

2016, ISS served 1600 institutional clients (Malenko and Shen, 2016), which more than doubled to 3400 in 2022[4]. The literature on the impact of proxy advisors on shareholder voting has also grown significantly (Alexander et al., 2010, Ertimur et al., 2013, Larcker et al., 2015, Malenko and Shen, 2016). The consistent finding is that proxy advisors' recommendations are a key determinant of voting outcomes.

Regarding how proxy advisors influence shareholders, Ertimur et al. (2013) argue that proxy advisors act as an information intermediary that processes tremendous volumes of information to provide recommendations on behalf of shareholders. As some institutional shareholders are relatively passive or do not have sufficient resources, purchasing proxy advisors' reports is less costly than doing the research themselves. Larcker et al. (2015) argue that most "general" shareholders own a small fraction of total shares but receive a small fraction of the benefits from voting. However, if they wish to vote, they must bear the entire cost related to the vote. Since a considerable amount of expertise in proxy advisor firms is used to collect, monitor and analyse reliable information efficiently (Ertimur et al., 2013), these firms are better able to examine firm governance issues and provide recommendations to institutional shareholders (Larcker and Tayan, 2011).

#### *2.2.3.3 The debate on ISS efficiency*

Despite the fact that ISS recommendations being established to benefit shareholders is still debatable. First, ISS uses standard approaches to evaluate all governance events through a "one-size-fits-all" methodology. These inflexible methods do not consider firm-specific

[4] See About ISS, https://www.issgovernance.com/about/about-iss/

conditions (Larcker and Tayan, 2011). As discussed above, boards modify their compensation policies under the same rules to avoid negative recommendations by proxy advisors, significantly increasing the homogenisation of executive compensation policies. Under this pressure, boards lose the necessary discretion to consider firm-specific conditions (Hayne and Vance, 2019). In addition, the criteria used to make recommendations lack transparency, which makes it harder for shareholders to verify their quality (McCahery et al., 2016). Based on these arguments, proxy advisors' recommendations may decrease shareholders' value because their quality is variable.

Secondly, there is a possible conflict of interest in that ISS can simultaneously provide two relevant services: ISS advises firms on how to improve their corporate governance while making voting recommendations (McCahery et al., 2016). Larcker and Tayan (2011) and Yermack (1993) argue that providing these two services may lead to a conflict of interest. In response, ISS states that it has established firewalls that successfully separate the two services and limit potential conflicts of interest (McCahery et al., 2016). According to a recent survey by Hayne and Vance (2019), although firm executives recognise that a conflict of interest exists, they do not believe this conflict negatively affects proxy advisors' recommendations. Hayne and Vance (2019) argue that potential conflicts of interest might not be the primary concern for shareholders because the benefits of following ISS recommendations may outweigh the drawbacks of such potential conflicts of interest.

Aware of these potential deficiencies, the SEC has discussed and taken several actions to clarify proxy advisors' responsibilities and provide guidance to institutional shareholders on using a proxy advisor. For example, in 2014, SEC provided guidelines on proxy voting responsibilities

in dealing with conflicts of interest in Staff Legal Bulletin 20[5]. On November 5, 2019, SEC voted on and approved the Proposed Amendments[6] to the rules for proxy voting. These vital amendments introduced more mandatory requirements for proxy advisors, such as a stricter disclosure of any conflict of interest.

Although regulators and academia have cast doubt on the efficiency of ISS recommendations, research by Albuquerque et al. (2020) shows that ISS recommendations are informative about the quality of firms' executive compensation packages. Specifically, they find that ISS "Against" recommendations have identified suboptimal executive compensation practices. For instance, firms that received ISS "Against" recommendations in the current fiscal year are associated with worse accounting performance in the following fiscal years. Their investigation further finds that the association between ISS "Against" recommendations and firms' worse future accounting performance is not affected by shareholders' voting results for Say-on-Pay. Albuquerque et al. (2020) conclude that ISS recommendations may be value-adding to shareholders in executive compensation. Nearly all disagreements occur when ISS recommends "Against", and shareholders vote "For"; this chapter aims to answer why shareholders vote in contrast to ISS.

### 2.2.4 The components of compensation contracts

Say-on-Pay mandates institutional shareholders to vote on executive compensation. Thus investigating the role the different compensation components play in determining

[5]SEC Staff Legal Bulletin (SLB) No. 20, "Proxy Voting: Proxy Voting Responsibilities of Investment Advisers and Availability of Exemptions from the Proxy Rules for Proxy Advisory Firms".
See https://www.sec.gov/interps/legal/cfslb20.htm
[6]SEC, *Amendments to Exemptions from the Proxy Rules for Proxy Voting Advice*, 17 CFR Part 240.
See https://www.sec.gov/rules/proposed/2019/34-87457.pdf

disagreements is essential because each compensation component aligns with long- and short-term institutional shareholders differently. In this chapter, I investigate whether disagreements are associated with salary, bonus, option grants or stock grants in compensation packages.

#### *2.2.4.1 Cash component of compensation contracts*

To attract high-quality executives, firms must pay higher compensation, including sufficient cash (Banker et al., 2013). However, theory indicates that excessive cash may lead to managerial opportunism (Dechow et al., 2008), which causes agency problems and adversely affects firms' long-term performance (Jung et al., 2012). Since cash compensation rewards executives' current performance (Watts, 2003), executives have incentives to boost firms' short-term profit to maximise their salary/bonus in the short-run, such as using earnings management (Holthausen et al., 1995, Healy, 1985, Jung et al., 2012). Berrone and Gomez-Mejia (2009) find that firms with higher cash compensation are more prone to accounting manipulation than those with more equity compensation. Iatridis (2018) finds that executive cash compensation is negatively related to firm value in the long-term but positively associated with firms' short-term growth rate, such as a higher one-year lagged operating income. Iatridis (2018) also reveals that cash compensation is positively associated with discretionary accruals, revealing that firms that pay more cash engage in earnings manipulation, leading to a higher short-term growth rate.

As discussed earlier, long-term institutional shareholders have a long-run orientation for governing firms, as they expect to receive stable dividend income and capital appreciation in the future (Bushee and Noe, 2000). Thus, if firms pay excessive cash to executives that incentivise managerial opportunism (Dechow et al., 2008), long-term institutional shareholders

vote “No” since it is harmful to firms’ long-term development. However, short-term institutional shareholders have the desire and expertise to gain short-term profits through regular trading (Brockman and Yan, 2009). As excessive cash payments incentivise executives to boost firms’ short-term profit (Iatridis, 2018), short-term institutional shareholders may vote “Yes” to compensation packages that better align with their short-term interests.

#### *2.2.4.2 Equity components in compensation contracts*

To motivate executives to make long-term value-enhancing decisions and mitigate agency problems, firms must provide compensation contracts that link to firms’ long-term performance (Fudenberg et al., 1990, Yermack, 1995). Theory suggests that equity compensation, including option and stock grants, provides these incentives (Smith Jr and Watts, 1982). Since rewards provided by equity compensation are forfeitable, it increases the cost for executives who leave the firm. Unless executives realise their reward in the stock market (e.g., sell equity grants when the vesting period is due), firm value and executives’ wealth are directly linked (Leone et al., 2006).

An extensive literature review finds evidence that equity compensation incentivises executives to maximise firm value by investing more in value-enhancing and risky projects (Gormley et al., 2013, Guay, 1999, Armstrong and Vashishtha, 2012). A few examples include Guay (1999), who finds that equity compensation is positively associated with firms’ investment opportunities, indicating executives receive incentives to choose more risky investments. Further, Armstrong and Vashishtha (2012) find that equity compensation provides CEOs with strong incentives to increase firm value by taking more systematic risks, which links to higher stock returns.

Although option and stock grants incentivise executives to take more risk, options lead executives to choose investment projects with higher risk levels. Since option payoffs are nonlinear and convex, they provide zero payoffs to executives if they do not meet the performance threshold but unlimited payoffs above the threshold (Bettis et al., 2018). Shue and Townsend (2017) find that larger option grants are significantly related to higher stock volatility, revealing that executives take more risks in choosing investment projects. For stock grants, the literature indicates that they restrict executives from choosing overly risky investments because they expose the executives to downside risk (Basuroy et al., 2014, Mehran, 1995). Consequently, as Ryan Jr and Wiggins III (2001) show, firms with higher stock grants have more stable but relatively lower performance because investments with less risk simultaneously reduce firms' risk and return.

In general, long-term institutional shareholders may favour equity compensation as it aligns with executives' wealth and firm value in the longer term (Armstrong and Vashishtha, 2012). However, unlike stock grants that expose executives to downside risk, option grants encourage executives to take on riskier projects that increase uncertainty in firms (Fich and Shivdasani, 2005). Therefore, long-term institutional shareholders may favour stock grants in compensation packages as they link to a more stable future performance. Regarding short-term institutional shareholders, the literature finds that they have preferences and specialties in trading firms with more uncertainty (Yan and Zhang, 2009) because they could build up profitable trading strategies on such firms. Since option grants incentivise executives to engage in risker projects that bring more uncertainty, short-term institutional shareholders may prefer compensation contracts that increase firms' volatility.

### 2.2.5 The disagreement between ISS and institutional shareholders

#### *2.2.5.1 Should institutional shareholders follow ISS?*

Given that most institutional shareholders rely on some form of proxy advisory service (Iliev and Lowry, 2015), it is reasonable to infer that they benefit from proxy advisors' recommendations to govern a firm better or fulfil their fiduciary duties. In general, institutional shareholders do not have unlimited resources to collect information, so purchasing proxy advisors' reports is cost-effective. Albuquerque et al. (2020) find that following ISS recommendations benefit institutional shareholders because the "Against" recommendations identify firms' low-quality compensation practices. From this perspective, it is expected that institutional shareholders should follow ISS recommendations. However, this does not explain why we continue to observe annual disagreements between ISS recommendations and shareholders.

#### *2.2.5.2 Is institutional shareholder investment horizon the cause of disagreement?*

An important factor that could potentially cause institutional shareholders to vote against ISS recommendations is the time horizon of their investment, as it alters institutional shareholders' willingness to govern a firm directly and subsequent reliance on ISS recommendations. As discussed in section 2.2.2.2, shareholder voting is a vital part of corporate governance (monitoring); studies find that shareholder voting is meaningful for firms (Bach and Metzger, 2019). However, the literature suggests that variation in the investment horizons of institutional shareholders can significantly affect their willingness to engage in monitoring a firm; some prefer to "voice" while others choose to "exit" (Bushee, 1998, Gaspar et al., 2005, Duan and Jiao, 2016, Ghaly et al., 2020). Variations in the investment horizon could be caused by different trading strategies (Gaspar et al., 2005), the maturity of their liabilities (Ghaly et al.,

2020) and economies of scale in collecting firm-specific information (Stathopoulos and Voulgaris, 2016).

The literature asserts that long-term institutional shareholders positively engage in firms' governance through “voice”, whereas short-term institutional shareholders have less desire to monitor firms in the long run and, therefore, prefer to “exit” (Duan and Jiao, 2016, Gillan and Starks, 2000, Pathan et al., 2021). By choosing “voice” or “exit”, institutional shareholders must make a cost-benefit trade-off, accepting monitoring costs only if the forthcoming benefits outweigh those costs (Kahn and Winton, 1998, Shleifer and Vishny, 1986). As a result, the trade-off for monitoring by long-term and short-term shareholders hinges on whether the benefits of following ISS recommendations outweigh the costs of independent research. More discussion of this channel follows.

#### *2.2.5.3 Short-term institutional shareholders and ISS recommendations*

The literature shows that short-term institutional shareholders with high portfolio turnover and highly diversified portfolio holdings rationally avoid direct monitoring (i.e., “voice”/vote) to minimise costs. Instead, they use their information advantage to gain short-term profits through regular trading (Brockman and Yan, 2009). For example, Yan and Zhang (2009) find that the percentage of short-term institutional shareholders’ ownership in a firm has a more substantial predictive power for returns of small, growth firms, indicating short-term institutional shareholders have expertise in trading firms that face more uncertainty. With this short-term orientation, studies provide different predictions for whether short-term institutional shareholders will follow ISS recommendations (Duan and Jiao, 2016, Iliev and Lowry, 2015, Malenko and Shen, 2016, Bushee, 2001).

On the one hand, short-term institutional shareholders prefer to "exit" a firm rather than engage in direct intervention through "voice". Given that it is costly to gather sufficient information to make an informed decision, Duan and Jiao (2016) argue that short-term institutional shareholders simply follow ISS's recommendations. Malenko and Shen (2016) argue that short-term institutional shareholders can benefit from following ISS recommendations to defend themselves from potential criticism, such as whether they vote in their clients' best interests in AGMs. That is because, in 2003 SEC Rule 206(4)-6, it is clearly stated that an institution "*could demonstrate that the vote was not a product of a conflict of interest if it voted client securities in accordance with a pre-determined policy, based upon the recommendations of an independent third party.*"[7] Both Iliev and Lowry (2015) and Malenko and Shen (2016) find evidence that ISS recommendations are more influential for institutional shareholders with higher portfolio turnover and smaller positions. However, those studies investigate short-term institutional shareholders' voting generally; that is, no distinction is made for the different compensation components that create distinct incentives and interests.

Evidence suggests that short-term institutional shareholders are keen on proposals that boost a firm's short-term returns. For example, Bushee (2001) finds that short-term institutional investors exhibit preferences for near-term earnings over long-term value, evidenced by a positive/negative association between short-term institutional investors' ownership level and firms' near-term/long-term earnings. His finding supports the argument that short-term institutional investors are myopic because they overemphasise short-term earnings potential

[7] See https://www.sec.gov/rules/final/ia-2106.htm

and undervalue a firm's long-term earnings potential. Thus, short-term institutional shareholders can vote differently from ISS due to the difference in investment horizon focus.

#### *2.2.5.4 Long-term institutional shareholders and ISS recommendation*

Given that long-term institutional shareholders have stable and concentrated ownership, they have a stronger desire to monitor firms (McCahery et al., 2016, Doidge and Dyck, 2015). They can distribute or amortise their monitoring costs over the long term, which is compensated for by receiving a long-term stable dividend income and capital appreciation (Bushee and Noe, 2000). To cast a meaningful vote, long-term institutional shareholders require high-quality information, which can come from purchasing a report from proxy advisors or doing their research (Iliev and Lowry, 2015).

The key benefit for institutional shareholders in using ISS proxy services is cost reduction. As discussed earlier, it is cost-effective to outsource the heavy work of collecting, processing and analysing information to experts in ISS (Malenko and Malenko, 2019). However, theory and empirical results suggest that it is more likely long-term shareholders will conduct their research to prepare for proxy voting rather than relying on ISS recommendations (Iliev and Lowry, 2015, Ertimur et al., 2013, Larcker et al., 2015, Malenko and Shen, 2016). The reasons are twofold. First, long-term institutional shareholders can reduce their research costs in the long run by spreading that cost through their wider asset base. The information they process in the current fiscal year could be relevant for several years. In summary, by benefiting from a longer investment horizon, long-term institutional shareholders can significantly reduce their research costs in the long run (Iliev and Lowry, 2015).

Secondly, long-term institutional shareholders could have more precise information than ISS. Benefiting from a longer investment horizon, long-term institutional shareholders can gather unique private information from individual firms. This unique information could be more precise than ISS recommendations, especially if the latter has a "one-size-fits-all" methodology. Empirical studies provide some support for this argument. Ertimur et al. (2013) and Larcker et al. (2015) find that the sensitivity between shareholder voting results and ISS recommendations is weaker for long-term institutional shareholders with a longer investment horizon and a large block of shares. Malenko and Shen (2016) argue that this evidence indicates long-term institutional shareholders are more willing to do their research; their vote is thus less likely to be correlated with ISS recommendations.

## 2.3 Hypothesis development

Institutional shareholders rely on proxy advisors' recommendations to vote in firms' AGMs to fulfil their fiduciary responsibility. By following ISS recommendations, institutional shareholders save the cost of conducting their research. Thus there should be fewer disagreements when voting on Say-on-Pay. However, given that disagreements are observed between ISS and shareholders, I argue that, as elaborated in section 2.2.4.2, institutional shareholders' investment horizon could be the determining factor that explains such disagreements. Say-on-Pay provides an appropriate vehicle to investigate the effect of the institutional shareholders' investment horizon on disagreements because voting is mandatory. It is reasonable to expect all parties to vote congruently for executive compensation, favourably, if appropriate, and unfavourably, if not. However, if parties evaluate compensation contracts differently, they may have different opinions on what is appropriate or inappropriate, driving disagreements.

To avoid monitoring costs, short-term institutional shareholders generally follow ISS. The literature reveals, however, that compensation contracts with higher option grants lead to higher volatility (Fich and Shivdasani, 2005) and that a more significant cash component (i.e., salary and bonus) leads to higher short-term returns (Iatridis, 2018). If these components benefit short-term institutional shareholders, they will vote "Yes" on compensation contracts that include such components, even if they are excessive and harm firms' sustainable development (Bushee, 2001, Graham et al., 2005). Conversely, ISS is likely to recommend an "Against" vote, leading to a disagreement. Based on this argument, the following hypothesis is proposed:

$H_1$: *Disagreements between shareholders and ISS are positively related to the proportion of short-term institutional shareholders' ownership when compensation packages contain excessive option grants and/or cash*.

As long-term dividends and capital appreciation compensate long-term institutional shareholders, they have a stronger incentive to monitor firms (Bushee and Noe, 2000, Gillan and Starks, 2000). To do so, long-term institutional shareholders conduct independent research to prepare for the AGM voting rather than indiscriminately following ISS recommendations. They can spread the cost through their broader asset base and reuse the information collected from one year to the next. Meanwhile, benefiting from a long holding period, long-term institutional shareholders could obtain unique private information from individual firms (Iliev and Lowry, 2015, Malenko and Shen, 2016). If long-term institutional shareholders vote based on their firm-specific information collected from independent research, then their decisions are expected to be independent of ISS recommendations. Therefore, long-term institutional shareholders' voting patterns will be uncorrelated with disagreements.

## 2.4 Research methods

### 2.4.1 Sample and data

I begin by collecting data from the ISS Voting Analytics database, which covers all Say-on-Pay voting outcomes from 2011 - 2020. The year 2011 was chosen as the start because it was the implementation year of the Dodd-Frank Consumer Protection Act. The data from the ISS Voting Analytics database is then combined with the Compustat Executive Compensation information, which covers executive compensation, firm fundamentals and stock ownership variables. Around 52% of observations from the voting database have been discarded because of unmatched results. Variables for institutional shareholder investment horizons have been generated from the Thomson Reuters Institutional Holdings (13F) database and merged with the previous dataset, with another 10% of observations being dropped. Finally, firm governance variables were generated from the Thomson Reuters Insider Filing, resulting in about 32% of the observations being dropped. The final sample has 10,004 firm-year observations. (See Table 2-1). Although shareholders vote for one bundle of compensation plans for all named executives, including the CEO, I follow prior studies and concentrate on CEO compensation because it is the most visible (Alissa, 2015, Kimbro and Xu, 2016, Collins et al., 2019)

In the sample, there are 9,069 observations (or 90.65%) where ISS has recommended a “For” vote and 9,055 observations (or 99.84%) where shareholders have followed ISS recommendation, whereas 725 votes (or 77.54%) of shareholders voted to “Pass” the vote when ISS recommended “Against”.

**Table 2-1 Sample selection process**

This Table describes each step in my sample selection procedure and the number of observations dropped from 2011 to 2020.

| Sample description | Number of observations |
|---|---|
| Observation covered by ISS Voting Analytics | 34086 |
| Less: | |
| Observation not covered by Execucomp and Compustat | -17399 |
| Observation not covered by Thomson Reuters Stock Ownership | -252 |
| Observation not covered by Thomson Reuters Institutional Holdings (13F) | -1604 |
| Observation not covered by CRSP and Thomson Reuters Insider Filing | -4827 |
| Final sample | 10004 |

The results show that disagreements between shareholders and ISS mostly occur when ISS recommends an "Against" vote and shareholders vote "Yes". Table 2-2 summarises these findings.

**Table 2-2 A summary of shareholder voting outcomes and ISS recommendations**

This Table summarises the shareholder voting outcomes and ISS recommendations in the sample from 2011 to 2020.

| | | Shareholder vote | | *Total* |
|---|---|---|---|---|
| | | Yes | No | |
| ISS recommendation | Against | 210 | 725 | *935* |
| | For | 9055 | 14 | *9069* |
| *Total* | | *9265* | *739* | *10004* |

### 2.4.2 The measure of disagreement between shareholder voting outcomes and ISS recommendations

To study the differences in voting behaviour between shareholders and ISS, I create a dummy variable "DISAGREE_D" equal to one if shareholders do not follow the ISS recommendation and zero otherwise. There are 739 firm-year observations coded one (treatment group), and

9,265 firm-year observations coded zero (control group). The 739 firm-year observations comprise the 725 cases that ISS recommended "Against" but shareholders voted "Yes" and 14 cases that ISS recommended "For" but shareholders voted "No". Table 2-3 summarises the main dummy variables in this study.

**Table 2-3 A summary of the dummy variables by definition and firm-year observation**

This Table summarises the firm-year observations of the DISAGREE_D dummy.

| Dummy | DISAGREE_D =1 | DISAGREE_D = 0 | *Total* |
|---|---|---|---|
| Disagree | 739<br>Shareholders do not follow ISS recommendation | 9265<br>Shareholders follow ISS recommendation | *10004* |

### 2.4.3 The measure of institutional shareholders' investment horizon

To test the effect that the institutional shareholder investment horizon has on the disagreement, I follow the literature (Gaspar et al., 2005, Stathopoulos and Voulgaris, 2016, Kim et al., 2019a, Nguyen et al., 2020, Pathan et al., 2021), and construct an investor turnover ratio to measure the investment horizon. The rationale for using the turnover ratio is that short-term institutional shareholders trade (rotate or churn) their shares more frequently than long-term institutional shareholders. Thus, the rotation (churn) of short-term institutional shareholders' portfolios is higher than their long-term counterparts. Specifically, I calculate each institutional shareholder's quarterly churn rate (CR) using the Thomson Reuters 13f Holdings database (Gaspar et al., 2005), which measures how frequently an institutional shareholder rotates its shares. The formula is:

$$CR_{i,t} = \frac{\sum_{j=1}^{Q_t} |N_{j,i,t}P_{j,t} - N_{j,i,t-1}P_{j,t-1} - N_{j,i,t-1}\Delta P_{j,t}|}{\sum_{j=1}^{Q_t} 0.5(N_{j,i,t}P_{j,t} + N_{j,i,t-1}P_{j,t-1})} \quad (1)$$

Where: $CR_{i,t}$ is the churn ratio for institutional shareholder $i$ in quarter $t$; $Q_t$ is the set of companies held by institutional shareholder $i$ in quarter $t$; $N_{j,i,t}$ is the number of shares of company $j$ held by institutional shareholder $i$ in quarter $t$; $P_{j,t}$ is the share price of company $j$; and $\Delta$ is the quarterly change operator. To generate a more accurate and stable measurement of the CR, following Cline et al. (2020) and Kim et al. (2019a), I calculate a quarterly average of the CR over the previous three quarters ($t$-3, $t$) for each institutional shareholder. The formula is:

$$Average\ CR_{i,t} = (\frac{1}{4}\sum_{r=0}^{3} CR_{i,t-r}) \quad (2)$$

I then define the investor turnover (INV_TURN) of company $j$ as the weighted average of the total portfolio churn rates of its institutional shareholders at time $t$ ($S_{j,t}$) as:

$$INV\_TURN_{j,t} = \sum_{i \in S_{j,t}} w_{j,i,t} \times (Average\ CR_{i,t}) \quad (3)$$

where: $S$ is the set of institutional shareholders in company $j$, and $w_{j.i,t}$ is the proportion of institutional shareholder $i$'s ownership. I then match the INV_TURN to the relevant company's voting outcomes for each fiscal year in the sample.

Following Gaspar et al. (2005), Yan and Zhang (2009), Kim et al. (2019a) and Döring et al. (2021), I calculate additional proxies for institutional shareholders' investment horizons by measuring the absolute level of ownership between long-term and short-term investors in a firm. First, I sort institutional shareholders based on their churn rate (CR). Secondly, I categorise institutional shareholders as short-term (SHORT) if they rank within the top half

(50%) in the CR ranking and long-term (LONG) if they rank within the bottom half (50%). I then calculate short-term (long-term) institutional shareholding ST_OWN (LT_OWN) by dividing the SHORT (LONG) proportion into the total outstanding shares.

### 2.4.4 The measurement of the different components of compensation packages

To test the effects of the institutional shareholder investment horizon on the disagreement conditional on the different compensation components, I generate several test variables. Following Humphery-Jenner et al. (2016) and Tosun (2020), I calculate the proportion of total annual CEO compensation that comes from option grants, stocks grants, salary and bonus payments. Then, I follow Stathopoulos and Voulgaris (2016) and define the payment/intensity as excessive if in the top 10% of each component in the whole Compustat dataset to limit the effect of possible missing data from other variables during the merge of datasets. Specifically, in the same Compustat dataset, I generate the dummy variables OPTION_TOP_D, STOCK_TOP_D, SALARY_TOP_D and BONUS_TOP_D equal to one for firms in the top 10% intensity of CEO option grants, stock grants, salary and bonus payment individually (Stathopoulos and Voulgaris, 2016), and zero otherwise. Then I combine these variables with my sample.

### 2.4.5 Baseline methods

I employ logit regression to empirically test my hypothesis. In Model (1), I test whether long-term and short-term institutional shareholders generally follow ISS recommendations. The dependent variable "DISAGREE_D" (equals one if shareholders do not follow ISS recommendations, zero otherwise) is regressed on "LT_OWN" and "ST_OWN", along with a series of control variables discussed in the following section. Model (3) is:

$$\Pr\,(DISAGREE\_D)_{i,t} = \beta_0 + \beta_1(LT\_OWN)_{i,t} + \beta_2(ST\_OWN)_{i,t} + \gamma * Controls_{i,t} + \varepsilon_{i,t} \quad (3)$$

Year and industry fixed effects are used in this Model to control for time-invariant and industry-invariant unobservable individual characteristics that could be correlated with the independent variable. In this essay, ten dummy variables have been generated for each year from 2011 to 2020 and for each industry based on the Fama-French 48 industrial classifications. All standard errors are clustered by industry.

To test my hypothesis, I interact my main test variables "LT_OWN" and "ST_OWN" with the dummy variables OPTION_TOP_D, STOCK_TOP_D, SALARY_TOP_D and BONUS_TOP_D in Model (1). The coefficients of the interaction terms are our interest. All control variables, year and industry fixed effects remain unchanged. Model (4) is:

$$\Pr\,(DISAGREE\_D)_{i,t} = \beta_0 + \beta_1(LT\_OWN)_{i,t} + \beta_2(ST\_OWN)_{i,t} + \beta_3\big(TOP\_D_{i,t} * LT\_OWN\big)_{i,t} + \beta_4\big(TOP\_D_{i,t} * ST\_OWN\big)_{i,t} + \gamma * Controls_{i,t} + \varepsilon_{i,t} \quad (4)$$

Based on prior research, I control CEO compensation, firm accounting and share market returns and risk, corporate governance, and other firm characteristics. Except for the dummy variables, to ameliorate adverse effects from outliers, I winsorize all dependent and independent variables at the first and ninety-ninth percentiles. In Appendix A, I provide all definitions and necessary calculation methods.

Following Stathopoulos and Voulgaris (2016), I control for CEO total compensation (LN_TDC1) because it is the primary concern of shareholders in Say-on-Pay that might drive the disagreement. Given that equity-based incentive (e.g., stock options and restricted stock) are extensively applied as a method of compensation (Mehran, 1995), following Humphery-Jenner et al. (2016) and Tosun (2020), I control the proportion of total annual CEO compensation that comes from option grants (OPTION_INTENSITY) and stocks (STOCK_INTENSITY), and the non-incentive proportion of cash (CASH_INTENSITY).

According to Kimbro and Xu (2016), shareholders are more likely to approve the compensation plan if there is a strong accounting performance before voting. Thus, I control for accounting performance measured as return on assets (ROA). Based on previous research, I control for the share return (RETURN) and share return volatility (VOLATILITY) over the 12 months before the vote (Kimbro and Xu, 2016, Collins et al., 2019). Following Döring et al. (2021), I control for share liquidity (STURNOVER), because liquidity may affect institutional shareholders' ability to govern firms through "Exit" or "Voice" (Duan and Jiao, 2016).

Following Collins et al. (2019), I control for top five executive ownership (EXECUTIVE_SHAREOWN) and independent directors on the board (INDEPENDENT_DIRECTOR) to address firm governance. Collins et al. (2019) find that a powerful CEO reduce Say-on-Pay favourable support. Thus, I include a dummy variable (CEO_CHAIRMAN) equal to one if the CEO is also the board's chairman and zero otherwise (Kimbro and Xu, 2016). Following Bebchuk and Fried (2005), I construct an Entrenchment index (E_INDEX) to measure the managers' entrenchment level. The E-index is made up of six firm provisions with one point each for the staggered board, limits to amend bylaws, limits to amend charter, supermajority, golden parachutes and poison pill. A higher number represents weaker shareholder power or more entrenched managers.

Given that Ertimur et al. (2013) find that shareholders are more likely to vote "Against" smaller firms, I control for firm size (LOG_ASSET), measured as the log of total assets. I also control for firm leverage (LEVERAGE) and market-to-book ratio (MB) because Collins et al. (2019) find that leverage is negatively related to voting results, while market-to-book is positively associated with voting results. Cash (CASH_AT), research and development expenditure (RD_AT) and capital expenditure (CAPEX_AT) are included because Brunarski et al. (2015) argue that CEOs may window-dress the performance (i.e., through these variables) to gain more support from Say-on-Pay, and find that these variables are associated with Say-on-Pay results. Cash, research and development expenditure and capital expenditure are scaled by the firm's total assets. To avoid reducing the sample size, I generate a dummy variable, RD_D, which equals one if R&D expense is reported in Compustat and zero otherwise (Canil and Karpavičius, 2020).

### 2.4.6 Identification tests

Even though I include a strand of control variables cited in previous related research in the baseline estimation, it is still possible that the study suffers from a missing variable bias. Furthermore, firms with disagreements between ISS and shareholders might be substantially different from firms that do not have disagreements, which raises the concern of selection bias. To ensure results in this chapter are not spurious, I use several methods to mitigate these possible endogeneity issues: a two-stage estimation with instrumental variables, falsification tests and entropy balancing.

#### *2.4.6.1 Two-stage estimation with instrumental variables*

I apply an instrumental variable (IV) in a two-stage least-squares (2SLS) to mitigate missing variable bias. This method aims to capture variations in institutional shareholder investment horizons exogenous to the Disagreement. I choose the annual growth of advertising expense (AD_GROWTH) as the instrumental variable.

Lou (2014) argues that a firm's advertising expense could boost its short-term value since it can increase temporary sales growth. As a result of the increased advertising expense, the stock price might experience a contemporaneous rise, which might appeal to short-term institutional shareholders. But, the increase in the firm's advertising expense is unlikely to be connected to disagreements between ISS recommendations and shareholders' voting results. Thus, the growth of a firm's advertising expense is plausibly and exogenously driving the institutional shareholder's investment horizon, but not the disagreement, which makes it a good IV to test the direction of causal relationships.

#### *2.4.6.2 Falsification test*

In the spirit of La Ferrara et al. (2012), Liu and Lu (2015) and Döring et al. (2021), I conduct a falsification test based on the baseline Model (2) to further address missing variable bias. The rationale for the falsification test is that if missing time-variant variables are driving the expected association between institutional shareholder investment horizons (test variable) and disagreements over time, then I should observe a significant relationship even in a falsification test. In other words, if the association in the baseline Model is spurious and missing variable(s) are the cause, I would still observe significant results even if I modify the test variable.

To conduct the falsification test, I randomly select values of the interaction term (TOP_D*ST_OWN) from my sample distribution within each firm over the whole period. I then randomly draw values to replace each firm's actual value of the interaction term. In these tests, the sequence of the interaction term is changed within each firm, but the distribution of the randomly drawn values remains the same as the real one. In my simulations, I repeat this procedure of randomly selecting and replacing the value of the interaction term and estimating my baseline Model 1000 times.

In summary, if the association found in the baseline Model is causal, I should expect the coefficients estimated in the falsification tests to follow a normal distribution with a mean value close to zero (La Ferrara et al., 2012).

#### *2.4.6.3 Entropy balancing (EB)*

To systematically address possible covariate imbalance (selection bias) in the two groups of the DISAGREE_D, I use entropy balancing (EB) as developed by Hainmueller (2012). Entropy balancing is a multivariate matching procedure that calculates weights for each observation in the control group to equalise the mean, variance and skewness of selected characteristic variables across treatment and control groups (Hainmueller, 2012, Hainmueller and Xu, 2013). I rerun my analysis on the weighted sample.

In the literature, most (McMullin and Schonberger, 2020, Faccio and HSU, 2017) use propensity score matching (PSM) to conduct a multivariate matching procedure. EB offers three conceptual advantages over PSM. First, EB applies different methods to assign weights to observations in the control group. PSM chooses the most similar observation from the control group to match with the treatment group based on the propensity score, whereas EB assigns continuous weights to observations in the control group. Thus, EB ensures the variance and skewness of covariate distributions are similar in both treated and controlled observations. Because of this advantage, most observations in the control group are saved and used to match observations in the treated group (McMullin and Schonberger, 2020). The second advantage is that EB requires researchers to set only one tolerance level for the convergence of the algorithm, which can significantly reduce research discretion (Shipman et al., 2017). For example, tolerance levels are the only input set by researchers. However, in PSM, researchers are required to decide the relevant calliper level or whether to replace the observation or not. The third advantage is EB can limit idiosyncratic noise by allocating continuous weights to all observations in the control group, whereas PSM can assign integer weights only to observations that have been matched (McMullin and Schonberger, 2020).

## 2.5 Results

### 2.5.1 Descriptive statistics

The descriptive statistics are presented in Table 2-4. The results show that DISAGREE_D has a mean value of 0.08, representing 8% of the total voting on which ISS and shareholders disagree. The main test variables confirm that institutional shareholders in the sample have a low investor turnover; i.e., the majority are long-term institutional shareholders. The average for INV_TRUN is 0.12, indicating institutional shareholders hold their position for about 25 months (=12 months/ (0.12*4). This result is consistent with Gaspar et al. (2005), whose average holding period is 27 months. Based on the $50^{th}$ percentile, long-term institutional shareholders own 54% of the total outstanding shares, and short-term institutional shareholders 27%, consistent with recent studies by Cline et al. (2020) and Kim et al. (2019a).

As a measure of equity-based incentives, equity intensity (OPTION_INTENSITY + STOCK_INTENSITY) is generally consistent with Tosun (2020), around 0.53. Compared to Tosun (2020), OPTION_INTENSITY drops from 0.19 (Tosun (2020) sample) to 0.11 (my sample, while STOCK_INTENSITY increases from 0.36 (Tosun (2020) sample) to 0.4 (my sample). This result indicates that firms are granting more stock than options as equity-based incentives. On average, the CEO total compensation is $6.78 million, which is higher than the $6.06 million reported by Collins et al. (2019).

Firm characteristic variables are consistent with the recent study by (Behera et al., 2022). For example, in my sample, the mean ROA is 0.05, market to book ratio is 1.76, the cash holding is 0.1, and the leverage is 0.26. In the Behera et al. (2022) sample, the mean ROA is 0.05, the market-to-book ratio is 1.54, the cash holding is 0.1, and the leverage is 0.22. For corporate

governance variables, in my sample, the percentage of independent directors on the board is 81%, indicating that corporate governance's quality has recently increased. For example, in the study by Collins et al. (2019), the mean of percentage of independent directors on board is 73 % from 2011 to 2015. In terms of firm performance variables, my sample has a median share market return of 13%, consistent with Behera et al. (2022) finding (of 12.6%).

**Table 2-4 The descriptive statistics of the variables**
This Table provides the descriptive statistics for all variables over the sample period from 2011 to 2020.

| Variable | n | Mean | S.D. | Min | 0.25 | Mdn | 0.75 | Max |
|---|---|---|---|---|---|---|---|---|
| DISAGREE_D | 10004 | 0.08 | 0.27 | 0 | 0 | 0 | 0 | 1 |
| INV_TURN | 10004 | 0.12 | 0.03 | 0.03 | 0.1 | 0.12 | 0.14 | 0.22 |
| LT_OWN | 10004 | 0.54 | 0.12 | 0.1 | 0.46 | 0.54 | 0.62 | 0.83 |
| ST_OWN | 10004 | 0.27 | 0.1 | 0.04 | 0.2 | 0.26 | 0.33 | 0.56 |
| OPTION_TOP_D | 10004 | 0.1 | 0.3 | 0 | 0 | 0 | 0 | 1 |
| STOCK_TOP_D | 10004 | 0.11 | 0.32 | 0 | 0 | 0 | 0 | 1 |
| SALARY_TOP_D | 10004 | 0.05 | 0.22 | 0 | 0 | 0 | 0 | 1 |
| BONUS_TOP_D | 10004 | 0.06 | 0.25 | 0 | 0 | 0 | 0 | 1 |
| LN_TDC1 | 10004 | 8.5 | 0.86 | 5.85 | 7.98 | 8.56 | 9.11 | 10.25 |
| TDC1 | 10004 | 6.78 | 5.44 | 0.32 | 2.93 | 5.23 | 9.05 | 28.16 |
| STOCK_INTENSITY | 10004 | 0.4 | 0.26 | 0 | 0.2 | 0.44 | 0.6 | 0.93 |
| CASH_INTENSITY | 10004 | 0.23 | 0.19 | 0 | 0.11 | 0.17 | 0.27 | 0.99 |
| LOG_ASSET | 10004 | 8.21 | 1.63 | 4.52 | 7.03 | 8.04 | 9.23 | 12.75 |
| MB | 10004 | 1.76 | 1.4 | 0.17 | 0.91 | 1.35 | 2.1 | 8.74 |
| LEVERAGE | 10004 | 0.26 | 0.2 | 0 | 0.1 | 0.25 | 0.39 | 0.9 |
| CASH_AT | 10004 | 0.1 | 0.1 | 0 | 0.02 | 0.07 | 0.15 | 0.53 |
| RD_AT | 10004 | 0.02 | 0.05 | 0 | 0 | 0 | 0.02 | 0.35 |
| RD_MISSING_D | 10004 | 0.4 | 0.49 | 0 | 0 | 0 | 1 | 1 |
| CAPEX_AT | 10004 | 0.04 | 0.04 | 0 | 0.01 | 0.03 | 0.05 | 0.21 |
| ROA | 10004 | 0.05 | 0.07 | -0.32 | 0.02 | 0.05 | 0.09 | 0.26 |
| RETURN | 10004 | 0.16 | 0.39 | -0.66 | -0.07 | 0.13 | 0.32 | 1.97 |
| VOLATILITY | 10004 | 6.89 | 7.39 | 0.44 | 2.59 | 4.51 | 8.16 | 44.22 |
| STURNOVER | 10004 | 20096 | 35225 | 61 | 2040 | 6377 | 22069 | 210000 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| EXECUTIVE_SHAREOWN | 10004 | 0.03 | 0.05 | 0 | 0 | 0.01 | 0.03 | 0.31 |
| INDEPENDENT_DIRECTOR | 10004 | 0.81 | 0.1 | 0.55 | 0.75 | 0.83 | 0.89 | 0.93 |
| CEO_CHAIRMAN | 10004 | 0.45 | 0.5 | 0 | 0 | 0 | 1 | 1 |
| E_INDEX | 10004 | 2.99 | 1.13 | 1 | 2 | 3 | 4 | 5 |

### 2.5.2 The effect of institutional shareholder investment horizon on disagreements

I run logit regressions to test the effect of institutional shareholder investment horizons on disagreements between ISS recommendations and shareholder voting results after controlling for other relevant determinants as identified in recent research. The results are reported as Model (1) in Column 1, Table 2-5. I then test the association between institutional shareholder investment horizons on the disagreement condition against the different components of compensation packages. Table 2-5, Columns 2 to 5, show the baseline results for Model (2).

In Column 1, institutional shareholders have been classified into short- and long-term by a 50% percentile in churn ratio ranking and regressed on DISAGREE_D. Column 1 shows that the coefficient of LT_OWN is insignificant, which supports my prediction that long-term institutional shareholders do independent research to make decisions. However, the coefficient of ST_OWN is significantly negative at the 1% level, indicating institutional shareholder investment horizons are negatively associated with disagreements between ISS recommendations and shareholder voting results. This result reveals that short-term institutional shareholders generally follow ISS recommendations to avoid monitoring costs.

For Columns 2 to 5, I regress the long-/short-term institutional shareholders' ownership (50% percentile in churn ratio ranking) condition on firms with excessive option grants, stock grants, salary payments and bonus payments against the DISAGREE_D. Column 2 shows that the coefficient of the interaction term between short-term ownership (ST_OWN) and firms with excessive option grants is significantly positive at the 10% level. This result indicates disagreements are caused by short-term institutional shareholders when firms have excessive option grants in compensation packages. This result supports my hypothesis that short-term institutional shareholders vote against ISS recommendations if they believe the compensation package better aligns with their interests.

Column 4 shows a significant positive coefficient (at the 5% level) for the interaction term between ST_OWN and firms with high salary payments, indicating disagreements between short-term institutional shareholders and ISS occur when firms pay excessive salaries in compensation. The results in Column 4 also support my hypothesis that short-term institutional shareholders prefer compensation packages with excessive salary payments that provide more short-term incentives for executives to focus on boosting short-term profit (Iatridis, 2018). However, ISS recognise excessive salary payments may cause managerial short-termism that harms firms' long-term development, which leads to disagreements.

Column 5 shows that the coefficient is insignificant for the interaction term between ST_OWN and firms with excessive bonus payments, which is inconsistent with my hypothesis. In Column 3, the results show that the interaction coefficient between ST_OWN and firms with excessive stock grants is significantly negative at the 1% level, indicating short-term institutional shareholders have fewer disagreements with ISS when firms have excessive stock grants.

In Columns 2 to 5, the coefficients between long-term institutional shareholders and firms with excessive option/stock grants and salary/bonus payments are insignificant, indicating long-term ownership does not lead to disagreements. These results further confirm our prediction that long-term institutional shareholders are more likely to conduct independent research to decide their vote (Ertimur et al., 2013, Larcker et al., 2015); therefore, there is no association with the ISS recommendations (Malenko and Shen, 2016).

The estimated coefficients on the control variables also provide insights. Firstly, CEO total compensation (LN_TDC1) is significantly positive at the 1% level, implying that higher compensation is more likely to lead to disagreements. The coefficient of CASH_INTENSITY is significantly positive at the 5% level. This result indicates that more cash in the compensation package has a higher likelihood of a disagreement.

Secondly, firms with a larger asset base and market-to-book ratio are less likely to have a disagreement with ISS recommendations and voting results, as evidenced by a significantly negative coefficient of LOG_ASSET and MB. However, firms with more significant leverage and cash holdings are more likely to have disagreements. In sum, firms with higher book and market value have fewer disagreements, while those with higher risk or agency concerns have more. Thirdly, fiscal and share market returns are also found significant. The coefficient of fiscal return and share market return are both negatively significant at the 1% level, revealing that higher firm performance is associated with a lower probability of disagreement.

Fourthly, for the governance variables, independent directors on the board and executive share ownership are significant in determining disagreements. Specifically, more independent directors on the board lead to fewer disagreements between ISS and shareholders. In contrast, a higher level of executive share ownership leads to a higher possibility of disagreements. It appears that better corporate governance can efficiently reduce the probability of disagreements.

## Table 2-5 The effect of institutional shareholder investment horizon on the disagreement condition with different components of compensation packages

This table presents results from logit regressions that address the effect of the institutional shareholder investment horizon on disagreements between shareholders and ISS recommendations conditioning on different components in compensation packages. The full sample contains U.S. Say-on-Pay voting outcomes from 2011 to 2020. The dependent variable in the logit regressions is a dummy variable when shareholders and ISS disagree. The investment horizon proxies are ownership by long-term and short-term shareholders classified by the 50% percentile of the churn ratio. From Columns 2 to 5, I interact short-/long-term ownership with OPTION_TOP_D, STOCK_TOP_D, SALARY_TOP_D and BONUS_TOP_D, dummy variables as one for firms with top 10% intensity of CEO option grants, stock grants, salary payment and bonus payment, and zero otherwise. All independent variables are defined in Appendix A. All Models include year and industry-fixed effects. The standard errors are clustered by industry. Year and industry indicator coefficients are omitted from the Table below. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. Z-statistics is in parentheses.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | DISAGREE_D | DISAGREE_D | DISAGREE_D | DISAGREE_D | DISAGREE_D |
| | | OPTION_TOP_D | STOCK_TOP_D | SALARY_TOP_D | BONUS_TOP_D |
| LT_OWN | -0.5314 | -0.6052 | -0.4852 | -0.7578 | -0.4008 |
| | (-1.1731) | (-1.1884) | (-1.2721) | (-1.4830) | (-0.8895) |
| ST_OWN | -1.2557*** | -1.4814*** | -0.7827* | -1.5671*** | -1.2069*** |
| | (-2.9440) | (-3.5527) | (-1.6627) | (-3.5921) | (-2.7756) |
| OPTION_TOP_D | | -0.9189 | | | |
| | | (-1.2106) | | | |
| OPTION_TOP_D*LT_OWN | | 0.9805 | | | |
| | | (0.7541) | | | |
| OPTION_TOP_D*ST_OWN | | 2.0730* | | | |
| | | (1.9087) | | | |
| STOCK_TOP_D | | | 1.5238** | | |
| | | | (2.4739) | | |
| STOCK_TOP_D*LT_OWN | | | -0.3792 | | |
| | | | (-0.4214) | | |
| STOCK_TOP_D*ST_OWN | | | -3.1765*** | | |
| | | | (-4.0882) | | |
| SALARY_TOP_D | | | | -1.1693 | |
| | | | | (-1.2786) | |
| SALARY_TOP_D*LT_OWN | | | | 2.1196 | |
| | | | | (1.3835) | |
| SALARY_TOP_D*ST_OWN | | | | 4.5902** | |
| | | | | (2.4014) | |
| BONUS_TOP_D | | | | | 0.3844 |
| | | | | | (0.4964) |

| | | | | | |
|---|---|---|---|---|---|
| BONUS_TOP_D*LT_OWN | | | | | -1.3121 |
| | | | | | (-1.3682) |
| BONUS_TOP_D*ST_OWN | | | | | -0.3415 |
| | | | | | (-0.2658) |
| LN_TDC1 | 1.2411*** | 1.2384*** | 1.2251*** | 1.2877*** | 1.3213*** |
| | (7.1753) | (7.2579) | (7.8146) | (7.7761) | (7.2085) |
| OPTION_INTENSITY | -0.6403 | -0.8829 | -0.6776 | -0.5860 | -0.5695 |
| | (-1.2959) | (-1.6168) | (-1.4477) | (-1.1541) | (-1.1247) |
| STOCK_INTENSITY | -0.3489 | -0.3345 | -0.7465*** | -0.3067 | -0.2872 |
| | (-1.0894) | (-1.0455) | (-2.6068) | (-0.9190) | (-0.8641) |
| CASH_INTENSITY | 1.6633** | 1.6481** | 1.5811** | 1.0400 | 2.1826*** |
| | (2.4654) | (2.4462) | (2.4972) | (1.4075) | (2.8344) |
| LOG_ASSET | -0.4286*** | -0.4256*** | -0.4254*** | -0.4496*** | -0.4375*** |
| | (-5.1608) | (-5.0723) | (-5.1568) | (-5.3188) | (-5.2221) |
| MB | -0.1418** | -0.1421** | -0.1510** | -0.1585** | -0.1479** |
| | (-2.0224) | (-2.0110) | (-2.1484) | (-2.2602) | (-2.0754) |
| LEVERAGE | 0.6316** | 0.6390** | 0.6552** | 0.6135** | 0.6223** |
| | (2.1834) | (2.1892) | (2.2038) | (2.0723) | (2.1261) |
| CASH_AT | 1.0935*** | 1.0915*** | 1.0838*** | 1.1773*** | 1.1006*** |
| | (2.8300) | (2.8429) | (2.8117) | (3.0164) | (2.8303) |
| RD_AT | 0.3523 | 0.3481 | 0.2862 | 0.3587 | 0.3304 |
| | (0.2250) | (0.2206) | (0.1898) | (0.2414) | (0.2120) |
| RD_MISSING_D | -0.0892 | -0.0879 | -0.0645 | -0.0883 | -0.0907 |
| | (-0.5243) | (-0.5128) | (-0.3882) | (-0.5367) | (-0.5401) |
| CAPEX_AT | -0.0139 | 0.0586 | 0.0647 | -0.0388 | 0.0298 |
| | (-0.0087) | (0.0364) | (0.0396) | (-0.0241) | (0.0187) |
| ROA | -2.6590*** | -2.6786*** | -2.6226*** | -2.5265*** | -2.6341*** |
| | (-3.5940) | (-3.6882) | (-3.6279) | (-3.3464) | (-3.5492) |
| RETURN | -0.4419*** | -0.4406*** | -0.4434*** | -0.4208*** | -0.4307*** |
| | (-3.5303) | (-3.5417) | (-3.5294) | (-3.3895) | (-3.4342) |
| VOLATILITY | 0.0063 | 0.0057 | 0.0055 | 0.0069 | 0.0063 |
| | (0.9829) | (0.8902) | (0.8649) | (1.0719) | (0.9860) |
| STURNOVER | 0.0000*** | 0.0000*** | 0.0000*** | 0.0000*** | 0.0000*** |
| | (3.6951) | (3.6543) | (3.7389) | (3.6122) | (3.6370) |
| EXECUTIVE_SHAREOWN | 2.5175** | 2.5589** | 2.4802** | 2.6204*** | 2.4128** |
| | (2.5741) | (2.5316) | (2.5124) | (2.7589) | (2.4461) |
| INDEPENDENT_DIRECTOR | -1.6371*** | -1.6178*** | -1.5570*** | -1.6710*** | -1.6563*** |
| | (-3.8316) | (-3.7817) | (-3.6760) | (-3.6691) | (-3.8123) |
| CEO_CHAIRMAN_D | -0.0438 | -0.0458 | -0.0475 | -0.0542 | -0.0502 |
| | (-0.4731) | (-0.4879) | (-0.5144) | (-0.5969) | (-0.5439) |
| E_INDEX | -0.0348 | -0.0357 | -0.0395 | -0.0452 | -0.0350 |
| | (-0.8717) | (-0.8889) | (-0.9665) | (-1.1425) | (-0.8834) |
| Constant | -7.3485*** | -7.2469*** | -7.3115*** | -7.2203*** | -8.1511*** |

| | | | | | |
|---|---|---|---|---|---|
| | (-4.2115) | (-4.1343) | (-4.7213) | (-4.1995) | (-4.5007) |
| Observations | 9,951 | 9,951 | 9,951 | 9,951 | 9,951 |
| Pseudo R2 | 0.0908 | 0.0915 | 0.0943 | 0.0956 | 0.0918 |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes | Yes |
| Cluster Industry | Yes | Yes | Yes | Yes | Yes |

### 2.5.3 Addressing endogeneity concerns

#### *2.5.3.1 Two-stage estimation with instrumental variables (2SLS)*

To address omitted variable concerns, I apply a two-stage least-squares (2SLS) approach with an instrumental variable (IV) and re-run the baseline regressions in Table 2-5. Following Kim et al. (2019a) and Lou (2014), I use the instrument variable AD_GROWTH in the two-stage estimation. Specifically, in the first stage, I individually regress AD_GROWTH on ST_OWN with three compensation dummies (SALARY_TOP_D/OPTION_TOP_D/STOCK_TOP_D) and include all controls in the baseline regression. In the second stage, I re-run the baseline regression using the predicted values of ST_OWN from the first stage.

The results from 2SLS regressions are presented in Table 2-6. Columns 1, 3 and 5 of Table 2-6 report the first-stage regression results. As predicted, the coefficients of annual growth of advertising expense are all significantly positive at 1% with short-term institutional ownership (ST_OWN), implying that increasing expense on boosting sales attracts short-term institutional shareholder investment.

In Column 2, the coefficient of the interaction term between ST_OWN and OPTION_TOP_D is significantly positive at the 10% level. This result confirms our baseline finding that short-term institutional shareholders cause disagreement when firms have high option grants in

compensation. Column 4 shows that the coefficient of the interaction term between ST_OWN and SALARY_TOP_D is significantly positive at the 5% level, revealing that short-term institutional shareholders drive disagreement when firms pay a high salary to executives. Column 6 shows the coefficient of the interaction term between ST_OWN and STOCK_TOP_D is significantly negative at the 10% level, indicating short-term institutional shareholders follow ISS when firms have high stock grants in the compensation package.

These results re-confirm our baseline findings that the associations between short-term ownership and the disagreement conditioning on salary payment, stock grants and option grants are causal. Meanwhile, these results mitigate the concern that severe missing variables exist in the baseline regression.

**Table 2-6 The effect of institutional shareholder investment horizon on disagreement conditional on different components of compensation packages: IV, 2SLS regressions (AD_GROWTH)**

This table presents the results of two-stage least-squares (2SLS) regressions that address the effect of institutional shareholder investment horizon on disagreements between shareholders and ISS recommendations conditional on compensation components, with annual growth of advertising expense (AD_GROWTH) as the instrumental variable. The dependent variable in the logit regressions is a dummy variable when shareholders and ISS disagree. The investment horizon proxies are ownership by long-term and short-term shareholders classified by the 50% percentile of the churn ratio. I interact ST_OWN with OPTION_TOP_D, STOCK_TOP_D, and SALARY_TOP_D. The full sample contains U.S. Say-on-Pay voting outcomes from 2011 to 2020. All independent variables are defined in Appendix A. All Models include year and industry-fixed effects. Year and industry indicator coefficients are omitted from the Table. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively; Z-statistics are in parentheses.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | OPTION | | SALARY | | STOCK | |
| | ST_OWN | DISAGREE_D | ST_OWN | DISAGREE_D | ST_OWN | DISAGREE_D |
| AD_GROWTH | 0.0143*** | | 0.0143*** | | 0.0143*** | |
| | (3.2052) | | (3.2294) | | (3.2274) | |
| OPTION_TOP_D*ST_OWN *(instructed)* | | 2.3160* | | | | |
| | | (1.7219) | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| SALARY_TOP_D*ST_OWN *(instructed)* | | | | 3.4669** | | |
| | | | | (2.0013) | | |
| STOCK_TOP_D*ST_OWN *(instructed)* | | | | | | -2.4926* |
| | | | | | | (-1.6669) |
| OPTION_TOP_D | 0.0037 | -0.2798 | | | | |
| | (0.4802) | (-0.4661) | | | | |
| OPTION_TOP_D*LT_OWN | | 0.7551 | | | | |
| | | (0.7249) | | | | |
| SALARY_TOP_D | | | 0.0047 | -0.5113 | | |
| | | | (0.6098) | (-0.6227) | | |
| SALARY_TOP_D*LT_OWN | | | | 2.4744* | | |
| | | | | (1.7250) | | |
| STOCK_TOP_D | | | | | -0.0004 | 0.5090 |
| | | | | | (-0.0856) | (0.9922) |
| STOCK_TOP_D*LT_OWN | | | | | | -0.2084 |
| | | | | | | (-0.2465) |
| ST_OWN *(instructed)* | | -1.5190** | | -1.5011** | | -0.9136 |
| | | (-2.5078) | | (-2.5613) | | (-1.5408) |
| LT_OWN | -0.1432*** | -0.4778 | -0.1432*** | -0.6450 | -0.1431*** | -0.4075 |
| | (-4.0373) | (-0.9314) | (-4.0351) | (-1.2591) | (-4.0189) | (-0.8350) |
| LN_TDC1 | 0.0199*** | 1.0714*** | 0.0200*** | 1.1046*** | 0.0198*** | 1.0576*** |
| | (2.9688) | (5.1685) | (3.0085) | (5.4855) | (2.9707) | (5.3188) |
| OPTION_INTENSITY | -0.0124 | -0.6410 | -0.0073 | -0.4612 | -0.0071 | -0.4953 |
| | (-0.8263) | (-1.1308) | (-0.5995) | (-1.0013) | (-0.5931) | (-1.1169) |
| STOCK_INTENSITY | -0.0049 | -0.2684 | -0.0051 | -0.2787 | -0.0047 | -0.6227* |
| | (-0.5573) | (-0.7061) | (-0.5900) | (-0.7251) | (-0.5390) | (-1.7520) |
| CASH_INTENSITY | -0.0142 | 1.5782*** | -0.0178 | 1.0860 | -0.0141 | 1.5004*** |
| | (-0.9828) | (2.8181) | (-0.9940) | (1.5859) | (-0.9599) | (2.7355) |
| LOG_ASSET | -0.0069*** | -0.4078*** | -0.0070*** | -0.4277*** | -0.0069*** | -0.4088*** |
| | (-2.7124) | (-4.0673) | (-2.7846) | (-4.3293) | (-2.7278) | (-4.1507) |
| MB | -0.0070*** | -0.1121* | -0.0070*** | -0.1177* | -0.0069*** | -0.1167* |
| | (-4.8966) | (-1.6793) | (-4.8465) | (-1.7818) | (-4.8711) | (-1.7518) |
| LEVERAGE | 0.0401*** | 0.6844** | 0.0400*** | 0.6580** | 0.0401*** | 0.6906** |
| | (4.1750) | (2.3244) | (4.1736) | (2.2126) | (4.1885) | (2.3214) |

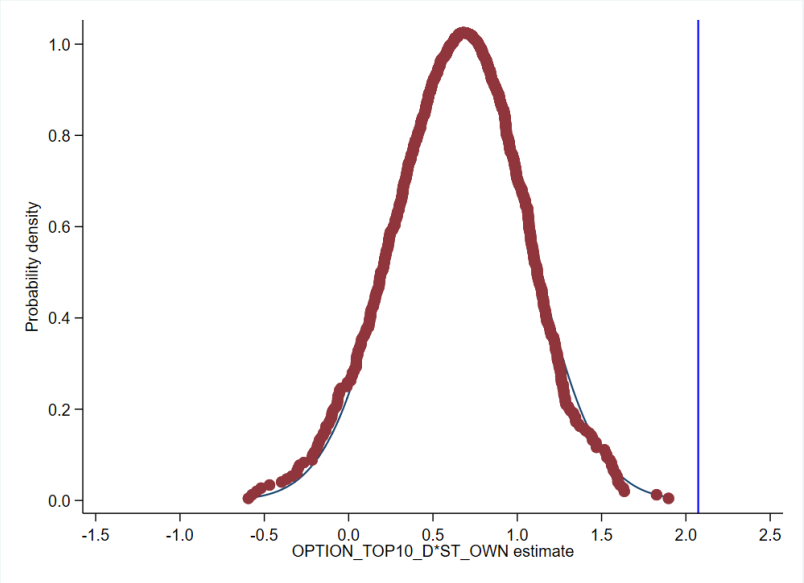
| | | | | | | |
|---|---|---|---|---|---|---|
| CASH_AT | 0.0616*** | 0.6724 | 0.0616*** | 0.6892 | 0.0616*** | 0.6474 |
| | (2.7681) | (1.2906) | (2.7636) | (1.3210) | (2.7591) | (1.2110) |
| RD_AT | 0.0403 | -2.1138 | 0.0403 | -2.1341* | 0.0408 | -2.1577 |
| | (1.2480) | (-1.5933) | (1.2389) | (-1.6644) | (1.2503) | (-1.6096) |
| RD_MISSING_D | -0.0034 | -0.4351*** | -0.0033 | -0.4461*** | -0.0034 | -0.4232*** |
| | (-0.4820) | (-2.8830) | (-0.4800) | (-2.9466) | (-0.4815) | (-2.8146) |
| CAPEX_AT | 0.1356** | -0.0758 | 0.1352** | -0.2433 | 0.1353** | -0.1970 |
| | (2.5832) | (-0.0439) | (2.5591) | (-0.1372) | (2.5659) | (-0.1149) |
| ROA | 0.0238 | -2.8561*** | 0.0239 | -2.7391*** | 0.0235 | -2.8103*** |
| | (0.7506) | (-3.7872) | (0.7585) | (-3.4974) | (0.7438) | (-3.7383) |
| RETURN | -0.0021 | -0.4081*** | -0.0021 | -0.3942*** | -0.0022 | -0.4055*** |
| | (-0.8843) | (-3.3451) | (-0.8809) | (-3.2286) | (-0.8903) | (-3.3430) |
| VOLATILITY | 0.0016*** | 0.0034 | 0.0016*** | 0.0035 | 0.0016*** | 0.0028 |
| | (7.5915) | (0.4921) | (7.5970) | (0.5016) | (7.5976) | (0.4136) |
| STURNOVER | -0.0000*** | 0.0000*** | -0.0000*** | 0.0000*** | -0.0000*** | 0.0000*** |
| | (-7.8109) | (4.5631) | (-7.8054) | (4.5375) | (-7.8132) | (4.6653) |
| EXECUTIVE_SHAREOWN | -0.3104*** | 3.4032*** | -0.3116*** | 3.4069*** | -0.3101*** | 3.2778*** |
| | (-8.8604) | (3.1955) | (-8.8992) | (3.1713) | (-8.7802) | (3.0437) |
| INDEPENDENT_DIRECTOR | 0.0595*** | -1.8086*** | 0.0591*** | -1.8695*** | 0.0593*** | -1.7771*** |
| | (3.2817) | (-3.3065) | (3.2847) | (-3.3321) | (3.2630) | (-3.2395) |
| CEO_CHAIRMAN_D | -0.0094*** | -0.0634 | -0.0094*** | -0.0644 | -0.0094*** | -0.0627 |
| | (-3.0711) | (-0.6040) | (-3.0896) | (-0.6208) | (-3.0847) | (-0.6053) |
| E_INDEX | 0.0012 | -0.0204 | 0.0011 | -0.0248 | 0.0011 | -0.0252 |
| | (0.6252) | (-0.3733) | (0.5969) | (-0.4534) | (0.6191) | (-0.4572) |
| Constant | 0.1906*** | -6.0556*** | 0.1920*** | -5.9526*** | 0.1910*** | -5.8450*** |
| | (3.2497) | (-3.5547) | (3.2194) | (-3.5172) | (3.2431) | (-3.6055) |
| Observations | 10,004 | 8,049 | 10,004 | 8,049 | 10,004 | 8,049 |
| R-squared | 0.2257 | - | 0.2257 | - | 0.2256 | - |
| Pseudo R2 | - | 0.1252 | - | 0.1275 | - | 0.1268 |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Cluster Industry | Yes | Yes | Yes | Yes | Yes | Yes |

#### *2.5.3.2 Falsification tests*

To further address possible omitted variable concerns, I employ a falsification test for my baseline estimation based on the coefficient of the interaction term between ST_OWN and compensation dummies (SALARY_TOP_D/OPTION_TOP_D/STOCK_TOP_D).

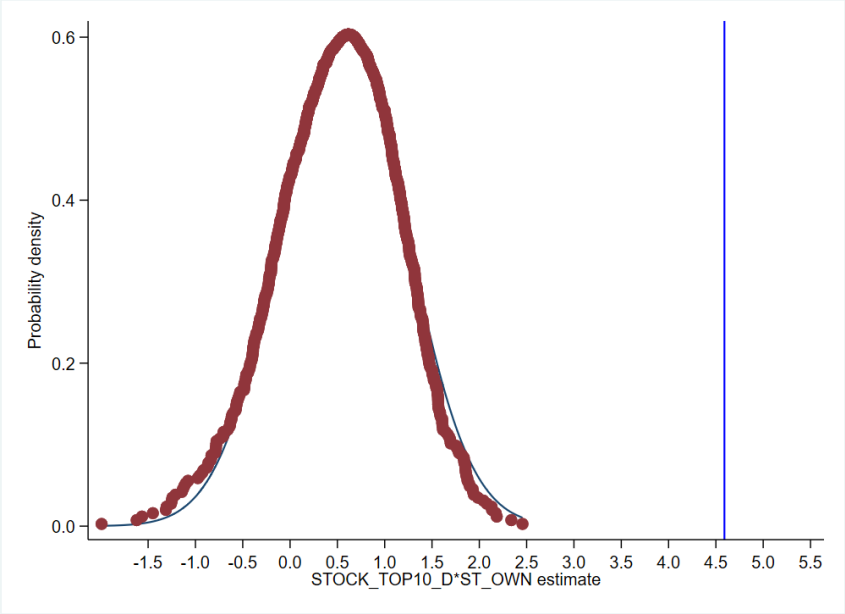
In Figure 2-1, I plot the density distribution of the 1000 estimates of the random draw of coefficients of the interaction term (OPTION_TOP_D*ST_OWN) within each firm. Figure 5-1 shows the distribution of estimated coefficients on the placebo OPTION_TOP_D*ST_OWN, centred on a mean close to zero. Meanwhile, my benchmark estimate of OPTION_TOP_D*ST_OWN (i.e., 2.073) from baseline regression is far beyond the right-hand tail of the distribution of these 1000 hundred placebo estimates. The blue vertical line in Figure 2-1 corresponds to the real benchmark estimate of OPTION_TOP_D*ST_OWN, which clearly lies outside the range of estimated coefficients from the placebo test. This result reveals that some missing variables are unlikely to drive the real estimate of OPTION_TOP_D*ST_OWN. This finding boosts my confidence that the association of short-term institutional shareholders with disagreement conditional on option grants is causal.

**Figure 2-1 The distribution of estimated coefficients with placebo OPTION_TOP_D*ST_OWN of disagreement**




Similar results are also found for the coefficient of SALARY_TOP_D*ST_OWN. Figure 2-2 presents the density distribution of the 1000 estimates of the random draw of the SALARY_TOP_D*ST_OWN in each firm. As expected, the distribution of the estimated coefficients on the false SALARY_TOP_D*ST_OWN is centred on a mean close to zero. The real benchmark estimate of SALARY_TOP_D*ST_OWN (the blue vertical line corresponding to 4.5902) lies far from the distribution of estimated coefficients from the simulation exercise. This finding indicates that it is highly unlikely the benchmark coefficient of SALARY_TOP_D*ST_OWN found in the baseline regression is spurious because of missing variable bias.

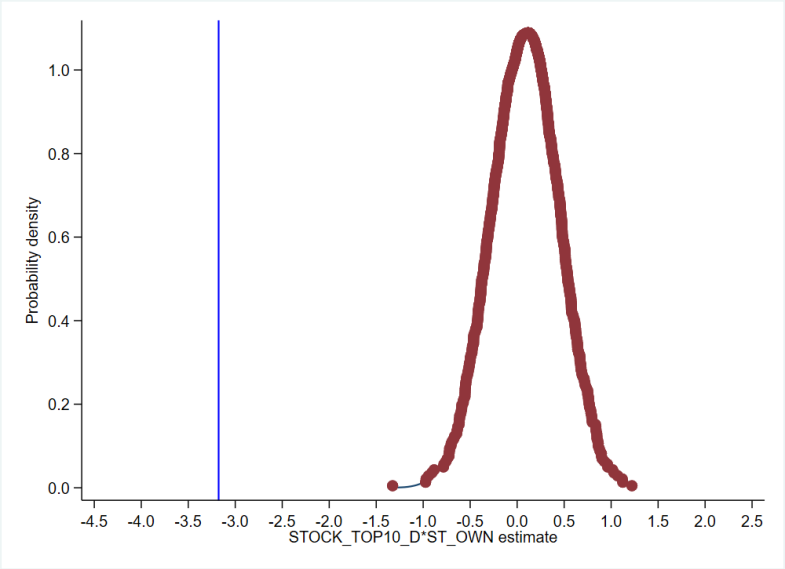
**Figure 2-2 The distribution of estimated coefficients with placebo SALARY_TOP_D*ST_OWN of the disagreement**




Regarding the coefficient of STOCK_TOP_D*ST_OWN, I employ the same falsification test to address the possible omitted variable concerns. Figure 2-3 illustrates the density distribution of the 1000 estimates of the random draw of the STOCK_TOP_D*ST_OWN within each firm. The distribution of the estimated coefficients on the false STOCK_TOP_D*ST_OWN is centred on a mean close to zero. Meanwhile, the real benchmark estimate of STOCK_TOP_D*ST_OWN, represented by the blue vertical line with the value of -3.1765, lies far from the distribution of estimated coefficients from the simulation exercise. This result reveals that some missing variables are unlikely to drive the real estimate of STOCK_TOP_D*ST_OWN.

Taken together, the results shown in Figures 2-1, 2-2 and 2-3 further confirm that there are causal relationships between short-term institutional and the disagreement conditioning on compensation with high option grants, stock grants and salary payment.

**Figure 2-3 Distribution of estimated coefficients with placebo STOCK_TOP_D*ST_OWN of the disagreement**




### *2.5.3.3 Entropy balancing*

My treatment group (DISAGREE_D equal one) includes 739 observations, but the control group (DISAGREE_D equal zero) consists of 9265 observations, leading to a possible covariate imbalance between the treatment and control groups. To overcome this possible imbalance, entropy balancing (EB) is employed to achieve covariate balancing by identifying continuous weights for the control group observations. To apply EB, a group of covariates has been specified (including all control variables). This group of covariates is separately controlled for in the EB procedure to test whether my main proxies are able to explain the disagreement. I ensure each treatment observation has a weighted control observation for each

firm-related variable, including all control variables. In my study, weighted control is achieved by ensuring each means, variance and skewness are equalised between treatment and weighted control groups. An iterative algorithm is applied by EB to find a weight for each observation in the control group. Once the weight is retained, a weighted logit regression is run to test possible associations with the disagreement dummy for the investor horizon proxies that have not been weighted.

Table 2-7, Column 1, shows the main test variable OPTION_TOP_D*ST_OWN result when all control variables are weighted. This result agrees with the unweighted logit regression in Table 2-5, with the same significance level of 10%. The significant coefficient confirms the positive association of the interaction term short-term institutional shareholder investment horizons and disagreements conditional on option grants. As shown in Column 2, there are similar results for STOCK_TOP_D*ST_OWN. The coefficient is significantly negative at the 1% level. This result is consistent with the baseline regressions without EB. Column 3 shows the coefficient of SALARY_TOP_D*ST_OWN is significantly positive at the 5% level after EB, which agrees with the result from the baseline regression. Overall, the EB approach reduces the endogeneity concern that firms with or without a disagreement are systematically different. The EB results verify my baseline results that short-term institutional shareholders drive disagreements when firms have high salary payments and option grants in compensation packages.

The results from these three tests boost my confidence in the robustness of my baseline findings that the relationship between short-term institutional ownership and disagreements conditional

on salary payment, stock and option grants are causal. To further address robustness, I use additional tests in Section 2.6.

**Table 2-7 The effect of institutional shareholder investment horizon on disagreements conditional on the different components in compensation packages: After EB weighting**

This table presents results from logit regressions that address the effect of institutional shareholder investment horizon on disagreements conditional on different components by weighted control observations after EB. The full sample contains U.S. Say-on-Pay voting outcomes from 2011 to 2020. The dependent variable in the logit regressions is a dummy variable when shareholders and ISS disagree. The investment horizon proxies are ownership by long- and short-term shareholders classified by the 50% percentile of the churn ratio. I interact ST_OWN with OPTION_TOP_D, STOCK_TOP_D, and SALARY_TOP_D. All independent variables are defined in Appendix A. All Models include year and industry-fixed effects. Year and industry indicator coefficients are omitted from the Table. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. Z-statistics are in parentheses.

| | (1) | (2) | (3) |
|---|---|---|---|
| | DISAGREE_D | DISAGREE_D | DISAGREE_D |
| | OPTION_TOP_D | STOCK_TOP_D | SALARY_TOP_D |
| OPTION_TOP_D*ST_OWN | 2.2509* | | |
| | (1.8554) | | |
| STOCK_TOP_D*ST_OWN | | -2.5113*** | |
| | | (-3.9328) | |
| SALARY_TOP_D*ST_OWN | | | 5.2385** |
| | | | (2.1315) |
| OPTION_TOP_D | -0.9403 | | |
| | (-1.1417) | | |
| OPTION_TOP_D*LT_OWN | 0.8896 | | |
| | (0.6885) | | |
| STOCK_TOP_D | | 1.2561** | |
| | | (2.4269) | |
| STOCK_TOP_D*LT_OWN | | -0.1749 | |
| | | (-0.2001) | |
| SALARY_TOP_D | | | -1.6028 |
| | | | (-1.4456) |
| SALARY_TOP_D*LT_OWN | | | 2.6127 |
| | | | (1.5953) |

| | | | |
|---|---|---|---|
| LT_OWN | -0.7535 | -0.6973* | -0.8888* |
| | (-1.4751) | (-1.8239) | (-1.7658) |
| ST_OWN | -1.4812*** | -0.8777* | -1.5164*** |
| | (-3.6517) | (-1.9501) | (-3.5784) |
| LN_TDC1 | 0.0748 | 0.0868 | 0.1297 |
| | (0.6449) | (0.8374) | (1.1402) |
| OPTION_INTENSITY | -0.4544 | -0.2771 | -0.2340 |
| | (-0.8690) | (-0.7037) | (-0.5662) |
| STOCK_INTENSITY | 0.0320 | -0.3878 | 0.0285 |
| | (0.1263) | (-1.6348) | (0.1122) |
| CASH_INTENSITY | 0.0472 | 0.0251 | -0.5313 |
| | (0.0833) | (0.0469) | (-0.8728) |
| LOG_ASSET | 0.0170 | 0.0093 | -0.0087 |
| | (0.2116) | (0.1149) | (-0.1070) |
| MB | 0.0170 | 0.0098 | 0.0039 |
| | (0.2461) | (0.1437) | (0.0558) |
| LEVERAGE | -0.0119 | -0.0134 | -0.0525 |
| | (-0.0388) | (-0.0433) | (-0.1708) |
| CASH_AT | 0.1396 | 0.1197 | 0.1458 |
| | (0.3467) | (0.2895) | (0.3580) |
| RD_AT | -0.3071 | -0.3476 | -0.1381 |
| | (-0.1992) | (-0.2344) | (-0.0986) |
| RD_MISSING_D | -0.1483 | -0.1315 | -0.1622 |
| | (-0.8755) | (-0.7995) | (-0.9899) |
| CAPEX_AT | 0.6415 | 0.6221 | 0.5543 |
| | (0.3888) | (0.3769) | (0.3399) |
| ROA | -0.1776 | -0.1232 | -0.1051 |
| | (-0.2392) | (-0.1666) | (-0.1375) |
| RETURN | -0.0210 | -0.0185 | -0.0114 |
| | (-0.1918) | (-0.1691) | (-0.1004) |
| VOLATILITY | 0.0087 | 0.0078 | 0.0098 |
| | (1.3888) | (1.2766) | (1.5295) |
| STURNOVER | -0.0000 | -0.0000 | -0.0000 |
| | (-1.1931) | (-1.3362) | (-1.3070) |
| EXECUTIVE_SHAREOWN | 0.3542 | 0.1891 | 0.4450 |
| | (0.3182) | (0.1743) | (0.4390) |

| | | | |
|---|---|---|---|
| INDEPENDENT_DIRECTOR | 0.4999 | 0.5627 | 0.4754 |
| | (1.1699) | (1.3276) | (1.0536) |
| CEO_CHAIRMAN_D | -0.0989 | -0.0944 | -0.0931 |
| | (-1.0234) | (-1.0153) | (-0.9956) |
| E_INDEX | -0.0392 | -0.0408 | -0.0476 |
| | (-0.9563) | (-0.9919) | (-1.1137) |
| Constant | 0.3303 | 0.1722 | 0.3419 |
| | (0.2698) | (0.1695) | (0.2843) |
| Observations | 9,951 | 9,951 | 9,951 |
| Pseudo R2 | 0.0404 | 0.0437 | 0.0956 |
| Year FE | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes |
| Cluster Industry | Yes | Yes | Yes |

## 2.6 Robustness tests

### 2.6.1 Additional proxy for institutional shareholders' investment horizon

I follow the standard practice to identify long- and short-term ownership based on the top/bottom tercile of the one-year average churn rate (Gaspar et al., 2005). However, my baseline results may be spurious because of an arbitrarily chosen cut-off point. To address this concern, following prior literature, I employ a robustness test that uses INV_TURN, the one-year average churn rate, to proxy institutional shareholders' investment horizon (Kim et al., 2019a, Stathopoulos and Voulgaris, 2016). A higher INV_TURN indicates a shorter investment horizon of institutional shareholders in a firm. I then interact INV_TURN with OPTION_TOP_D, STOCK_TOP_D, SALARY_TOP_D and BONUS_TOP_D and re-run the baseline regression with Model (2).

Table 2-8, Column 1, shows the result of the coefficient of OPTION_TOP_D*INV_TURN, which is significantly positive at the 10% level. This result agrees with our baseline finding that firms with more short-term institutional shareholders are more likely to disagree with ISS recommendations when option grants are high in compensation packages. Column 3 similarly shows that the coefficient of SALARY_TOP_D*INV_TURN is significantly positive at the 1% level, which is consistent with the baseline result that short-term institutional shareholders drive disagreements when firms have high salary payments. In Column 2, the coefficient of STOCK_TOP_D*INV_TURN is significantly negative at the 10% level, which also agrees with the result in baseline regression. Overall, our results are robust to an alternative proxy for institutional shareholders' investment horizons.

## Table 2-8 The effect of institutional shareholder investment horizon on the disagreements conditional on different components in compensation packages with an additional proxy

This table presents results from logit regressions that address the effect of the institutional shareholder investment horizon on disagreements conditional on different compensation components with an additional proxy. The full sample contains U.S. Say-on-Pay voting outcomes from 2011 to 2020. The dependent variable in the logit regressions is a dummy variable when shareholders and ISS disagree. The investment horizon proxy is the average churn ratio (INV_TURN). I interact INV_TURN with OPTION_TOP_D, STOCK_TOP_D, and SALARY_TOP_D. All independent variables are defined in Appendix A. All Models include year and industry-fixed effects. Year and industry indicator coefficients are omitted from the Table. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. Z-statistics is in parentheses.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | DISAGREE_D | DISAGREE_D | DISAGREE_D | DISAGREE_D |
| | OPTION_TOP_D | STOCK_TOP_D | SALARY_TOP_D | BONUS_TOP_D |
| OPTION_TOP_D*INV_TURN | 4.6804* | | | |
| | (1.8594) | | | |
| STOCK_TOP_D*INV_TURN | | -3.3879* | | |
| | | (-1.6691) | | |
| SALARY_TOP_D*INV_TURN | | | 13.6376*** | |
| | | | (2.9965) | |
| BONUS_TOP_D*INV_TURN | | | | -2.0425 |
| | | | | (-0.6645) |
| OPTION_TOP_D | -0.5215 | | | |
| | (-1.2714) | | | |
| STOCK_TOP_D | | 0.9406*** | | |
| | | (2.9163) | | |
| SALARY_TOP_D | | | -0.8632 | |
| | | | (-1.3552) | |
| BONUS_TOP_D | | | | -0.0816 |
| | | | | (-0.1591) |
| INV_TURN | -1.6033 | -0.5611 | -1.9852 | -0.8833 |
| | (-1.0136) | (-0.3341) | (-1.1619) | (-0.5192) |
| LN_TDC1 | 1.2216*** | 1.2064*** | 1.2654*** | 1.3091*** |
| | (7.1850) | (7.5275) | (7.6328) | (7.2577) |
| OPTION_INTENSITY | -0.9076* | -0.6907 | -0.6147 | -0.6063 |
| | (-1.6454) | (-1.4678) | (-1.2223) | (-1.1992) |
| STOCK_INTENSITY | -0.3567 | -0.7431*** | -0.3265 | -0.3029 |
| | (-1.1387) | (-2.5930) | (-1.0038) | (-0.9197) |

| | | | | |
|---|---|---|---|---|
| CASH_INTENSITY | 1.6605** | 1.5915** | 1.0571 | 2.2029*** |
| | (2.4461) | (2.4444) | (1.4056) | (2.9058) |
| LOG_ASSET | -0.4207*** | -0.4215*** | -0.4465*** | -0.4377*** |
| | (-4.8806) | (-4.9719) | (-5.1533) | (-5.1131) |
| MB | -0.1392** | -0.1519** | -0.1634** | -0.1478** |
| | (-1.9964) | (-2.1362) | (-2.3762) | (-2.1052) |
| LEVERAGE | 0.6213** | 0.6194** | 0.6024** | 0.6089** |
| | (2.2349) | (2.1982) | (2.1798) | (2.1821) |
| CASH_AT | 1.0976*** | 1.0732*** | 1.1962*** | 1.1057*** |
| | (2.7271) | (2.6611) | (2.8407) | (2.7241) |
| RD_AT | 0.3803 | 0.3375 | 0.4437 | 0.3972 |
| | (0.2399) | (0.2273) | (0.2929) | (0.2581) |
| RD_MISSING_D | -0.0862 | -0.0608 | -0.0789 | -0.0847 |
| | (-0.5028) | (-0.3708) | (-0.4784) | (-0.5052) |
| CAPEX_AT | 0.0570 | 0.0419 | 0.0544 | 0.0424 |
| | (0.0364) | (0.0265) | (0.0349) | (0.0270) |
| ROA | -2.7624*** | -2.7036*** | -2.5723*** | -2.7078*** |
| | (-3.7257) | (-3.6688) | (-3.3432) | (-3.6057) |
| RETURN | -0.4401*** | -0.4345*** | -0.4138*** | -0.4261*** |
| | (-3.5019) | (-3.4081) | (-3.2932) | (-3.3455) |
| VOLATILITY | 0.0042 | 0.0042 | 0.0056 | 0.0048 |
| | (0.6365) | (0.6467) | (0.8576) | (0.7435) |
| STURNOVER | 0.0000*** | 0.0000*** | 0.0000*** | 0.0000*** |
| | (3.9112) | (3.9892) | (3.9600) | (3.9419) |
| EXECUTIVE_SHAREOWN | 2.9520*** | 2.8346*** | 3.0989*** | 2.8364*** |
| | (2.7630) | (2.6702) | (2.9848) | (2.7399) |
| INDEPENDENT_DIRECTOR | -1.6855*** | -1.6342*** | -1.7677*** | -1.7147*** |
| | (-3.9971) | (-3.8980) | (-3.9228) | (-4.0142) |
| CEO_CHAIRMAN_D | -0.0441 | -0.0411 | -0.0507 | -0.0477 |
| | (-0.4728) | (-0.4443) | (-0.5602) | (-0.5186) |
| E_INDEX | -0.0390 | -0.0389 | -0.0459 | -0.0374 |
| | (-0.9497) | (-0.9344) | (-1.1438) | (-0.9225) |
| | | | | |
| Constant | -7.5019*** | -7.4352*** | -7.4345*** | -8.3121*** |
| | (-4.2622) | (-4.4373) | (-4.2327) | (-4.5412) |

| | | | | |
|---|---|---|---|---|
| Observations | 9,951 | 9,951 | 9,951 | 9,951 |
| Pseudo R2 | 0.0899 | 0.0916 | 0.0945 | 0.0901 |
| Year FE | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes |
| Cluster Industry | Yes | Yes | Yes | Yes |

## 2.7 Conclusion

In this chapter, I examine the association between institutional shareholder investment horizons and disagreements conditional on different components in compensation packages. Long- and short-term institutional shareholders have distinct cost-benefit trade-offs to determine whether to follow ISS recommendations (Kahn and Winton, 1998). Both long- and short-term institutional shareholders may follow ISS recommendations to avoid costly monitoring to fulfil their fiduciary duty. However, short-term institutional shareholders prefer excessive option grants and salary payments in the compensation packages because they better align with their interests. ISS recognise these high salary payments and option grants are excessive and harm firms' sustainable development. Therefore, short-term institutional shareholders and ISS disagree when firms have excessive option grants and salary payments in compensation contracts. Meanwhile, long-term institutional shareholders are keen on conducting independent research because they can spread the cost over the long run and have more precise information about invested firms (Malenko and Malenko, 2019). Since long-term institutional shareholders make decisions independently, their voting results are irrelevant to disagreements.

Previous research incorporates the level of institutional ownership in the study of Say-on-Pay but overlooks the heterogeneity across institutional shareholders. In this chapter, I find that although short-term institutional shareholders generally follow ISS recommendations in voting on Say-on-Pay, this relationship depends on the design of the compensation contracts. The results show that short-term institutional shareholders are more likely to disagree with ISS when firms give executives excessive options and salaries. These results indicate that short-term institutional shareholders make strategic choices in the form of compensation packages that drive salient disagreements with ISS recommendations. The results also suggest that long-

term institutional shareholders do not correlate with disagreements in the Say-on-Pay vote, supporting the view that they conduct independent research on which to base their decisions.

The results in this chapter remain robust to additional tests to address possible endogeneity concerns. First, I apply a two-stage least squares estimation with instrumental variables to mitigate omitted variable bias concerns. Secondly, I apply falsification tests to confirm missing variables are not driving my baseline findings. Thirdly, I use entropy balancing to overcome a possible selection bias between firms with or without disagreement. Finally, by using an additional proxy for investment horizon, the average churn ratio, I again confirm my main findings are not spurious because of an arbitrarily chosen cut-off point.

Over 90% of shareholder voting outcomes follow ISS recommendations, supporting the theory that shareholders make better decisions at a lower cost when following ISS recommendations. However, to the best of my knowledge, no research examines the other 8% who do not follow ISS recommendations. This chapter provides insights into why shareholders disagree with ISS. This study is most likely the first to consider the investment horizon of institutional shareholders as a key influence.

This study provides new evidence for shareholder governance behaviour. Existing research argues that short-term institutional shareholders are not actively engaged in monitoring firms (e.g., “voice” or vote) because direct monitoring is not aligned with their interests (Duan and Jiao, 2016). Nevertheless, I find that short-term institutional shareholders choose option grants

and salary payments as preferable forms for executive compensation design because they believe such forms boost firms' short-term profits, better aligning with their interests.

This study also helps policymakers determine whether more regulation of ISS is needed. Since long-term institutional shareholders have more firm-specific information, their research is deemed more precise (Ertimur et al., 2013, Larcker et al., 2015). If long-term institutional shareholders vote against ISS recommendations, it may raise concerns about the ISS recommendations' quality. The findings from this study do not support the argument that more regulation is needed for ISS because long-term institutional shareholders do not go against ISS recommendations. Taken together, disagreements are not caused by a conflict between long-term institutional shareholders and ISS but by short-term shareholders strategically making decisions that are more in line with their interests.

## Appendix Table 1: Variable definitions

| Variable | Definition (Variable source is in bracket) |
|---|---|
| DISAGREE_D | Dummy variable, equal to one if shareholders do not follow the ISS recommendation and zero otherwise (ISS Voting Analytics) |
| INV_TURN | Weighted average of institutional shareholders' churn rates. Formulations defined in section 4.3 (Thomson Reuters Ins. Holding 13F) |
| LT_OWN | Long-term institutional ownership whose turnover is bottom half (13F) |
| ST_OWN | Short-term institutional ownership whose turnover is top half (13F) |
| OPTION_TOP_D | Dummy variable, equal to one if firms with top 10% intensity of CEO option grants and zero otherwise (Compustat) |
| STOCK_TOP_D | Dummy variable, equal to one if firms with top 10% intensity of CEO stock grants and zero otherwise (Compustat) |
| SALARY_TOP_D | Dummy variable, equal to one if firms with top 10% intensity of CEO salary payment and zero otherwise (Compustat) |
| BONUS_TOP_D | Dummy variable, equal to one if firms with top 10% intensity of CEO bonus payment and zero otherwise (Compustat) |
| LN_TDC1 | Natural logarithm of CEO total compensation (TDC1) (Compustat) |
| OPTION_INTENSITY | The proportion of total annual CEO compensation that comes from option grants (Compustat) |
| STOCK_INTENSITY | The proportion of total annual CEO compensation that comes from stock grants (Compustat) |
| CASH_INTENSITY | The proportion of total annual CEO compensation that comes from cash payments (Compustat) |
| LOG_ASSET | Natural logarithm of firm's total assets (at) (Compustat) |
| MB | Martlet to book ratio (Compustat) |
| LEVERAGE | Total debt / Total assets (Compustat) |
| CASH_AT | Total cash holding / Total assets (Compustat) |
| RD_AT | Research and development expenditure / Total assets (Compustat) |
| RD_MISSING_D | Dummy variable, equal to one if research and development expenditure is reported missing and zero otherwise (Compustat) |
| CAPEX_AT | Capital expenditure / Total assets (Compustat) |
| ROA | Return on asset (Net income / Total assets) (Compustat) |
| RETURN | 12-month cumulative stock return, ending on the month before voting (Compustat) |
| VOLATILITY | 12-month stock return volatility, ending on the month before voting (Compustat) |
| STURNOVER | 12-month average stock trading volume, ending on the month before voting (Compustat) |
| EXECUTIVE_SHAREOWN | Total shares owned by executives (Thomson Reuters Insider Filing) |
| INDEPENDENT_DIRECTOR | Percentage of independent directors on board (Thomson Reuters Insider Filing) |
| CEO_CHAIRMAN | Dummy variable, equal to one if CEO is also the chairperson of the board and zero otherwise (Thomson Reuters Insider Filing) |
| E_INDEX | Count of six antitakeover provisions: golden-parachute agreements, supermajority requirements for mergers, poison pills, staggered boards, limits to shareholder amendments, supermajority for charter amendments (Thomson Reuters Insider Filing) |

# Chapter 3: CEO-employee pay ratio and labour investment efficiency


## Abstract

This chapter examines the association between the CEO-employee pay ratio and a firm's labour investment efficiency. The results indicate that firms with a larger pay ratio have lower labour investment efficiency through over-investing in labour. This result provides additional evidence to support the Rent Extraction Theory that posits a negative relationship between the pay ratio and labour investment efficiency. The theory contends that CEOs require excess employees to "build their empire" to extract rent from companies, leading to over-investment in labour. I use firm fixed effects, falsification tests and entropy balancing to address endogeneity concerns. The results remain robust to additional controls and exclude alternative explanations. The findings can inform firms' stakeholders in making investment decisions, especially when a firm suffers from low labour investment efficiency.

## 3.1 Introduction

Labour is key for firms to succeed in modern market competition. This is not merely because enough labour is essential in traditional manufacturing industries but also for the burgeoning service sectors that rely heavily on creative employees (Ghaly et al., 2020). Effectively investing in labour ensures firms meet their market demand and minimise their labour costs, an approach that is directly linked to their financial performance. Jung et al. (2014) find that approximately two-thirds of production costs are from labour-related expenses, significantly affecting firms' profitability. Because of this significance, recent research focuses on finding determinants that can help enhance labour investment efficiency. For example, Cao and Rees (2020) find that employee-friendly firms can invest in labour more efficiently because better treatment of employees improves labour recruitment and retention. Sualihu et al. (2021a) find that stock options exacerbate inefficient labour investment because they incentivise managers to take additional risks in decision-making, leading to a deviation from optimal labour investment.

A series of research provides insights into labour investment; however, it focuses on either the view of employees (employee treatment) or managers (incentive compensation). A possible factor that may have been missed in explaining labour investment that has the potential to affect employees and managers simultaneously is the CEO-employee pay ratio or the ratio. The ratio measures how many times the firm's CEO earns relative to the median employee's salary. Implemented by the Dodd-Frank Act (Section 953 (b)) in 2018, the pay ratio is disclosed in financial statements. Given that the ratio links the pay of employees with that of the CEO, the size of the pay gap may influence employees' behaviour, thereby affecting labour investment efficiency.

Three distinct theories provide unique predictions regarding how the CEO-employee pay ratio could potentially affect labour investment efficiency. Firstly, the Talent Assignment Theory states that a large CEO-employee pay ratio is a reflection of CEOs' talent and ability (Cheng et al., 2017a). That is because modern firms are generally complex and large, which require talented CEOs to efficiently manage (Gabaix and Landier, 2008, Tervio, 2008, Edmans et al., 2009). To attract and secure talented CEOs, firms intend to provide them with an optimal contract with sufficient payments (Cheng et al., 2017a). Nevertheless, multiple hierarchies exist in complex firms, which leads to a noticeably large pay gap between their CEOs and rank-and-file employees. Generally, employees who work on the different hierarchies are expected to be paid on an escalating scale corresponding with their skillset, position and level of responsibility. Since CEOs are at the top of the hierarchy, they should be compensated proportionately for their talent and ability. As a result, a large pay gap is observed between CEOs and rank-and-file employees. Based on this theory, talented CEOs should make better investment decisions, including labour investment. Therefore, I expect a larger CEO-employee pay ratio to affect labour investment efficiency positively.

Secondly, the Rent Extraction Theory suggests that CEOs are keen on extracting rents from firms. As a result, CEOs' rent-seeking behaviour may significantly increase their pay, causing a larger CEO-employee pay ratio. To successfully capture rent from firms, CEOs are required to "build their empire" to gain more power (Stein, 2003). Williamson (1963) argues that increasing employee numbers enables CEOs to obtain more power and prestige. However, increasing investment in the labour force away from optimal levels can cause inefficient labour

investment. In line with this theory, I expect that a larger CEO-employee pay ratio leads to a lower labour investment efficiency because of over-investment in labour.

Thirdly, the Equity Theory posits that rank-and-file employees may perceive inequity because of a feeling of unfairness caused by a large CEO-employee pay ratio (Akerlof and Yellen, 1990). Literature suggests that employees who perceive inequity participate in costly behaviours that could harm firms' performance. These detrimental behaviours include shirking and excessive voluntary turnover (Adams, 1965, Cowherd and Levine, 1992, Martin, 1979, Faleye et al., 2013). As a result, if firms are constantly losing employees because of the perceived inequity driven by a large CEO-employee pay ratio, the labour shortage will reduce labour investment efficiency within a period of time. In this case, I expect that a larger CEO-employee pay ratio leads to a lower labour investment efficiency because of under-investment in labour.

Several OLS regressions have been employed to study the association between the CEO-employee pay ratio and labour investment efficiency and a series of techniques to address endogeneity concerns. For example, I employ firm fixed effects to mitigate the effect of possible time-invariant missing variables. I also use falsification tests and impact threshold of compounding variables (ITCV) to address missing variable concerns. The results reveal a significant negative relationship between the CEO-employee pay ratio and labour investment efficiency, indicating that firms with a larger pay gap have lower labour investment efficiency. The relationship is more relevant when firms over-invest in labour, which supports the Rent Extraction Theory. My baseline findings remain robust under all testing techniques.

The contributions of this chapter are two-fold. First, the chapter's results highlight the value of mandatory disclosure of the CEO-employee pay ratio. The current literature debate focusses on whether the CEO-employee pay ratio provides stakeholders with additional information about executive compensation and firm performance. This chapter, however, demonstrates the CEO-employee pay ratio significantly impacts labour investment efficiency. Secondly, this chapter provides a more in-depth analysis of the economic implications of the CEO-employee pay ratio. A number of studies have evaluated the relationship between the CEO-employee pay ratio and overall firm performance using proxies such as Tobin's Q and ROA, but they have produced conflicting results (Cheng et al., 2017a, Elkins, 2016). This chapter's results suggest a clear association between a larger CEO-employee pay ratio and lower labour investment efficiency (i.e., over-invested in labour), indicating CEOs are extracting rent from firms. These results can also help stakeholders make informed investment decisions, especially when a firm suffers from low labour investment efficiency.

The structure of this chapter is as follows: Section 3.2 reviews the literature in the field of CEO-employee pay ratio and labour investment efficiency. Section 3.3 provides my hypothesis given current theories. Section 3.4 develops the research methodology, samples and data. Section 3.5 outlines the results from the baseline regressions and endogeneity tests. Section 3.6 details robustness tests, and section 3.7 concludes the chapter.

## 3.2 Literature review

### 3.2.1 CEO-employee pay ratio

#### *3.2.1.1 The background to the CEO-employee pay ratio*

In January 2018, following Section 953 (b) of the Dodd-Frank Act, the SEC mandated disclosure of the CEO-to-employee pay (the pay ratio), requiring firms to compare the CEO's compensation and the payment to the median employee in the firm. The disclosure can be found in the proxy statement (DEF 14A) in SEC filings, including details of the sample, data, calculation method and an explanation from management. Foreign private issuers, emerging growth companies, and smaller reporting entities are exempt from disclosing the ratio. For this disclosure, the SEC emphasises that "investors can use the pay ratio information to determine the "fairness" of a company's compensation structure that, in turn, informs investors' advisory Say-on-Pay votes."[8] The SEC allows some discretion when calculating the ratio to reduce disclosure costs and if needed, a Supplementary Pay Ratio can be included by management. For instance, the *Foreign Data Privacy Law Exemption* excludes some employees in the pay ratio calculation (up to 5% of the total number) if those employees are located in foreign jurisdictions where it is not permitted to disclose employee compensation. *Cost of Living Adjustment* permits firms to adjust employees' compensation based on living expenses in calculating the pay ratio if those employees are located in a different jurisdiction from the CEO. Moreover, if managers believe it is necessary, firms may disclose a supplementary pay ratio calculated by any method the firm chooses with a detailed explanation. For example, firms may choose to exclude a one-off payment to the CEO.

[8] See letter from Senator Robert Menendez et al. to Michael Piwowar, Acting Chairman, U.S. SEC (Mar. 14, 2017), https://www.sec.gov/comments/pay-ratio-statement/cll3-1660758-148835.pdf

#### *3.2.1.2 Information provided by the CEO-employee pay ratio*

Firms' stakeholders, such as shareholders, labour unions, executives, and rank-and-file workers, may obtain material information from the CEO-employee pay ratio. Specifically, labour unions and investor advocacy groups deem the pay ratio benefits them in casting a vote on Say-on-Pay[9] because it provides additional, meaningful information on CEO compensation, which follows the SEC (2015) discussion. For instance, the American Federation of Labor and Congress of Industrial Organizations released a proxy voting guideline that states that, for the purpose of fiduciary voting, executive compensation should be contrasted with peers in the industry and employees in the same firm [10.] Similarly, as a non-profit association of pension funds, the Council of Institutional Investors believes how much a firm pays its employees is vital in determining whether executive compensation packages are effective and reasonable [11].

However, the literature indicates that the release of the pay ratio could harm firms because rank-and-file employees are disincentivised by information on how severe the within-firm pay disparity is. Equity Theory predicts that employees may recognise a higher pay ratio as a signal of unfair treatment regarding peer firms and then engage in behaviours that harm their firm's operations, such as sabotage, shirking, or frequent voluntary turnover (Adams, 1965, Cowherd and Levine, 1992). Wade et al. (2006) argue that rank-and-file employees recognise the CEO's compensation as an apparent reference to address whether their payment is "fair". Smith and Kuntz (2013) suggest that an extremely large CEO-employee pay ratio may make rank-and-file employees "disillusioned". Therefore, the release of the pay ratio can be deemed a fair

[9] See Securities and Exchange Commission (SEC). Pay ratio disclosure. (Aug. 5, 2015), https://www.sec.gov/rules/final/finalarchive/finalarchive2015.shtml
[10] See AFL-CIO (2012). Proxy voting guidelines: Exercising authority, restoring accountability, https://aflcio.org/sites/default/files/2017-03/proxy_voting_2012.pdf
[11] See a comment letter from the Council of Institutional Investors to SEC, https://www.sec.gov/comments/s7-07-13/s70713-296.pdf

benchmark for rank-and-file employees and lead to harmful consequences for a firm (Akerlof and Yellen, 1990, Crawford et al., 2021, Hicks, 1963).

Analogously, industry trade organisations and business-related groups have criticised the mandated disclosure of the pay ratio[12]. They comment that the pay ratio provides no material, significant information on CEO compensation because it is incorporated in other SEC filings. Therefore, calculating the ratio imposes extra costs without benefit to firms. An example of this attitude can be found in a comment letter from Exxon Mobil[13]; Malcolm Farrant, the vice president of human resources, remarked that a large pay ratio does not lead to detrimental effects on firms. He asserts that compensating CEOs' "individual performance and specific job requirements" is the reason for a wider pay disparity. His opinion aligns with the Talent Assignment Theory that states that within-firm pay disparity is driven by a firm's strategy to retain and reward superior CEO talent (Cheng et al., 2017a). Since modern firms rely on different levels of organisational hierarchy to operate, a higher level demands additional levels of an employee's talent and ability. Therefore, employees are supposed to be rewarded on an escalating scale that is congruent with their skillset.

In the end, the SEC took a stand on mandating the pay ratio disclosure. However, the dispute produced contradictory predictions on whether firms would benefit or be devastated by the disclosure.

[12] See Securities and Exchange Commission (SEC). Pay ratio disclosure. (Aug. 5, 2015), https://www.sec.gov/rules/final/finalarchive/finalarchive2015.shtml
[13] See SEC Comments on Pay Ratio Disclosure
https://www.sec.gov/comments/s7-07-13/s70713-568.pdf

#### *3.2.1.3 Economic consequences of the CEO-employee pay ratio*

A considerable amount of research provides evidence of the consequence of the CEO-employee pay ratio and its mandatory disclosure, such as its impact on firm performance, management and employee reactions to the disclosure, along with the effect on shareholders (e.g., stock market returns and Say-on-Pay voting). Detailed discussions are provided in the following sections.

Firm performance

The literature provides ample but contradictory evidence on the relationship between a large pay ratio and firm performance. For instance, in the case of U.S. firms, studies find a positive association between firm performance and a large pay ratio, which supports the Talent Assignment Theory but contradicts the Rent Extraction Theory's prediction (Cheng et al., 2017a, Mueller et al., 2017, Uygur, 2019). Faleye et al. (2013) find that a high pay ratio is significantly and positively associated with employee productivity, contrary to what the Equity Theory predicts. However, Rouen (2020) finds no significant relationship between firm performance and the CEO-employee pay ratio. Instead, evidence from Rouen (2020) shows a negative association between unexplained CEO pay to median employee pay ratio and firm performance. Elkins (2016) and Green and Zhou (2019) also find an analogously negative association between the pay ratio and firm performance. However, they do not separate the pay ratio into explained or unexplained parts.

From an international perspective, by investigating Chinese data, Banker et al. (2016) find a positive association between firm performance and within-firm pay disparity, claiming support for the Talent Assignment Theory in that a high compensation premium for executive talent leads to better firm performance. Using Korean data, Shin et al. (2015) find that firm performance (measured by accounting results and stock returns) is negatively related to a large pay ratio, supporting the Equity Theory. It is worth noting that Tobin's Q and ROA are the most commonly used firm performance measures in these studies.

The results from this empirical research, however, require careful interpretation. For instance, the significant association found in many studies that apply the general pay ratio disappears when Rouen (2020) disaggregates the pay ratio into explained and unexplained components (Cheng et al., 2017a, Mueller et al., 2017). As a result, simply testing ROA or Tobin's Q might be insufficient to investigate the comprehensive effect of the pay ratio on firm performance. For instance, Bardos et al. (2021) find that a large CEO-employee pay ratio is related to narrower bond yield spreads, indicating that the optimal design of the CEO compensation package can enhance firms' borrowing efficiency and the operating result. By that analogy, my study will examine whether firm performance is improved by the mandated disclosure through linking the pay ratio to firms' labour investment efficiency.

Management and employee reactions

Boone et al. (2020b) provide evidence that there were noticeable reactions (e.g., window-dressing) from management and employees to the compulsory disclosure of the CEO-employee pay ratio; reactions are more relevant for a high, unexpected ratio. Specifically, their results show managers are keen on window-dressing their high pay ratio through a longer discretionary

narrative with spin language in the financial report. However, lower productivity has been observed from employees when the pay ratio is unexpectedly high. Intriguingly, management's spin language does not affect employees' reactions.

Jung et al. (2018b) find that firms with better corporate governance are less likely to disclose a supplementary pay ratio, whereas firms that pay greater excess compensation to CEOs are more likely to provide a supplementary pay ratio. Surprisingly, supplementary pay ratios in some firms are higher than the required pay ratio. Jung et al. (2018b) explain that these firms are trying to notify stakeholders about their tournament incentive compensation.

Shareholder reactions

The stock market and Say-on-Pay voting are the two major channels through which we can observe shareholders' reactions to the compulsory disclosure of the CEO-employee pay ratio. Pan et al. (2020) investigated the first-time disclosure of the pay ratio in the U.S. market. They find that firms announcing higher pay ratios have lower abnormal returns in the short term; this effect is more salient when firms' shareholders are adversely affected. They provide further evidence that investors who are averse to inequality are shifting investments from firms with high pay ratios to those with a more reasonable pay ratio. That study reveals that equity markets show concern over a high CEO-employee pay ratio.

As for the effect on Say-on-Pay voting, Boone et al. (2020b) find that firms with high pay ratios increase dissent voting in Say-on-Pay votes compared with those with lower pay ratios. This effect remains unchanged despite the proxy advisor recommending a "For" vote. Similarly, a large pay ratio will impose a stronger adverse effect on dissent voting if firms have more

institutional ownership. Based on these findings, a larger CEO-employee pay ratio helps inform firms' shareholders, management, and employees, thereby driving economic consequences for firms.

### 3.2.2 Labour investment inefficiency

#### *3.2.2.1 Deviations from optimal labour investment*

Firms can deviate from their optimal human-capital investment by over- or under-investing in labour; the literature provides examples of both. With over-investment, the Agency Theory suggests that self-interested executives may over-hire employees to build their own empire, which allows them to obtain more power and security in the firm (Ghaly et al., 2020). Williamson (1963) presents an example that expanding employee numbers is the fastest and least-cost approach for managers to gain power. Bertrand and Mullainathan (2003) argue that managers may be reluctant to fire underperforming employees because they prefer to have a "quiet life" by avoiding conflict or difficult decisions in the workplace.

Pagano and Volpin (2005) argue that top executives can form an alliance with underperforming employees against hostile takeovers by abstaining from layoffs and wage cuts. In return, those employees exert power (if they have it) against the takeover by refusing to sell their shares or by lobbying the public. Another kind of employee-management alliance can be built in firms with poor performance. Atanassov and Kim (2009) posit that, under pressure, firms would rather sell assets to survive than fire employees on a large scale to avoid strong union laws. Edmans et al. (2009) find that employees who work geographically closer to the firm's headquarters are less likely to be fired, which might be caused by executives' attempts to obtain a well-supported power base.

Under-investment in labour occurs when managers fail to hire sufficient workers to execute a valuable investment. This might be caused by outside pressures from myopic investors (Von Thadden, 1995, Stein, 1989). For example, managers may decide to shut down profitable projects to meet specific earnings targets set by short-term investors because these projects may require long-term investment and have adverse effects on current profits and stock prices (Bushee, 1998, Porter, 1992). To do so, managers must lay off employees and turn down projects, which inevitably results in under-investment in labour. In a comprehensive survey, Graham et al. (2005) empirically find that over 78% of managers are willing to sacrifice long-term investments to meet short-run earnings targets.

#### *3.2.2.2 The consequences of inefficient investment in labour*

The literature presents evidence that deviations from optimal investment in labour (both under and over-investment) affect the wage bill and productivity and, consequently, reduce firm performance (Ghaly et al., 2020, Stein, 1989, Williamson, 1963). Lecuona and Reitzig (2014) find that insufficient human resources weaken firms' general profitability and, using historical data from the Dutch East India Company, Sgourev and van Lent (2017) find that human resource slack significantly reduces firm efficiency. Conversely, Vanacker et al. (2017) find that in countries with better labour protection laws, maintaining excess labour is harmful to productivity and profitability because managers are more challenged to lay off redundant employees. In the U.S., the cost of adjusting labour is substantial, especially for those firms with millions of labourers. Dube et al. (2010) show that replacing a worker generally costs, on average, $4000, with roughly $2000 for replacing manual labour workers and around $7000

for changing professional employees. In sum, firm performance suffers when managers' labour investment decisions deviate from the optimal level (Sirmon and Hitt, 2009).

#### *3.2.2.3 The determinants of inefficient labour investment*

The literature suggests that labour investment is one of the most critical decisions for firms to enhance corporate competitiveness (Becker, 1962, Lazear and Shaw, 2007, Teece, 2011). As discussed in the previous section, deviating from optimal labour investment can reduce firm efficiency and, ultimately, firm value (Ghaly et al., 2020). Considering the salient effect of labour investment on firm performance, prior studies have evaluated the determinants of labour investment inefficiency.

Jung et al. (2014) find that higher-quality financial reporting is positively associated with efficient labour investment. They emphasise that high-quality financial reporting can significantly diminish information asymmetry and lead to better labour investment decisions. Ben-Nasr and Alshwer (2016) find that greater stock price informativeness is positively related to higher labour investment efficiency. They argue that better-informed stock prices create a monitoring environment for managers and prevent them from conducting inefficient labour investment decisions. Ghaly et al. (2020) find that long-term institutional investors can better monitor managers and reduce agency conflicts in firms' decision-making, leading to increased labour investment efficiency. Khedmati et al. (2020) find that stronger connections between CEOs and independent board members are negatively related to firms' labour investment efficiency. They argue this connection (especially directors with external network ties to the CEO) weakens monitoring by independent board members, exacerbating the inefficient labour investment issue. Cao and Rees (2020) examine the relationship between employee-friendly

policies and lower deviations of optimal labour investment and conclude that employee-friendly firms have higher labour investment efficiency. Sualihu et al. (2021a) explore the effect of different executive equity compensation on reducing inefficient investment. The researchers posit that stock options aggravate and restricted stocks mitigate labour investment inefficiency. They argue that though both stock options and restricted stocks encourage risk-taking in labour investment, only the restricted stocks expose managers to downside risks, limiting the overly risky labour investment. In a recent study, Sualihu et al. (2021b) find that accurate and less dispersed analyst forecast properties are positively related to better labour investment efficiency. They conclude that analysts' monitoring and information intermediary roles are two major channels for this relationship.

Prior research has evaluated multiple determinants of labour investment efficiency; however, within-firm disparity (proxied by the CEO-employee pay ratio), a vital corporate compensation issue highly likely to influence efficient labour investment, has been overlooked.

### 3.2.3 Linking the CEO-employee pay ratio to labour investment efficiency: A theoretical view

#### *3.2.3.1 The Talent Assignment Theory*

Current literature suggests that a high CEO-employee-pay ratio can be seen as a result of a firm's strategy to secure superior CEO talent (Cheng et al., 2017a). This result is more distinct in highly competitive industries where talented CEOs are scarce and vital to the success and efficient management of complex modern firms (Gabaix and Landier, 2008, Tervio, 2008, Edmans et al., 2009). For example, larger, complex firms can secure a talented CEO and minimise agency problems by providing an optimal contract that includes sufficient incentive payments (Cheng et al., 2017a). However, though the contract is optimal, multiple hierarchies

in the firm can lead to an observable, large pay gap. Complex firms require a strict governance framework across incremental work levels to maintain a higher state of functioning; such a framework then demands an accompanying level of ability and talent to fill positions within the hierarchy. Logically, employees within the hierarchy should be compensated on an escalating scale congruent with their skillset, position and level of responsibility. CEOs, who are at the top of their hierarchy, should be paid proportionately for their talent and ability, leading to a larger pay gap compared with rank-and-file employees. Consequently, based on this argument, a large pay gap between rank-and-file workers and the CEO is reasonable in larger and more complex firms. To validate this argument, it's also reasonable to expect that talented CEOs should demonstrate a skillset congruent with their position and should make better investment decisions, an example of which would be labour investment. Thus, I expect that firms with higher CEO-employee pay ratios have higher labour investment efficiency (i.e., neither over- nor under-investment).

#### *3.2.3.2 The Rent Extraction Theory*

The Rent Extraction Theory states that executives, such as the CEO, are more likely to capture rent in larger firms where more potential rent is available (Bebchuk et al., 2011, Bebchuk and Fried, 2004, Rouen, 2020, Mueller et al., 2017). As it is impossible for rank-and-file workers to extract significant rent, rent-seeking behaviour potentially increases executives' compensation resulting in a larger pay ratio. To successfully extract rent from a firm, executives are required to "build their empire" by increasing the size of the firm, which enables them to gain more power as well as more available rent (Stein, 2003). One approach to achieving this goal is to increase investment in the labour force, which may be easier to increase than fixed assets. Executives can earn more "security, power, status and prestige" by simply

increasing employee numbers (Williamson, 1963). Inevitably, expanding employee numbers beyond optimal levels leads to inefficient labour investment (over-investment) and poor firm performance (high labour-related cost). In this way, firms with a higher CEO-employee pay ratio have lower labour investment efficiency because of over-investment in labour.

#### *3.2.3.3 The Equity Theory*

The Equity Theory posits that a large pay gap in a firm can cause a feeling of unfairness in rank-and-file employees (Akerlof and Yellen, 1990). Once lower-paid employees perceive inequity, they engage in costly behaviours that are detrimental to firm performance, such as shirking and excessive voluntary turnover (quitting) (Adams, 1965, Cowherd and Levine, 1992, Martin, 1979, Faleye et al., 2013). The "at-will" employment convention in the U.S. exacerbates this issue (Bebchuk et al., 2011), as either employers or employees can end the employment relationship at any time without any financial punishment or notice in advance. In line with this theory, for a certain period, the shortage of labour caused by the perceived inequity from a large pay gap leads to under-investment in labour. Thus, I predict that firms with a higher CEO-employee pay ratio have lower labour investment efficiency because of labour under-investment.

## 3.3 Hypothesis development

*The Talent Assignment Theory*

The Talent Assignment Theory suggests that pay disparity reflects CEOs' ability and performance, thus, I expect firms with greater pay disparity to have a better labour investment efficiency than those with less pay disparity because talented CEOs should make better labour investment decisions. It is worth noting that labour investment efficiency is denoted as neither over- nor under-investment in labour; thus, labour investment efficiency is the difference between firms' net hire and the sum of the absolute value of over-investment and under-investment of labour. The lower the difference, the greater the efficiency. If this theory is valid, we should observe a significant and positive association between labour investment efficiency and the CEO-employee pay ratio in the baseline estimation. A positive association indicates a large payment causes a large pay ratio to compensate and secure a talented CEO, which also benefits the firm because it reflects better labour investment decisions. In contrast, if the association is negative or insignificant, there is insufficient evidence to support the Talent Assignment Theory. Based on this argument, the following hypothesis is proposed:

*$H_1$: The CEO-employee pay ratio is positively associated with efficient labour investment.*

*The Rent Extraction Theory*

The Rent Extraction Theory predicts that executives "build their empire" by increasing employee numbers to extract rent from the company (Williamson, 1963). If the theory is valid, pay disparity, as a reflection of managerial rent extraction, leads to worse investment efficiency by over-investing in labour. Thus, overall, we should observe a negative relationship between

the CEO-employee pay ratio and labour investment efficiency. Consistent with this argument, the following hypothesis is proposed:

*$H_2$: The CEO-employee pay ratio is negatively associated with efficient labour investment.*

To test whether the CEO-employee pay ratio leads to over-investment in labour, I follow Cao and Rees (2020) to generate OVER_LABOUR as the dependent variable, representing the positive abnormal net hiring for over-investment in labour. I then regress OVER_LABOUR against the test variable pay disparity (CEO-employee pay ratio) and other controls in the literature (Mueller et al., 2017). If I see a significant, positive relationship between OVER_LABOUR and the pay ratio, then the Rent Extraction Theory has more empirical support. In this case, a large pay ratio is detrimental to firms' labour investment efficiency because CEO rent extraction destroys firm value. The hypothesis is thus:

*$H_3$: The CEO-employee pay ratio is positively associated with over-investment in labour.*

*The Equity Theory*

The Equity Theory states that perceived inequity caused by a large pay ratio for rank-and-file employees causes destructive behaviours like shirking and quitting. As a result, these behaviours inevitably lead to a worse labour investment efficiency for firms that have a high employee turnover and under-investment in labour. Thus, overall, we should observe a negative relationship between the CEO-employee pay ratio and labour investment efficiency. Based on this argument, the following hypothesis is proposed:

*$H_4$: The CEO-employee pay ratio is negatively associated with efficient labour investment*.

To further test this theory, I follow Cao and Rees (2020) and generate the dependent variable UNDER_LABOUR, which is the negative abnormal net hiring as a proxy for under-investment in labour. If a large pay ratio does cause a feeling of inequity in employees that results in quitting, then we will observe a significant, positive relationship between UNDER_LABOUR and the pay ratio. If the test supports the theory, a large pay ratio harms firms by under-investing in labour. Based on this argument, the following hypothesis is proposed:

*$H_5$: The CEO-employee pay ratio is positively associated with under-investing in labour*.

Table 3-1 summarises the hypothesis development based on the Talent Assignment Theory, Rent extraction Theory and Equity Theory.

## 3.4 Research method

### 3.4.1 Sample and data

To test my hypotheses, I collect data from several databases: financial data from Compustat; stock return data from CRSP; institutional ownership data from the Thomson Financial Institutional Holdings (13f) database; executive compensation data from ExecuComp; and CEO-employee pay ratio data calculated from firms' financial data. The sample ranges from the fiscal year 1992 to 2020 because the ExecuComp database started recording data in 1992. The final sample consists of 1748 firm-year observations after merging all databases. To mitigate the effect of outliers, I winsorize all continuous variables at the 1st and 99th percentiles.

**Table 3-1 A summary of the hypothesis development**

| | **Labour investment efficiency** | **Theory** | **Explanation** | **Hypothesis** | **Prediction** | **Sub-Hypothesis** | **Prediction** |
|---|---|---|---|---|---|---|---|
| **CEO-employee pay ratio** | Optimal | Talent Assignment | If the pay ratio is primarily a reflection of managerial talent, firms with a larger pay gap should have optimal labour investment (better efficiency), as talented CEOs will always make better labour investment decisions. | A higher CEO-employee pay ratio leads to a higher labour investment efficiency | Positive | | |
| | Over-investing | Rent Extraction | If the pay ratio is primarily a reflection of CEOs' rent extraction behaviour, firms with a larger pay gap should have over-investing in labour (worse efficiency), as CEOs need to "built their empire" by increasing employee number. | A higher CEO-employee pay ratio leads to a lower labour investment efficiency | Negative | A higher CEO-employee pay ratio leads to **more over-**investing in labour | Positive |
| | Under-investing | Equity | If the pay ratio is primarily a reflection of employees' perceived inequity, firms with a larger pay gap should have under-investing in labour (worse efficiency), as employees perceived more inequity and will voluntarily quit their jobs. | A higher CEO-employee pay ratio leads to a lower labour investment efficiency | Negative | A higher CEO-employee pay ratio leads to **more under-**investing in labour | Positive |

### 3.4.2 The measurement of labour investment efficiency

I choose firms' net hiring to proxy firms' investment in employees. It is calculated as the percentage change in employee numbers between two fiscal years (Pinnuck and Lillis, 2007). I then regress net hiring over several firm fundamental economic variables and capture the residuals from the regression of the abnormal net hiring (Model (5)). Since abnormal net hiring can have positive or negative values, following prior research, I obtain absolute values and label them as the dependent variable (inefficient labour investment) (Ben-Nasr and Alshwer, 2016, Jung et al., 2014, Stoughton et al., 2017, Khedmati et al., 2020, Ghaly et al., 2020). The higher value of the dependent variable, the lower the labour investment efficiency. Model (5) is given below:

$$NET\_HIRE_{it} = \beta_0 + \beta_1 SALES\_GROWTH_{it-1} + \beta_1 SALES\_GROWTH_{it} + \beta_3 \Delta ROA_{it} + \beta_4 \Delta ROA_{it-1} + \beta_5 ROA_{it} + \beta_6 RET_{it} + \beta_7 SIZE\_R_{it} + \beta_8 QUICK_{it-1} + \beta_9 \Delta QUICK_{it-1} + \beta_{10} \Delta QUICK_{it} + \beta_{11} LEV_{it-1} + \beta_{12} AUR_{it-1} + \beta_{13} LOSS\_BIN1_{it-1} + \beta_{14} LOSS\_BIN2_{it-1} + \beta_{15} LOSS\_BIN3_{it-1} + \beta_{16} LOSS\_BIN4_{it-1} + \beta_{17} LOSS\_BIN5_{it-1} + INDUSTRY\_FE + YEAR\_FE + \varepsilon_{IT} \quad (5)$$

where: $NET\_HIRE_{it}$ is the percentage change in the number of employees from fiscal year t to fiscal year t-1; *SALES_GROWTH* is the percentage change in sales; *ROA* is the return on assets; RET is the total annual stock return; *SIZE* is the percentile rank of firm size; *QUICK* is the ratio of cash and short-term investments plus receivables to current liabilities; *LEV* is measured as long-term debt plus debt in current liabilities, scaled by the book value of assets; *AUR* is the ratio of annual sales to total assets; and *LOSS_BINs* are five dummy variables that indicate each interval of length 0.005 from 0 to -0.025. *INDUSTRY_FE* represents dummy variables for

each industry identified by the Fama and French (1997) 48-industry classification code. *YEAR_FE* represents dummy variables for each fiscal year in the sample. Variables definitions are given in Appendix.

### 3.4.3 Measurement of CEO-employee pay ratio

Following Faleye et al. (2013), Przychodzen and Gómez-Bezares (2021) and Alan et al. (2020), I generate the pay ratio from firms' financial data. I define average ordinary employee compensation as the total employee expense (*xlr* from Compustat), deduct total executive compensation (sum of all executives' *TDC1* from ExecuComp), and then divide by the total employee number (*emp* from Compustat). I then generate the CEO-employee pay ratio as the natural log of dividing CEO total compensation (*TDC1* from ExecuComp) into the average ordinary employee compensation. It is worth noting that generating the pay ratio from firms' financial data provides sufficient samples to conduct this study as I can have a relatively long range of time (1992 to 2020). Although firms have disclosed the pay ratio since 2017, the shorter time range (2017 to 2020) significantly limits the sample size.

### 3.4.4 The model to test the hypothesis and control variables

To test my hypotheses that predict a causal relationship between the CEO-employee pay ratio and inefficient labour investment, I use Model (6) in the baseline regression:

$$INEFF\_LABOR_{it} = \beta_0 + \beta_1 LN\_PAY\_RATIO_{it-1} + \beta_2 LN\_SIZE_{it-1} + \beta_3 MTB_{it-1} + \beta_4 QUICK_{it-1} + \beta_5 LEV_{it-1} + \beta_6 DIV\_D_{it-1} + \beta_7 CFO\_STD_{it-1} + \beta_8 SALES\_STD_{it-1} + \beta_9 TANGIBLES_{it-1} + \beta_{10} LOSS\_D_{it-1} + \beta_{11} INST\_OWN_{it-1} + \beta_{12} NET\_HIRE\_STD_{it-1} +$$

$$\beta_{13} LABOR\_INTENSITY_{it-1} + \beta_{14} CEO\_OWNERSHIP_{it} + \beta_{15} |AB\_INVEST\_OTHER|_{it} + \beta_{16} AQ_{it-1} + YEAR\_FE + INDUSTRY\_FE + \varepsilon_{it} \quad (6)$$

where: the dependent variable is INEFF_LABOR for firm *i* at the end of fiscal year t. The main test variable is the natural log of the CEO-employee pay ratio for firm *i* at the end of fiscal year *t*. Prior research suggests several variables are likely to be associated with firms' investment efficiency. Thus, following Ben-Nasr and Alshwer (2016) and Jung et al. (2014), I control for firm size (FIRM_SIZE); market to book (MTB); quick ratio (QUICK); leverage (LEV); the standard deviation of firm *i*'s cash flows from operations from fiscal year *t-5* to *t-1* (CFO_STD); the standard deviation of firm *i*'s sales from year *t-5* to *t-1* (SALES_STD); PP&E at the end of fiscal year *t-1* scaled by total assets at the end of fiscal year *t-1* (TANGIBLES); a dummy variable coded as one if firm *i* had negative ROA for fiscal year *t-1* (LOSS_D); and the standard deviation of firm *i*'s change in the number of employees from fiscal year *t-5* to *t-1* (NET_HIRE_STD). Following Ryan Jr and Wiggins III (2002), I control for CEO stock ownership (CEO_OWNERSHIP) and a dummy variable indicating whether firm *i* paid dividend in fiscal year *t-1* (DIV_D). Detailed definitions of and justification for variables are in the Appendix. This Model includes industry and year fixed effects similar to Model (1), and all standard errors are clustered by firm.

### 3.4.5 Identification tests

#### *3.4.5.1 Addressing endogeneity concerns*

Endogeneity concerns in this study could be caused by omitted variables. Although several vital variables found to be significant in the literature have been included in the baseline tests, it is possible that a variable may be missing that could affect the CEO-employee pay ratio and

labour investment efficiency at the same time (Larcker and Rusticus, 2010). As a result, the association found in the regression might be spurious, caused by the missing variable. If we include the missing variable in the regression, the association between labour investment and pay ratio will disappear.

In the following section, I choose several techniques to mitigate endogeneity concerns, including firm fixed effect; falsification tests; impact threshold of compounding variables (ITCV); and entropy balancing techniques.

#### *3.4.5.2 Firm fixed effects*

Firms may have distinct characteristics that could affect the pay ratio. These unobservable and time-invariant characteristics could lead to a spurious association between the pay ratio and inefficient labour investment (Salomon and Wu, 2012). To alleviate the impact of any firm time-invariant characteristics on my baseline regressions, I use firm fixed effects in addition to year fixed effects in the baseline regressions. If I observe similar, significant relationships to previous regressions, my baseline results are not affected by unobservable and time-invariant firm characteristics.

#### *3.4.5.3 Falsification tests*

In line with La Ferrara et al. (2012), I use a falsification test based on my baseline regression to further address potential missing variable bias. The rationale for the falsification test is that if some missing time-variant variables are driving the association between the CEO-employee pay ratio (test variable) and labour investment efficiency over time, then I should observe a

significant relationship even in a falsification test. In other words, if the association found in the baseline Model is spurious and the missing variables are the cause, I would still observe significant results even if I modify the test variable.

To use the falsification test, I randomly select values of the test variable (LN_PAY_RATIO) from my sample distribution for each firm over the whole period. Then I use the randomly drawn values to replace each firm's actual value of the test variable. Though the sequence of the test variable is changed in each firm, the distribution of the randomly drawn values remains the same as the real one. In my simulations, I repeat this procedure 1000 times by randomly selecting and replacing the value of the interaction term and estimating my baseline Model.

In summary, if the association found in the baseline Model is causal, I expect the coefficients estimated in the falsification tests to follow a normal distribution with a mean close to zero (La Ferrara et al., 2012).

#### *3.4.5.4 The impact threshold of the confounding variable*

Larcker and Rusticus (2010) argue that it is meaningful to address how severe a missing variable could overturn the relationship found in baseline regressions since control variables used in the tests may be far from sufficient to identify causality. Following Frank (2000) and Sualihu et al. (2021a), I apply the impact threshold of the confounding variable (ITCV) approach to address this concern. This approach evaluates how significant an omitted variable could be in relation to the main test variable and the dependent variable (i.e., INEFF_LABOUR, OVER_LABOUR, and UNDER_LABOUR) that will make the test variables statistically

insignificant. A larger impact threshold indicates that a plausible omitted variable is less likely to make my test variables statistically insignificant.

#### *3.4.5.5 Entropy balancing (EB)*

Firms with better labour investment efficiency (low abnormal labour hiring) may differ significantly from those with worse labour investment efficiency (high abnormal labour hiring) because of some unique characteristic(s). These differences may cause a covariate imbalance between the two types of firms and raise the concern of self-selection bias. To overcome this issue, I use entropy balancing (EB) to achieve covariate balancing by identifying continuous weights for the two groups of the firm. Specifically, I match firms with below-median abnormal labour hiring with those with above-median on all the control variables from the baseline tests. If similar results are found between the EB and baseline tests, I can mitigate the endogeneity concerns to the extent of self-selection bias.

## 3.5 Results

### 3.5.1 Descriptive statistics and univariate results

Table 3-2 presents the descriptive statistics of variables included in Model (6). The results show that inefficient labour investment (INEFF_LABOR) has a mean of 0.1 and a median of 0.07, indicating firms' real net hiring deviates on average from their expected net hiring (identified by Model (5)) by 10%. The standard deviation of INEFF_LABOR is 0.12. The findings for INEFF_LABOR are consistent with those observed by Jung et al. (2014) (a mean (median) of 0.11 (0.07) and a standard deviation of 0.13). I divided my independent variable INEFF_LABOR into two subsamples based on the sign of INEFF_LABOR, over-investment in labour (OVER_INVEST_LABOR) and under-investment in labour (UNDER_INVEST_LABOR). Roughly 25% (441/1748) of observations are recognised as over-investment in labour and 75% (1307/1748) as under-investment in labour, which is similar to Cao and Rees (2020) finding 32% (68%) of observations recognised as over-investment (under-) in labour.

The mean and median values of my main test variables for the CEO-employee pay ratio (PAY_RATIO) are 117.01 and 64.14, respectively, revealing that, on average, a CEO's compensation is 117 times that of the median employee's pay. The value varies significantly between firms, evidenced by a stunning standard deviation of 161.16 and a large mean to median gap. Because of limited data in the study of CEO pay ratio (Crawford et al., 2021), prior studies' sample size varies from 162 (Crawford et al., 2021) to 2303 (Pan et al., 2019); the pay ratio also has a broad spread of summary statistics in different studies. However, the results found in this study with 1748 firm-year observations align with most prior studies. Notably, Cheng et al. (2017a) report a mean and median value for the pay ratio of 103.2 and

**Table 3-2 Descriptive statistics of the labour efficiency analysis**

This Table provides the descriptive statistics for all variables in Model 2 over the entire sample period from 1992 to 2020.

| Variable | n | Mean | S.D. | Min | 0.25 | Mdn | 0.75 | Max |
|---|---|---|---|---|---|---|---|---|
| INEFF_LABOR | 1748 | 0.1 | 0.12 | 0 | 0.03 | 0.07 | 0.12 | 1.48 |
| OVER_INVEST_LABOR | 441 | 0.12 | 0.19 | 0 | 0.02 | 0.06 | 0.14 | 1.62 |
| UNDER_INVEST_LABOR | 1307 | 0.09 | 0.08 | 0 | 0.04 | 0.08 | 0.12 | 0.81 |
| PAY_RATIO | 1748 | 117.01 | 161.16 | 3.24 | 30.11 | 64.14 | 131.16 | 865.81 |
| LN_PAY_RATIO | 1748 | 4.17 | 1.07 | 1.41 | 3.4 | 4.16 | 4.88 | 6.76 |
| LN_SIZE_LD | 1748 | 7.84 | 1.61 | 2.29 | 6.72 | 7.81 | 8.98 | 10.79 |
| MTB_LD | 1748 | 3.09 | 5.5 | -34.08 | 1.51 | 2.41 | 3.77 | 47.68 |
| QUICK_LD | 1748 | 1.08 | 0.72 | 0.06 | 0.63 | 0.94 | 1.3 | 6.71 |
| LEV_LD | 1748 | 0.28 | 0.2 | 0 | 0.15 | 0.26 | 0.37 | 1.67 |
| DIV_D_LD | 1748 | 0.64 | 0.48 | 0 | 0 | 1 | 1 | 1 |
| CFO_STD_LD | 1748 | 225.78 | 404.28 | 0.58 | 26.37 | 72.46 | 202.5 | 2028.23 |
| SALES_STD_LD | 1748 | 804.36 | 1323.27 | 0.1 | 112.88 | 288.66 | 776.8 | 6335.65 |
| TANGIBLES_LD | 1748 | 0.44 | 0.26 | 0.01 | 0.21 | 0.44 | 0.67 | 0.92 |
| LOSS_D | 1748 | 0.11 | 0.31 | 0 | 0 | 0 | 0 | 1 |
| INST_OWN_LD | 1748 | 0.71 | 0.22 | 0 | 0.59 | 0.74 | 0.89 | 1 |
| NET_HIRE_STD_LD | 1747 | 0.13 | 0.21 | 0.01 | 0.04 | 0.07 | 0.14 | 3.13 |
| LABOR_INTENSITY_LD | 1748 | 0.01 | 0.01 | 0 | 0 | 0 | 0.01 | 0.08 |
| CEO_OWNERSHIP | 1748 | 1.02 | 3.06 | 0 | 0 | 0 | 0.74 | 23.7 |
| AB_INVEST_OTHER | 1748 | 0.1 | 0.05 | 0 | 0.06 | 0.1 | 0.13 | 0.68 |
| AQ_LD | 1748 | -22.45 | 39.71 | -340.39 | -20.47 | -8.79 | -4.02 | -0.27 |

78.8, respectively, and Pan et al. (2019) report a pay ratio mean and median of 145 and 65, respectively, in their sample.

The summary statistics of other control variables are generally consistent with recent studies, such as Cao and Rees (2020), Khedmati et al. (2020) and Sualihu et al. (2021a). For instance, in this chapter, the means (medians) of LN_SIZE_LD; MTB_LD; and AB_INVEST_OTHER are 7.84 (7.81); 3.09 (2.41); and 0.1 (0.1), respectively, which are comparable with those reported by Khedmati et al. (2020) (i.e., 7.62 (7.45) for LN_SIZE_LD; 3.3 (2.47) for MTB_LD; and 0.1 (0.08) for AB_INVEST_OTHER).

Table 3-3 presents the Pearson correlation coefficients for all variables in Model (6). Notably, there is a positive and significant correlation between the CEO-employee pay ratio (LN_PAY_RATIO) and ineffective labour investment (INEFF_LABOR), revealing that firms with a large pay gap between the CEO and the median employee are generally associated with a higher inefficient investment in labour. The correlations among other variables are as expected and are comparable with previous studies such as Ben-Nasr and Alshwer (2016), Khedmati et al. (2020) and Mueller et al. (2017). For example, firm size (LN_SIZE_LD) is significantly positively associated with the pay ratio (PAY_RATIO), which agrees with Mueller et al. (2017) that larger firms generally have a higher pay ratio (as a proxy for pay disparity) as a result of a more complex hierarchy.

### 3.5.2 The impact of pay ratio on inefficient labour investment

Table 3-4 reports the main results for the association between the CEO-employee pay ratio and inefficient labour investment after controlling for other relevant determinants from recent research. Column 1 presents the baseline regression of Model (6). Using inefficient labour investment (INEFF_LABOR) as the dependent variable, the estimated coefficient on LN_PAY_RATIO is significantly positive at the 1% level. This result indicates that a greater CEO-employee pay ratio is associated with a higher level of inefficient labour investment, suggesting a large pay gap between the CEO and the median employee exacerbates inefficient labour investment. I also find that LN_PAY_RATIO is economically significant.

Table 3-3 Pearson Correlation coefficients for variables in Model 2

This Table provides the Pearson pair-wise correlation between all variables in Model 2. * indicates significance at the 5% level.

| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) | INEFF_LABOR | 1 | | | | | | | | | | | | | | | | | | | |
| (2) | OVER_INVEST_LABOR | 0.9995* | 1 | | | | | | | | | | | | | | | | | | |
| (3) | UNDER_INVEST_LABOR | -0.9732* | . | 1 | | | | | | | | | | | | | | | | | |
| (4) | PAY_RATIO | 0.0618* | 0.1521* | 0.0114 | 1 | | | | | | | | | | | | | | | | |
| (5) | LN_PAY_RATIO | 0.0577* | 0.1577* | 0.0065 | 0.8032* | 1 | | | | | | | | | | | | | | | |
| (6) | LN_SIZE_LD | -0.0857* | -0.0677 | 0.0958* | 0.2823* | 0.4002* | 1 | | | | | | | | | | | | | | |
| (7) | MTB_LD | -0.0345 | -0.0539 | 0.0434 | 0.1735* | 0.1500* | 0.2352* | 1 | | | | | | | | | | | | | |
| (8) | QUICK_LD | 0.0974* | 0.0557 | -0.0814* | -0.1129* | -0.1326* | -0.1641* | 0.0398 | 1 | | | | | | | | | | | | |
| (9) | LEV_LD | 0.0376 | 0.0382 | -0.0669* | 0.1838* | 0.2072* | -0.027 | -0.1317* | -0.2873* | 1 | | | | | | | | | | | |
| (10) | DIV_D_LD | -0.0657* | -0.0183 | 0.0830* | 0.0525* | 0.0312 | 0.4778* | 0.1418* | -0.0820* | -0.1373* | 1 | | | | | | | | | | |
| (11) | CFO_STD_LD | -0.0733* | -0.0684 | 0.0778* | 0.0822* | 0.2080* | 0.5956* | 0.1167* | -0.1245* | 0.0381 | 0.2176* | 1 | | | | | | | | | |
| (12) | SALES_STD_LD | -0.0553* | -0.0538 | 0.0550* | 0.0940* | 0.2175* | 0.5316* | 0.0910* | -0.1027* | 0.0565* | 0.1966* | 0.7436* | 1 | | | | | | | | |
| (13) | TANGIBLES_LD | -0.0153 | 0.0108 | 0.0171 | 0.0657* | -0.0553* | 0.0441 | -0.0818* | -0.3079* | 0.2199* | 0.0031 | 0.0063 | -0.0937* | 1 | | | | | | | |
| (14) | LOSS_D | 0.1082* | 0.0393 | -0.1698* | -0.0864* | -0.1018* | -0.2400* | -0.1024* | -0.0322 | 0.1259* | -0.2139* | -0.0331 | -0.0057 | -0.0474* | 1 | | | | | | |
| (15) | INST_OWN_LD | 0.0237 | 0.0576 | -0.0034 | 0.1202* | 0.2381* | 0.0993* | -0.021 | 0.0709* | 0.0657* | -0.2416* | 0.0069 | 0.0520* | -0.1081* | 0.015 | 1 | | | | | |
| (16) | NET_HIRE_STD_LD | 0.1059* | 0.1048* | -0.0987* | 0.015 | 0.0161 | -0.0957* | -0.0183 | 0.0630* | -0.0071 | -0.1983* | -0.0495* | 0.0436 | -0.1406* | 0.0961* | 0.0962* | 1 | | | | |
| (17) | LABOR_INTENSITY_LD | 0.0065 | -0.0376 | -0.0366 | 0.3606* | 0.3158* | -0.3471* | 0.0476* | -0.0618* | 0.0692* | -0.2805* | -0.2086* | -0.1966* | 0.0733* | 0.0224 | -0.0114 | -0.0058 | 1 | | | |
| (18) | CEO_OWNERSHIP | -0.015 | -0.022 | 0.0258 | -0.0136 | -0.0574* | -0.1588* | -0.0253 | 0.0448 | -0.0173 | -0.1357* | -0.1281* | -0.0977* | 0.0377 | -0.0265 | 0.1164* | 0.0169 | 0.1232* | 1 | | |
| (19) | AB_INVEST_OTHER | 0.1384* | 0.0149 | -0.2121* | -0.0996* | -0.0611* | -0.1483* | -0.0464 | 0.1336* | 0.0612* | -0.1100* | -0.1161* | -0.0746* | -0.3333* | 0.1316* | 0.0588* | 0.1287* | -0.0497* | -0.0021 | 1 | |
| (20) | AQ_LD | 0.0392 | 0.0327 | -0.0518 | -0.1377* | -0.1625* | -0.2377* | -0.0781* | 0.0318 | -0.0472* | -0.0486* | -0.3237* | -0.3580* | 0.0909* | -0.0454 | 0.0029 | -0.0171 | 0.0764* | 0.0695* | 0.0632* | 1 |

The results reveal that a one standard deviation increase in the CEO-employee pay ratio is associated with a 20.97% increase in inefficient labour investment[14]. It is worth noting that a standard deviation increase in the CEO-employee pay ratio means CEOs earn roughly 161 times more than the median employee[15]. These results provide preliminary evidence to support Rent Extraction and Equity Theories, predicting a positive relationship between the pay ratio and inefficient labour investment. However, the result contradicts the Talent Assignment Theory (hypothesis 1) that the CEO-employee pay ratio is a reflection of CEOs' ability and predicts a negative relationship between pay ratio and inefficient labour investment.

Moreover, other firm characteristics could also affect labour investment efficiency. In line with Khedmati et al. (2020), firms with greater liquidity (QUICK_LD), higher levels of inefficient investment in other non-labour investment (AB_INVEST_OTHER), and firms that have experienced a financial loss in the last financial year (LOSS_D_LD) are more likely to engage in activities that lead to inefficient labour investment. However, larger firms (LN_SIZE_LD) tend to have more efficient labour investments.

In Table 3-4, Columns 2 and 3, I split my sample into two subsamples and examine the effect of the CEO-employee pay ratio on each; one has over-investment in labour (positive abnormal net hiring), and the other has under-investment in labour (negative abnormal net hiring). For simplicity of interpretation, like the presentation of INEFF_LABOR, I use the absolute value

[14] The mean value of INEFF_LABOR in the sample is 0.1. The coefficient and standard deviation of LN_PAY_RATIO is 0.0196 and 1.07, respectively. A one standard deviation increase in LN_PAY_RATIO is associated with a 20.97% increase in inefficient labour investment (0.0196*1.07/0.1=20.97%). For robustness purpose, I re-run the same estimation with PAY_RATIO (pay ratio without the natural logarithm transformation). A one standard deviation increase in PAY_RATIO is associated with a 19.65% increase in inefficient labour investment (0.0001219*161.16/0.1=19.65%), which is similar with the estimation using LN_PAY_RATIO.
[15] The sample mean value of PAY_RATIO is 117.01 and its standard deviation is 161.16.

of both dependent variables (over- and under-investment in labour) in the following estimation that shows a positive coefficient on INEFF_LABOR for both subsamples meaning that a larger pay ratio is related to a higher level of inefficient labour investment. Column 2 shows that the coefficient of LN_PAY_RATIO is positive and significant at the 1% level, revealing that firms with a larger pay ratio are associated with a higher level of over-investment in labour. However, Column 3 shows no significant relationship between the pay ratio and firms with under-investment in labour. This additional evidence strongly supports the Rent Extraction Theory (Hypothesis 3) that the CEO-employee pay ratio reflects managerial rent extraction and predicts a positive association between the pay ratio and over-investment in labour. I find no evidence to support the Equity Theory (hypotheses 4 and 5).

The Equity Theory predicts that high employee perceived inequity may lead to excessive voluntary turnover causing under-investment in labour. To test this prediction (hypothesis 5), I separate the sample into two subsamples: one with employee turnover higher than the sample median of 1.02 and the other with employee turnover lower than or equal to the median. I re-run the regression in Column 3 using the two new subsamples. The results presented in Columns 4 and 5, show no significant association between the pay ratio and under-investment in labour. In summary, these results strongly support the Rent Extraction Theory but demonstrate no evidence for the Equity Theory or Talent Assignment Theory.

## Table 3-4 The CEO-employee pay ratio and ineffective labour investment

This table presents results from OLS regressions that address the effect of the CEO-employee pay ratio on ineffective labour investment (abnormal net hiring). Column 1 shows the results of regressing abnormal net hiring (INEFF_LABOR, obtained from Model 5) on the CEO-employee pay ratio and control variables. Column 2 shows the results of regressing over-investment in labour (OVER_LABOR, the positive abnormal net hiring) on the CEO-employee pay ratio and control variables. Column 3 shows the results of regressing under-investment in labour (UNDER_LABOR, the negative abnormal net hiring) on the CEO-employee pay ratio and control variables. Column 4 shows the results of regressing under-investment in labour on CEO-employee pay ratio and control variables, with firms having employee turnover less than the sample median 1.02. Column 5 shows the results of regressing under-investment in labour on CEO-employee pay ratio and control variables, with firms having employee turnover higher than the sample median 1.02. All control variables are defined in Appendix A. All regressions include year and industry fixed effects. Year and industry indicator coefficients are omitted from the Table below. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics is in parentheses.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | INEFF_LABOR | OVER_LABOR | UNDER_LABOR | UNDER_LABOR TURNOVER>1.02 | UNDER_LABOR TURNOVER<=1.02 |
| LN_PAY_RATIO | 0.0196*** | 0.0608*** | -0.0032 | -0.0003 | -0.0020 |
| | (2.9592) | (3.5551) | (-0.8085) | (-0.0757) | (-0.3133) |
| LN_SIZE_LD | -0.0087* | -0.0304*** | 0.0023 | -0.0014 | 0.0070 |
| | (-1.8921) | (-3.6511) | (0.6862) | (-0.3913) | (1.2845) |
| MTB_LD | 0.0002 | -0.0005 | 0.0001 | 0.0006 | 0.0000 |
| | (0.3344) | (-0.4579) | (0.1967) | (0.9183) | (0.0459) |
| QUICK_LD | 0.0162* | 0.0064 | 0.0079 | 0.0119 | 0.0199* |
| | (1.8442) | (0.5008) | (1.3678) | (1.6151) | (1.9283) |
| LEV_LD | 0.0077 | 0.0250 | 0.0095 | 0.0035 | -0.0136 |
| | (0.4179) | (0.5080) | (0.5577) | (0.2460) | (-0.6306) |
| DIV_D_LD | 0.0015 | 0.0262 | -0.0051 | -0.0019 | -0.0103 |
| | (0.1407) | (1.3131) | (-0.6198) | (-0.2705) | (-0.9987) |
| CFO_STD_LD | -0.0000 | -0.0000 | -0.0000 | 0.0000 | -0.0000 |
| | (-0.5492) | (-0.1496) | (-0.6864) | (0.8940) | (-0.6369) |
| SALES_STD_LD | -0.0000 | -0.0000 | -0.0000 | -0.0000 | -0.0000** |
| | (-1.2412) | (-0.6426) | (-1.3630) | (-1.0349) | (-2.4527) |
| TANGIBLES_LD | 0.0588** | 0.1049* | 0.0296 | 0.0528** | 0.0033 |
| | (2.3762) | (1.9532) | (1.2574) | (2.4432) | (0.1007) |
| LOSS_D_LD | 0.0316* | 0.0259 | 0.0304** | 0.0379** | 0.0142 |
| | (1.9036) | (0.4563) | (2.5978) | (2.0754) | (1.1022) |
| INST_OWN_LD | 0.0034 | 0.0202 | -0.0157 | -0.0151 | -0.0347 |
| | (0.1296) | (0.3247) | (-0.7834) | (-0.8203) | (-0.9264) |
| NET_HIRE_STD_LD | 0.0415 | 0.0654 | 0.0288 | 0.0129 | 0.0617 |
| | (1.4797) | (1.1337) | (1.6252) | (1.3039) | (1.6232) |
| LABOR_INTENSITY_LD | -0.4236 | -1.9966* | 0.2129 | -0.1450 | 0.4851 |
| | (-0.9832) | (-1.8737) | (0.5077) | (-0.4701) | (0.7657) |
| CEO_OWNERSHIP | -0.0006 | -0.0002 | -0.0010 | -0.0000 | -0.0007 |
| | (-0.9151) | (-0.1069) | (-1.5631) | (-0.0472) | (-0.5587) |
| AB_INVEST_OTHER | 0.3891* | -0.0347 | 0.4542*** | 0.4063* | 0.3384** |
| | (2.0347) | (-0.3772) | (3.5226) | (1.9996) | (2.4696) |

| | | | | | |
|---|---|---|---|---|---|
| AQ_LD | 0.0001 | 0.0000 | 0.0001 | -0.0000 | 0.0001 |
| | (1.0646) | (0.1994) | (1.1666) | (-0.3997) | (0.6526) |
| Constant | 0.0025 | 0.0282 | 0.0307 | 0.0023 | 0.0484 |
| | (0.0661) | (0.3306) | (0.8797) | (0.0388) | (1.0523) |
| Observations | 1,746 | 438 | 1,305 | 516 | 788 |
| Adjusted R-squared | 0.0804 | 0.0888 | 0.1341 | 0.2370 | 0.1563 |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes | Yes |
| Cluster Firm | Yes | Yes | Yes | Yes | Yes |
| Cluster Year | Yes | Yes | Yes | Yes | Yes |

### 3.5.3 Addressing endogeneity concerns

#### *3.5.3.1 Firm fixed effects*

My findings present a solid, notable positive association between the CEO-employee pay ratio and inefficient labour investment; the association is more salient for firms with over-labour investment. However, as discussed in section 3.4.5, some firm time-invariant characteristics can lead to spurious associations in estimates. To mitigate the impact of possible time-invariant characteristics (e.g., firm unobservable characteristics), I apply firm fixed effects on all my baseline regressions in Table 3-4. Table 3-5 presents all baseline regressions with firm fixed effects. Like the baseline estimation, Column 1 shows that the coefficient of LN_PAY_RATIO is positively significant at the 10% level. Similar results found in Column 2 with a positive association between the pay ratio and ineffective labour investment are salient for firms with over-investment in labour, as evidenced by the significantly positive (at the 5% level) coefficient of LN_PAY_RATIO. The results in Columns 1 and 2 suggest that the first two baseline regressions are not affected by time-invariant firm characteristics.

However, after applying firm fixed effects, the coefficient of LN_PAY_RATIO becomes significantly negative (at the 5% level) in the regression for UNDER_LABOR (Column 3); the coefficient was negative but insignificant in the baseline regression. This result indicates that, after mitigating the impact of time-invariant characteristics, a large pay gap between the CEO and the median employee reduces firms' inefficient labour investment when firms are under-investing in labour. Moreover, from the subsample analysis, the results in Column 4 shows that firms with lower employee turnover are more likely to benefit from a large pay ratio to reduce inefficient labour investment, evidenced by the significantly negative coefficient at the 10% level. However, Column 5 shows no relevant association between the pay ratio and labour

**Table 3-5 The CEO-employee pay ratio and ineffective labour investment with firm fixed effects**

This table presents results from OLS regressions that address the effect of the CEO-employee pay ratio on ineffective labour investment (abnormal net hiring). Column 1 shows the results of regressing abnormal net hiring (INEFF_LABOR, obtained from Model 5) on the CEO-employee pay ratio and control variables. Column 2 shows the results of regressing over-investment in labour (OVER_LABOR, the positive abnormal net hiring) on the CEO-employee pay ratio and control variables. Column 3 shows the results of regressing under-investment in labour (UNDER_LABOR, the negative abnormal net hiring) on the CEO-employee pay ratio and control variables. Column 4 shows the results of regressing under-investment in labour on the CEO-employee pay ratio and control variables, with firms having employee turnover less than the sample median 1.02. Column 5 shows the results of regressing under-investment in labour on the CEO-employee pay ratio and control variables, with firms having employee turnover higher than the sample median 1.02. All control variables are defined in Appendix A. All regressions include year and firm fixed effects. Year and firm indicator coefficients are omitted from the Table below. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics are in parentheses.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | INEFF_LABOR | OVER_LABOR | UNDER_LABOR | UNDER_LABOR TURNOVER>1.02 | UNDER_LABOR TURNOVER<=1.02 |
| LN_PAY_RATIO | 0.0148* | 0.0501** | -0.0100** | 0.0018 | -0.0126* |
| | (1.7062) | (2.1544) | (-2.3693) | (0.4307) | (-1.9854) |
| LN_SIZE_LD | -0.0213** | -0.0444* | -0.0138** | -0.0039 | -0.0189*** |
| | (-2.4634) | (-1.7563) | (-2.2594) | (-0.4816) | (-3.2823) |
| MTB_LD | 0.0003 | 0.0008 | 0.0001 | 0.0010 | 0.0003 |
| | (0.4351) | (0.6549) | (0.2025) | (1.0411) | (0.3401) |
| QUICK_LD | 0.0240** | 0.0362 | -0.0037 | 0.0161 | -0.0190 |
| | (2.5610) | (1.6469) | (-0.4524) | (0.9624) | (-1.3558) |
| LEV_LD | 0.0092 | -0.0061 | -0.0060 | -0.0036 | -0.0516 |
| | (0.2552) | (-0.0930) | (-0.1378) | (-0.1322) | (-1.0776) |
| DIV_D_LD | 0.0247* | 0.0784* | -0.0098 | -0.0044 | -0.0111 |

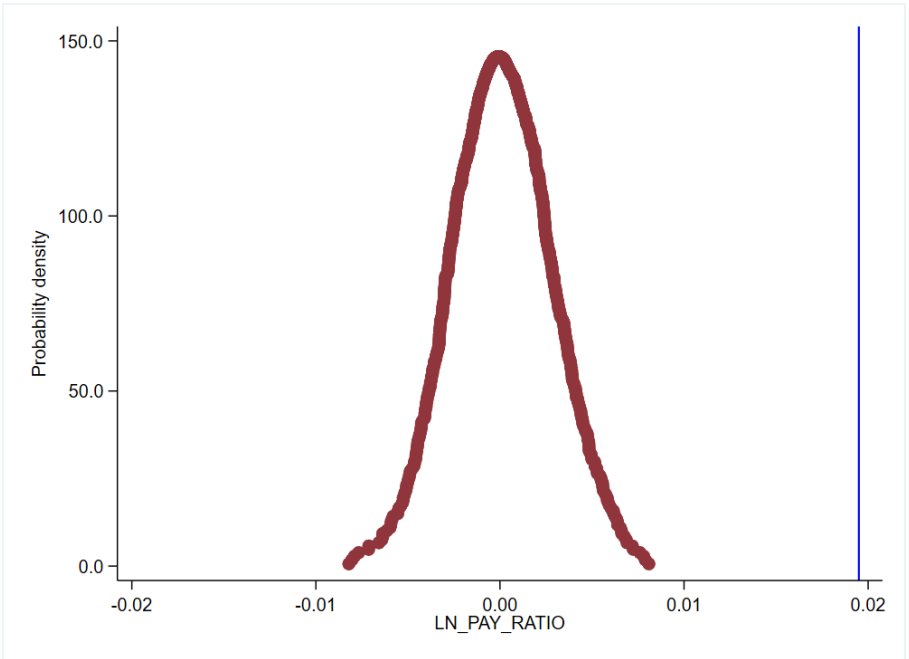
| | | | | | |
|---|---|---|---|---|---|
| | (1.9710) | (1.9237) | (-1.1694) | (-0.4857) | (-1.2831) |
| CFO_STD_LD | -0.0000 | 0.0000 | -0.0000 | -0.0000* | -0.0000 |
| | (-0.8099) | (0.1126) | (-0.7699) | (-1.7972) | (-0.2794) |
| SALES_STD_LD | -0.0000 | -0.0000 | -0.0000 | -0.0000 | -0.0000 |
| | (-1.5308) | (-1.6673) | (-0.5009) | (-0.4821) | (-1.0380) |
| TANGIBLES_LD | 0.1630*** | 0.5205** | 0.0318 | 0.1430*** | 0.0063 |
| | (2.9107) | (2.3071) | (0.7647) | (3.4329) | (0.1000) |
| LOSS_D_LD | 0.0109 | 0.0189 | 0.0070 | 0.0120 | -0.0069 |
| | (0.7073) | (0.3199) | (0.7213) | (0.9255) | (-0.6021) |
| INST_OWN_LD | 0.0429 | 0.1279 | 0.0391 | 0.0122 | 0.0506* |
| | (0.8902) | (0.6896) | (1.3574) | (0.2747) | (1.7160) |
| NET_HIRE_STD_LD | -0.0274 | -0.0873 | 0.0105 | 0.0110 | 0.0100 |
| | (-1.2872) | (-1.2222) | (0.7823) | (1.4491) | (0.5763) |
| LABOR_INTENSITY_LD | -1.5549 | -7.6611* | 1.0699 | 0.5194 | 1.3371 |
| | (-1.5367) | (-1.9826) | (1.4552) | (0.5461) | (1.2769) |
| CEO_OWNERSHIP | -0.0003 | 0.0026 | -0.0012 | 0.0004 | -0.0028* |
| | (-0.1875) | (0.5911) | (-1.1269) | (0.6127) | (-1.7752) |
| AB_INVEST_OTHER | 0.0851 | -0.0857 | 0.2779** | 0.3755 | 0.3148** |
| | (0.6665) | (-0.4611) | (2.3588) | (1.3985) | (2.0528) |
| AQ_LD | 0.0000 | -0.0001 | 0.0001* | 0.0000 | 0.0001 |
| | (0.0380) | (-0.7661) | (1.7198) | (0.2821) | (0.9704) |
| | | | | | |
| Constant | 0.0767 | -0.0338 | 0.1816*** | -0.0390 | 0.2846*** |
| | (0.9385) | (-0.1347) | (3.0016) | (-0.2465) | (5.1596) |
| | | | | | |
| Observations | 1,725 | 388 | 1,275 | 483 | 745 |
| Adjusted R-squared | 0.1789 | 0.1590 | 0.2587 | 0.2636 | 0.2762 |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| Firm FE | Yes | Yes | Yes | Yes | Yes |
| Cluster Firm | Yes | Yes | Yes | Yes | Yes |
| Cluster Year | Yes | Yes | Yes | Yes | Yes |

investment efficiency for firms with higher employee turnover. In summary, the results in Columns 3, 4 and 5 provide further evidence against the Equity Theory; employees appear not to see a large pay gap as a sign of inequity.

### *3.5.3.2 Falsification tests*

To further mitigate the missing variable concerns, I apply two falsification tests to my test variable LN_PAY_RATIO which was found significant in my baseline regression (Columns 1 and 2 in Table 3-4). In Figure 3-1, I plot the density distribution of the 1000 estimates of the random draw of coefficients of the test variable (LN_PAY_RATIO) in each firm and regress on INEFF_LABOR along with all controls. Figure 3-1 shows the distribution of estimated coefficients on the placebo LN_PAY_RATIO, which is centred on a mean close to zero. My benchmark estimate of LN_PAY_RATIO (i.e., 0.019) from the baseline regression is far beyond the right-hand tail of the distribution of these 1000 hundred placebo estimates. The blue vertical line in Figure 3-1 corresponds to the real benchmark estimate of LN_PAY_RATIO, which clearly lies outside the range of estimated coefficients from the placebo test. This result shows that some missing variables are highly unlikely to drive the real estimate of

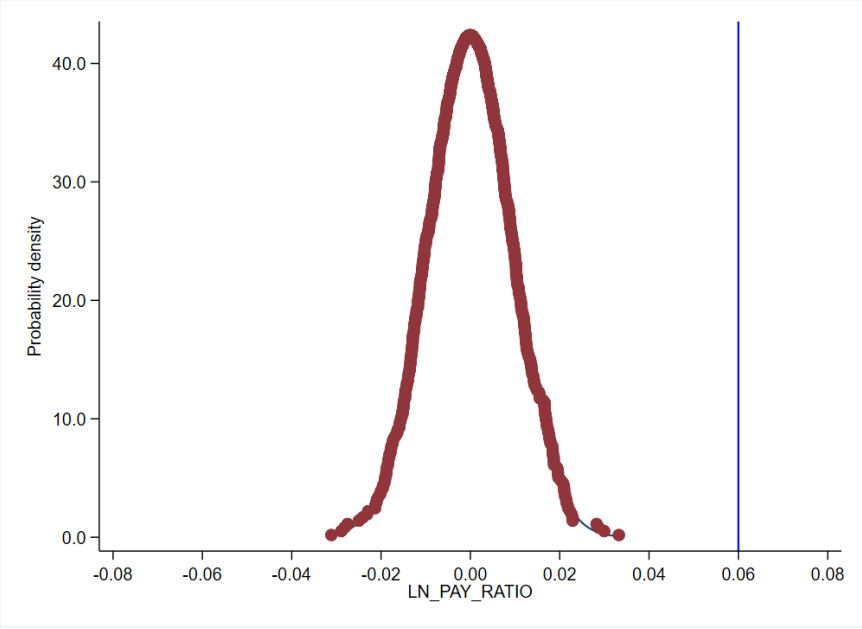
**Figure 3-1 Distribution of the estimated coefficients with placebo LN_PAY_RATIO and ineffective labour investment**



LN_PAY_RATIO. This finding boosts my confidence that the association of the CEO-employee pay ratio with the labour investment efficiency is causal.

Similar results can also be found for the coefficient of LN_PAY_RATIO regressed on over-investment in labour (OVER_LABOR). Figure 3-2 presents the density distribution of the 1000 estimates of the random draw of the LN_PAY_RATIO in each firm. As expected, the distribution of the estimated coefficients on the false LN_PAY_RATIO is centred on a mean close to zero. Meanwhile, the real benchmark estimate of LN_PAY_RATIO (the blue vertical line corresponding to the value 0.06) lies far from the distribution of estimated coefficients in the simulation exercise. This finding indicates that it is highly unlikely the benchmark coefficient of LN_PAY_RATIO found in the baseline regression is spurious because of missing variable bias. Taken together, the results shown in Figures 3-1 and 3-2 further confirm

**Figure 3-2 Distribution of estimated coefficients with placebo LN_PAY_RATIO and over-investment in labour**



that there are causal relationships between the CEO-employee pay ratio and labour investment inefficiency.

#### *3.5.3.3 The impact threshold of confounding variable test*

The impact threshold of confounding variable (ITCV) has been widely used in recent literature to address missing variable concerns (Khedmati et al., 2020, Sualihu et al., 2021b). Although it is not a foolproof way to solve the concern (Sualihu et al., 2021a), Larcker and Rusticus (2010) argue that ITCV can show how severe it is if a missing variable overturns the relationship found in the baseline estimation. Ideally, the larger the ITCV of the test variable, the lower the chance of a plausible omitted variable that could overturn the test variable into being statistically insignificant. By using the "konfound" command in STATA (Xu et al., 2019) after the main baseline regression of Column 1 in Table 3-4, the ITCV procedure provides scores of 0.159 for the LN_PAY_RATIO. This result reveals that the correlation between a confounding variable and LN_PAY_RATIO and INEFF_LABOR has to be greater than about 15.9% (i.e., 0.0252^0.5) to overturn the baseline result. The ITCV procedure also provides the percentage of bias that would invalidate the inference, which in this study is 33.82%. In other words, 591 cases (out of the sample 1747) would have to be replaced with cases for which there is an effect of 0. Similar results are found for the other main baseline regression in Column 2 in Table 3-4. The ITCV procedure provides scores 0.289 for LN_PAY_RATIO, indicating the correlation between a confounding variable and LN_PAY_RATIO, and OVER_LABOR has to be greater than about 28.9% (i.e., 0.0834^0.5) to overturn the baseline result. That is, 44.71% or 196 cases (out of the sample 438) would have to be replaced with cases for which there is an effect of 0. Overall, these results from the ITCV procedure show that the positive association between LN_PAY_RATIO and ineffective labour investment is unlikely to be caused by a

correct omitted variable. However, it is worth noting that though the ITCV procedure enhances causal inference in this study, it does not prove causality.

#### *3.5.3.4 Entropy balancing*

Given that the CEO-employee pay ratio has a large standard deviation and a wide gap between mean and median values in the sample, firms with larger pay ratios may differ significantly from those with lower pay ratios because of some unique characteristics. These differences may cause a covariate imbalance between the two types of firms and raise the concern of self-selection bias. Armstrong et al. (2010) argue that if a hypothesised causal variable is generated endogenously by the board's decision, using a matching method will be beneficial in addressing self-selection bias. I apply entropy balancing (EB) to achieve covariate balancing to overcome this issue. To do so, I first create a dummy variable, HIGH_LN_PAY_RATIO_D, to separate my sample into treatment and control groups (equal to one if a pay ratio is higher than the sample mean for LN_PAY_RATIO of 4.16, and zero otherwise). Following that, I match firms with above-mean pay ratio (treatment) with those with below-mean pay ratio (control) on all control variables from the baseline estimation, which outputs continuous weights for the two groups. In this study, weighted control is achieved by ensuring each mean, variance and skewness is equalised between treatment and weighted control groups. Once the weight is retained, a weighted OLS regression is run to test possible associations with ineffective labour investment for the CEO-employee pay ratio that has not been weighted.

Table 3-6, Column 1, details the results of the Model in the baseline regression when all control variables have been weighted. This result agrees with the unweighted OLS regression in Table 3-4, and the significance level remains at 1%. The significant coefficient reconfirms the

positive association between the CEO-employee pay ratio and inefficient labour investment. As shown in Column 2, similar results are found for OVER_LABOR. The coefficient of the LN_PAY_RATIO is significantly positive at the 1% level. This result is fairly consistent with the baseline regressions without EB. In Columns 3, 4 and 5, the coefficients of LN_PAY_RATIO are all insignificant, which also agrees with the baseline results. Overall, the EB approach reduces the endogeneity concern that firms with a high pay ratio or a low pay ratio are systematically different. It also verifies my baseline result that firms with a higher pay ratio tend to have lower labour investment inefficiency.

**Table 3-6 CEO-employee pay ratio and ineffective labour investment: After entropy balanced weighting**

This table presents results from OLS regressions that address the effect of the CEO-employee pay ratio on ineffective labour investment (abnormal net hiring) by weighted control observations after EB. Column 1 shows the results of regressing abnormal net hiring (INEFF_LABOR, obtained from Model 5) on the CEO-employee pay ratio and control variables. Column 2 shows the results of regressing over-investment in labour (OVER_LABOR, the positive abnormal net hiring) on the CEO-employee pay ratio and control variables. Column 3 shows the results of regressing under-investment in labour (UNDER_LABOR, the negative abnormal net hiring) on the CEO-employee pay ratio and control variables. Column 4 shows the results of regressing under-investment in labour on CEO-employee pay ratio and control variables, with firms having employee turnover less than the sample median 1.02. Column 5 shows the results of regressing under-investment in labour on CEO-employee pay ratio and control variables, with firms having employee turnover higher than the sample median 1.02. All control variables are defined in Appendix A. All regressions include year and industry fixed effects. Year and industry indicator coefficients are omitted from the Table below. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics is in parentheses.

| | (1) | (2) | (3) | (5) | (6) |
|---|---|---|---|---|---|
| | INEFF_LABOR | OVER_LABOR | UNDER_LABOR | UNDER_LABOR TURNOVER<=1.02 | UNDER_LABOR TURNOVER<=1.02 |
| LN_PAY_RATIO | 0.0201*** | 0.0581*** | 0.0009 | 0.0029 | 0.0032 |
| | (3.6041) | (2.8382) | (0.2970) | (0.9518) | (0.4553) |
| LN_SIZE_LD | -0.0075 | -0.0319** | 0.0012 | -0.0045* | 0.0046 |
| | (-1.5055) | (-2.4568) | (0.3115) | (-1.7575) | (0.7485) |
| MTB_LD | -0.0002 | -0.0000 | -0.0002 | -0.0000 | -0.0001 |
| | (-0.3390) | (-0.0266) | (-0.2377) | (-0.0452) | (-0.1341) |
| QUICK_LD | 0.0144 | 0.0238 | -0.0000 | -0.0013 | 0.0162 |
| | (1.1914) | (0.8671) | (-0.0025) | (-0.5038) | (1.1086) |
| LEV_LD | 0.0179 | 0.0346 | 0.0140 | 0.0000 | -0.0046 |
| | (0.7242) | (0.8925) | (0.6426) | (0.0013) | (-0.1754) |
| DIV_D_LD | 0.0034 | 0.0273 | 0.0047 | 0.0092 | -0.0023 |
| | (0.2978) | (0.9890) | (0.5958) | (1.5013) | (-0.2233) |
| CFO_STD_LD | -0.0000 | -0.0000 | -0.0000* | 0.0000 | -0.0000 |
| | (-1.3894) | (-0.4079) | (-1.7302) | (0.9292) | (-1.0641) |

| | | | | | |
|---|---|---|---|---|---|
| SALES_STD_LD | -0.0000 | 0.0000 | -0.0000 | -0.0000 | -0.0000 |
| | (-0.0087) | (0.0943) | (-0.3962) | (-0.6700) | (-1.6007) |
| TANGIBLES_LD | 0.0371 | 0.0973 | 0.0058 | 0.0205* | -0.0105 |
| | (1.4521) | (1.4942) | (0.2195) | (1.8315) | (-0.2792) |
| LOSS_D_LD | 0.0191 | 0.0428 | 0.0190 | 0.0307 | 0.0076 |
| | (1.5227) | (0.5240) | (1.5858) | (1.4103) | (0.6739) |
| INST_OWN_LD | 0.0641* | 0.1597 | -0.0019 | -0.0240 | -0.0169 |
| | (1.9014) | (1.2891) | (-0.1132) | (-1.5549) | (-0.6468) |
| NET_HIRE_STD_LD | 0.0265 | 0.0422 | 0.0264*** | 0.0144* | 0.0396*** |
| | (1.6560) | (0.6993) | (2.8107) | (1.7675) | (2.9805) |
| LABOR_INTENSITY_LD | -0.1610 | -1.6829 | 0.1079 | -0.2059 | -0.0762 |
| | (-0.6384) | (-1.7008) | (0.4106) | (-0.9698) | (-0.1714) |
| CEO_OWNERSHIP | 0.0000 | 0.0021 | -0.0009 | 0.0006 | -0.0009 |
| | (0.0113) | (0.4951) | (-0.9448) | (1.0842) | (-0.7856) |
| AB_INVEST_OTHER | 0.1794 | -0.1406 | 0.3855*** | 0.0146 | 0.3109** |
| | (1.4896) | (-0.8238) | (4.4603) | (0.1718) | (2.3323) |
| AQ_LD | 0.0001 | 0.0002 | 0.0000 | -0.0000 | 0.0000 |
| | (1.1340) | (0.9992) | (0.6063) | (-0.1977) | (0.2571) |
| | | | | | |
| Constant | -0.0292 | -0.0666 | 0.0304 | 0.0773*** | 0.0424 |
| | (-0.4991) | (-0.3891) | (0.7222) | (2.8265) | (0.7088) |
| | | | | | |
| Observations | 1,746 | 438 | 1,305 | 516 | 788 |
| Adjusted R-squared | 0.1055 | 0.1855 | 0.1718 | 0.2111 | 0.1887 |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes | Yes |
| Cluster Firm | Yes | Yes | Yes | Yes | Yes |
| Cluster Year | Yes | Yes | Yes | Yes | Yes |

## 3.6 Robustness tests

### 3.6.1 Additional controls

In section 3.5, though several techniques have been used to address endogeneity issues, I conduct some additional tests to further alleviate concern about potential omitted variables or alternative explanations that might drive the result. Following prior literature, these additional tests include a number of control variables in addition to the baseline regressions.

#### *3.6.1.1 CEO compensation*

Sualihu et al. (2021a) find that CEO compensation, especially the incentive portions, are determinants of labour investment efficiency. They demonstrate that stock options exacerbate inefficient labour investment and restricted options alleviate it. In their estimation, they also control for CEO total compensation, which is significantly positively associated with ineffective labour investment. To ensure the association between the CEO-employee pay ratio and labour investment efficiency is not affected by CEO compensation, I include CEO total compensation, CEO stock options, and CEO restricted stock in additional testing of Model (2). Given that stock options and restricted stock are highly correlated with CEO total compensation, I separate them into two regressions. In the additional tests, CEO compensation is measured as total compensation (TDC1) value for firm *i* at the end of financial year *t*[16]. Stock options are measured as the dollar value of stock option value (scaled by TDC1) for firm *i* at the end of financial year *t*, and restricted stock is measured as the dollar value of restricted stock fair value (scaled by TDC1) for firm *i* at the end of financial year *t*. The results reported in Columns 1 and 2 of Table 3-7, show that the main test variable, LN_PAY_RATIO, remains significantly

[16] For robustness, I replace the value of CEO total compensation, stock option, and restricted stocks at the end of financial year *t-1* in the additional tests, the LN_PAY_RATIO remains statistically significant with a positive sign.

positive at the 5% level for both estimates. These results indicate that the impact of the CEO-employee pay ratio on ineffective labour investment is unaffected when controlling for CEO compensation.

#### *3.6.1.2 Corporate governance*

Corporate governance is seen as a sign of better monitoring (Larcker et al., 2007) that can significantly reduce agency costs and improve firm performance (Core et al., 1999). Although Faleye et al. (2013) find that corporate governance does not determine the CEO-employee pay ratio, I check whether corporate governance is a channel for the pay ratio to affect labour investment efficiency.

Following previous research (Khedmati et al., 2020, Ghaly et al., 2020, Sualihu et al., 2021a), I use the percentage of independent board members (INDEP_DIRECT) and entrenchment index (E-INDEX) (Bebchuk et al., 2009) to control for corporate governance. The E-index, which ranges from 0 to 6, measures the managerial entrenchment levels based on provisions that prevent shareholder governance and a hostile takeover (Bebchuk et al., 2009). A lower E-index indicates stronger corporate governance since there are fewer anti-takeover provisions and less prevention of shareholder governance (Jung et al., 2014). In line with Sualihu et al. (2021a), to test whether the effect of the pay ratio depends on corporate governance, I construct an additional dummy variable, GOODGOV, that equals one if the E-index is less than its sample median value of two and zero otherwise. The results are presented in Table 3-7, Columns 3 to 5. The main test variable, LN_PAY_RATIO, remains significantly positive, revealing that the CEO-employee pay ratio plays an independent role in driving ineffective labour investment after controlling for the quality of corporate governance. The

INDEP_DIRECT, E_INDEX and GOODGOV are all insignificant in the additional tests, indicating corporate governance does not play a role in driving labour investment efficiency. These results confirm the findings in Jung et al. (2014).

To further explore whether corporate governance creates a potential channel for the pay ratio to affect labour investment efficiency and, consistent with Khedmati et al. (2020) and Sualihu et al. (2021a), I interact my main test variable LN_PAY_RATIO with stronger corporate governance (GOODGOV). The results presented in Table 3-7, Column 6, show that the coefficient of the interaction term (LN_PAY_RATIO*GOODGOV) is statistically insignificant, suggesting that the CEO-employee pay ratio has an independent effect on labour investment efficiency.

#### *3.6.1.3 Institutional investors' horizon*

Ghaly et al. (2020) demonstrate that firms monitored by long-term investors have fewer agency conflicts in investment decisions and, therefore, have better labour investment efficiency. To ensure the effect of LN_PAY_RATIO on labour investment efficiency is not affected by long-term investors, I include institutional investors' horizon as an additional control in Model (2). Following Nguyen et al. (2020), I apply investor turnover (INV_TURN) to proxy institutional investors' horizons. The definition and calculation of INV_TURN are given in section 2.4.3. The results are presented in Table 3-7, Column 7. The coefficient of LN_PAY_RATIO remains positive and statistically significant, indicating that the effect of the pay ratio on labour investment efficiency is not affected by institutional investors' horizons.

#### *3.6.1.4 Corporate social responsibility (CSR)*

Cao and Rees (2020) find that employee-friendly firms have better labour investment efficiency because employee-friendly policies facilitate easier recruitment and retention of talent, thereby making better labour investment decisions. Like previous additional tests, I control for corporate social responsibility (CSR) to ensure the effect of LN_PAY_RATIO on ineffective labour investment is independent. Following Nguyen et al. (2020), I collect data on CSR from the KLD database. I then calculate a CSR proxy as the sum of a firm's good social performance[17] and deduct bad social performance[18] from the four main dimensions (i.e., diversity, employee relations, community, and environment)[19]. In Table 3-7, Column 8, the results show that including CSR as an additional control does not change the effect of LN_PAY_RATIO on ineffective labour investment, evidenced by a significant, positive coefficient of LN_PAY_RATIO.

#### *3.6.1.5 Firms' cost of capital and degree of financial constraints*

Benmelech et al. (2021) find that firms' labour investment decisions are affected by their cost of capital and degree of financial constraints because investment in and financing of labour is costly. To rule out the potential effect of the cost of accessing labour, following Ghaly et al. (2020), I include a firm's cost of capital (COST_OF_CAPITAL) and degree of financial

[17] I define good social performance if a firm shows "strength" in the provisions of diversity, employee relations, community and environment. Each shown "strength" adds one to the CSR proxy.
[18] I define bad social performance if a firm shows "concern" in the provisions of diversity, employee relations, community and environment. Each shown "concern" deducts one from the CSR proxy.
[19] For robustness, I replace the aggregated proxy CSR by four proxies of each dimension in the additional test, as in CAO, Z. & REES, W. 2020. Do employee-friendly firms invest more efficiently? Evidence from labor investment efficiency. *Journal of Corporate Finance,* 65**,** 101744. The results show that the coefficient of LN_PAY_RATIO remains positive and statistically significant.

constraint (FIN_CONSTRAINT) in my Model (2). In line with Lau et al. (2010), I apply Easton (2004) MPEG ratio (modified price-earnings ratio divided by the short-term earnings growth rate) as a proxy for the implied cost of capital, which is calculated as the PE ratio divided by the growth in earnings. To measure the degree of financial constraint, I calculate Kaplan and Zingales (1997) index (KL-index) as a proxy. The KL-index is a relative measure of a firm's reliance on external financing. The higher the index, the worse is the financial condition of the firm. Table 3-7, Columns 9 and 10, show that controlling for a firm's cost of capital and degree of financial constraint does not affect the statistical significance and the sign of LN_PAY_RATIO.

In summary, my results are robust with regard to the additional variables in this Section, mitigating concerns of missing variable bias and providing confidence by ruling out alternative explanations.

## Table 3-7 CEO-employee pay ratio and ineffective labour investment with additional control variables

This table presents results from OLS regressions that address the effect of the CEO-employee pay ratio on ineffective labour investment (abnormal net hiring), controlling for additional variables found vital in the literature. CEO compensation (CEO_COMPENSATION) is measured as the total compensation (TDC1) value for firm *i* at the end of financial year *t*. Stock option (CEO_OPTION) is measured as the dollar value of stock option value (scaled by TDC1) for firm *i* at the end of financial year *t*. Restricted stock (CEO_STOCK) is measured as the dollar value of restricted stock fair value (scaled by TDC1) for firm *i* at the end of financial year *t*. Independent director (INDEP_DIRECT) is measured as the percentage of independent board members. E-index is the Bebchuk et al. (2009) entrenchment index. Good governance (GOODGOV) is a dummy variable that equals one if the E-index is less than its sample median 2, and zero otherwise. GOODGOV_D is the interaction term with LN_PAY_RATIO and GOODGOV. Institutional investors' horizon (INV_TURN) is measured following Ghaly et al. (2020). Corporate social responsibility (CSR) is measured following Nguyen et al. (2020). Cost of capital (COST_CAPITAL) is measured by the MPEG ratio following Easton (2004). Financial constraint (FIN_CONS) is measured by the Kaplan and Zingales (1997) index. All other control variables are defined in Appendix A. All regressions include year and industry fixed effects. Other controls, year and industry indicator coefficients are omitted from the Table below. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics is in parentheses.

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| INEFF_LABOR | CEO_COMPEN | CEO_OPTION_STOCK | INDEP_DIRECT | E_INDEX | GOODGOV | GOODGOV_D | INV_TURN | CSR | COST_OF_CAPITAL | FIN_CONSTRAINT |
| LN_PAY_RATIO | 0.0238** | 0.0214** | 0.0258* | 0.0173** | 0.0174** | 0.0158* | 0.0127* | 0.0329* | 0.0203** | 0.0196*** |
| | (2.5369) | (2.2030) | (1.8279) | (2.0613) | (2.0756) | (1.7108) | (1.6685) | (1.8190) | (2.5518) | (2.7801) |
| CEO_COMPENSATION | -0.0000 | | | | | | | | | |
| | (-0.8681) | | | | | | | | | |
| CEO_OPTION | | 0.0211 | | | | | | | | |
| | | (0.7392) | | | | | | | | |
| CEO_STOCK | | 0.0299*** | | | | | | | | |
| | | (2.9458) | | | | | | | | |
| INDEPENDENT_DIRECTOR | | | -0.0085 | | | | | | | |
| | | | (-0.1191) | | | | | | | |
| E_INDEX | | | | 0.0010 | | | | | | |
| | | | | (0.2547) | | | | | | |
| GOODGOV | | | | | -0.0138 | -0.0417 | | | | |
| | | | | | (-1.5394) | (-1.0440) | | | | |
| LN_PAY_RATIO*GOODGOV | | | | | | 0.0069 | | | | |
| | | | | | | (0.7075) | | | | |
| INV_TURN | | | | | | | -0.1963 | | | |
| | | | | | | | (-0.5885) | | | |
| CSR | | | | | | | | -0.0070 | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | (-1.4070) | | |
| COST_OF_CAPITAL | | | | | | | | | -0.0000** | |
| | | | | | | | | | (-2.1390) | |
| FINANCIAL_CONSTRAINTS | | | | | | | | | | -0.0000 |
| | | | | | | | | | | (-0.1679) |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1,746 | 959 | 627 | 1,107 | 1,107 | 1,107 | 573 | 266 | 1,533 | 1,736 |
| Adjusted R-squared | 0.0810 | 0.1199 | 0.0683 | 0.1331 | 0.1345 | 0.1342 | 0.2295 | 0.2222 | 0.0851 | 0.0803 |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cluster Firm | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cluster Year | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

## 3.7 Conclusion

In this chapter, I contribute to the executive compensation literature by evaluating the association between the CEO-employee pay ratio and labour investment efficiency. Extant theories (i.e., the Talent Assignment Theory, Rent Extraction Theory and Equity Theory) predict a distinct relationship between pay ratio and labour investment efficiency. The Talent Assignment Theory posits that a larger pay ratio reflects a CEO's ability and performance. Therefore a talented CEO could make better investment decisions and improve labour investment efficiency. However, the Rent Extraction Theory states that CEOs need to increase the number of employees to "build their empire" to extract rent from companies. Thus, CEOs tend to over-invest in labour, leading to lower labour investment efficiency. Similarly, the Equity Theory expects employee perceived inequity caused by a large pay ratio will cause frequent quitting, driving to a high employee turnover and under-investment in labour.

In this chapter, I provide novel evidence of the relationship between the CEO-employee pay ratio and labour investment efficiency. After incorporating a series of relevant control variables taken from recent research, the results show a significant and positive association between the CEO-employee pay ratio and ineffective labour investment. This result indicates that firms with larger within-firm pay disparity have a lower labour investment efficiency. This result is contrary to the Talent Assignment Theory, but supports the prediction of the Rent Extraction and Equity Theories. In a further subsample analysis, I find that the association between pay ratio and labour investment efficiency is greater when firms over-invest in labour, which rules out the Equity Theory that suggests under-investing in labour. In summary, evidence from the baseline regressions reveals that a higher CEO-employee pay ratio may better reflect the rent extracted by CEOs.

I use several additional tests to mitigate concerns of endogeneity and alternative explanations. First, I re-run the baseline regressions with firm fixed effects to alleviate the impact of any firm time-invariant characteristics. Secondly, I apply falsification tests to mitigate concerns of omitted variable bias. Thirdly, I use entropy balancing to overcome possible selection bias between firms with high pay and low pay ratios. Finally, I introduce 10 additional variables to control for alternative explanations. The results from these additional tests support my main findings that a causal effect exists between the CEO-employee pay ratio and ineffective labour investment.

The findings in this chapter provide vital contributions to the corporate finance literature. First, evidence in this chapter sheds light on the usefulness of the compulsory disclosure of the CEO-employee pay ratio. The recent debate centred on whether the CEO-employee pay ratio can inform firms' stakeholders about the top executive's pay and firm performance because some argue that the disclosure provides no additional information. However, this Chapter provides evidence of the effect of the CEO-employee pay ratio on labour investment efficiency.

Secondly, this Chapter extends research on the economic consequence of the CEO-employee pay ratio. Extant studies focus on evaluating the relationship between the CEO-employee pay ratio and overall firm performance using proxies like Tobin's Q or ROA and generate conflicting results (Cheng et al., 2017a, Elkins, 2016). The results in this chapter suggest that a larger CEO-employee pay ratio correlates with lower labour investment efficiency (e.g., over-invested in labour), indicating CEOs are extracting rent from firms. These findings can help

firms' stakeholders make better informed investment decisions, especially when the firm suffers from low labour investment efficiency.

## Appendix: Description of the regression variables

| Variable | Description (Variable source is in bracket) |
|---|---|
| *Variables used in Model (5):* | |
| NET_HIRE | Percentage change in the number of employees from financial year t-1 to financial year t (Compustat) |
| SALES_GROWTH | Percentage change in sales in year t (Compustat) |
| SALES_GROWTH_LD | Percentage change in sales in year t-1 (Compustat) |
| ΔROA | Change in return on assets in year t (Compustat) |
| ΔROA_LD | Change in return on assets in year t-1 (Compustat) |
| ROA | Return on assets in year t (Compustat) |
| RET | Stock return in year t (Compustat) |
| SIZE_R | The rank of firm size, percentile rank of the natural logarithm of total stock value in year t-1 (Compustat) |
| QUICK | Quick ratio in year t (Compustat) |
| ΔQUICK | Percentage change of QUICK in year t (Compustat) |
| ΔQUICK_LD | Percentage change of QUICK in year t-1 (Compustat) |
| AUR_LD | Ratio of annual sales to a firm's total assets, lagged by one financial year (Compustat) |
| LOSS_BIN/X | Five individual loss bins to indicate each 0.005 interval of ROA from 0 to -0.025 in year t-1. Specifically, LossBin1 equals 1 if ROA is between -0.005 and 0. LossBin2 equals 2 if ROA is between -0.005 and -0.010. LossBin3 equals 3 if ROA is between -0.010 and -0.015. LossBin4 equals 4 if ROA is between -0.015 and -0.020. LossBin5 equals 5 if ROA is between -0.020 and -0.025. (Compustat) |
| | |
| *Variables used in Model (6):* | |
| INEFF_LABOR | Inefficient investment in labour is the dependent variable in Model (2). It is the absolute value of the residuals from Model (1) in financial year t. (Compustat) |
| OVER_INVEST_LABOR | Absolute value of INEFF_LABOR if INEFF_LABOR>0 (Compustat) |
| UNDER_INVEST_LABOR | Absolute value of INEFF_LABOR if INEFF_LABOR<0 (Compustat) |
| PAY_RATIO | CEO-employee pay ratio, calculated from firms' financial data. I define average ordinary employee compensation as the total labour expense (*xlr* from Compustat), deduct total executive compensation (sum of all executives' *TDC1* from ExecuComp), then divide by the total employee number (*emp* from Compustat). |

| | |
|---|---|
| LN_PAY_RATIO | Natural logarithm of PAY_RATIO (Compustat) |
| LN_SIZE_LD | Natural logarithm of firm's total asset, lagged by one financial year (Compustat) |
| MTB_LD | Market to book ratio, lagged by one financial year (Compustat) |
| QUICK_LD | Quick ratio, lagged by one financial year (Compustat) |
| LEV_LD | Leverage, sum of current and long-term liabilities at the end of year t-1, divided by total assets in year t-1 (Compustat) |
| DIV_D_LD | Dummy variable equal to one if the firm paid dividends, lagged by one financial year (Compustat) |
| CFO_STD_LD | Standard deviation of operating cash flow from year t-5 to t-1 (Compustat) |
| SALES_STD_LD | Standard deviation of sales from year t-5 to t-1 (Compustat) |
| TANGIBLES_LD | Property, plant, and equipment in year t-1, divided by firm's total assets in year t-1 (Compustat) |
| LOSS_D | Dummy variable equal to one if ROA is negative for year t-1 (Compustat) |
| INST_OWN_LD | Institutional shareholder ownership, lagged by one financial year (Compustat) |
| NET_HIRE_STD_LD | Standard deviation of NET_HIRE, lagged by one financial year (Compustat) |
| LABOR_INTENSITY_LD | Labour intensity, number of employees divided by firm's total assets at the end of financial year t-1 (Compustat) |
| CEO_OWNERSHIP | CEO stock ownership (Thomson Reuters Insider Filing) |
| AB_INVEST_OTHER | Abnormal other investments (non-labour investment) in year t, the absolute value of the residual from the Model: INVEST_OTHER= $\beta 0 + \beta 1$SALE_GROWTH + $\varepsilon$, where INVEST_OTHER is the sum of capital expenditure, research and development expenditure, deduct cash receipts from the sale of PP&E, all scaled by one year lagged total assets. (Compustat) |
| AQ_LD | Accounting report quality measured in light of the Dechow and Dichev (2002) Model. The Model regresses the working capital accruals on one-year-lagged, current, and one year-ahead CFO, the change in revenue, and PP&E. I use the Model cross-sectional by industry-year and store the residuals. I then calculate the standard deviation of residuals over year t-5 to t-1, and times by negative one. (Compustat) |
| | |
| *Additional control variables* | |
| CEO_COMPEN | CEO compensation, CEO's total compensation (TDC1) for firm i at the end of financial year t (Compustat) |
| CEO_OPTION_STOCK | Sum of CEO option and stock ownership, CEO stock option ownership is measured as the dollar value of stock option value (scaled by TDC1) for firm i at the end of financial year t; CEO restricted stock ownership is |

| | |
|---|---|
| | measured as the dollar value of restricted stock fair value (scaled by TDC1) for firm i at the end of financial year t (Compustat) |
| INDEP_DIRECT | Percentage of independent directors on the board (Thomson Reuters Insider Filing) |
| E_INDEX | E-index is the Bebchuk et al. (2009) entrenchment index. (Thomson Reuters Insider Filing) |
| GOODGOV | Dummy variable, equal to one if the E-index is less than its sample median 2, and zero otherwise. |
| INV_TURN | Institutional investors' investment horizon, detailed definition see Chapter two. (13F) |
| CSR | Corporate social responsibility, measured following Nguyen et al. (2020). |
| COST_CAPITAL | Cost of capital, measured by the MPEG ratio following Easton (2004). |
| FIN_CONS | Financial constraints, measured by the Kaplan and Zingales (1997) index. |

# Chapter 4: CEO-employee pay ratio and stock price crash risk


## Abstract

This chapter investigates the relationship between the CEO-employee pay ratio and stock price crash risk. I find novel evidence that firms with a larger pay ratio have a higher chance of experiencing a stock price crash in the following fiscal year, supporting the Rent Extraction Theory that predicts a positive association between the pay ratio and stock price crash risk. I use firm fixed effects, two-stage estimation with instrumental variables, change of specification and entropy balancing to address endogeneity concerns. My results remain robust to additional controls and alternative measurements of the pay ratio. These findings inform firms' shareholders in making investment decisions, especially when they are prone to wisely managing stock price crash risk.

## 4.1 Introduction

Since the implementation of Section 953 (b) of the Dodd-Frank Act in 2018, a great deal of research has studied the economic consequences of within-firm pay disparity represented by a larger CEO-employee pay ratio (the pay ratio). These studies shed light on the effects of the pay ratio on firms' performance and the impact on shareholders, which provides insight into whether the mandatory disclosure of the pay ratio informs stakeholders. For example, Mueller et al. (2017) find that firm performance is enhanced with a larger pay ratio, but Rouen (2020) finds no significant association between the CEO-employee pay ratio and firm performance. With respect to shareholders' reaction to the pay ratio, Pan et al. (2020) examine the first-time disclosure of the pay ratio in the U.S. stock market and find that firms exhibit lower abnormal market returns from announcing higher pay ratios. Specifically, if a firm's pay ratio increases by one standard deviation, on average, its seven-day cumulative abnormal returns will be lower by around 42 basis points. This study indicates that equity markets are concerned about a high CEO-employee pay ratio, at least in the short term.

A question arises: Will the pay ratio's effect on the stock market act like a "shock" in the short term? Or are there any other impacts from the pay ratio that could potentially and significantly alter share price in the long run? Answering these questions would provide new evidence on the economic consequences of the mandated pay ratio information and offer insights into investor welfare.

Stock price crash risk is a meaningful indication of shareholders' long-term investment, especially for retail shareholders. Given the recent stock market turmoil, retail shareholders could experience significant losses when firms' stock price crashes in their highly concentrated portfolios (Barber and Odean, 2013). As a result, answering what determines shareholders' perceived stock price crash risk could be conducive to protecting shareholder value in the long run. Recently, academic studies have identified a series of determinants of stock price crash risk, such as financial reporting opacity (Hutton et al., 2009), tax avoidance (Kim et al., 2011b), corporate social responsibility (Kim et al., 2014), CEO incentive compensation (Kim et al., 2011a), CEO characteristics (Andreou et al., 2017, He, 2015, Kim et al., 2016b), stock liquidity (Chang et al., 2017), media coverage (Aman, 2013), political incentives (Piotroski et al., 2015), and religion (Callen and Fang, 2015a). However, the CEO-employee pay ratio, a corporate compensation issue that could potentially impact stock price crash risk, has been overlooked.

To investigate the relationship between the CEO-employee pay ratio and stock price crash risk, a series of OLS regressions are conducted. Several techniques are used to mitigate endogeneity concerns, such as firm fixed effects, the change of specification, two-stage estimation with instrumental variables, impact threshold of compounding variables (ITCV) and entropy balancing. The findings suggest a positive association between the CEO-employee pay ratio and stock price crash risk, indicating that firms with a high within-firm pay disparity have more future stock price crashes. The findings remain robust to all testing techniques mentioned above. In a further cross-sectional study, I find that firms granting more stocks to their CEO are less

likely to experience a stock price crash risk, given a large CEO-employee pay ratio. However, corporate governance does not vary the relationship between the CEO-employee pay ratio and stock price crash risk.

This chapter makes two main contributions to the current literature. First, it provides novel evidence on whether the CEO-employee pay ratio can increase shareholders' knowledge about top executives' pay. This result suggests that the CEO-employee pay ratio positively affects stock price crash risk. This finding may help shareholders protect their investments if they manage stock price crash risk wisely. Secondly, this study extends the literature on the determinants of stock price crash risk. The literature provides little insight into the effect of executive compensation on crash risk (Jia, 2018b). However, evidence in this chapter reveals that a larger within-firm pay disparity incentivises CEOs to hoard bad news, leading to a higher chance of a stock crash. Thus, boards can benefit from these results to make informed decisions in designing their CEO's compensation package, especially when the firm has suffered several recent price crashes.

The structure of this chapter is as follows: Section 4.2 reviews the literature in the field of CEO pay disparity and stock price crash risk. Section 4.3 develops the hypothesis based on the current theory. Section 4.1 outlines the research methodology, the sample and the data. Section 4.5 discusses the baseline results, and section 4.6 details the cross-sectional tests. Section 4.7

provides the results of two additional robustness tests. Section 4.8 presents a vital channel of the relationship found in baseline regression, and section 4.9 concludes the chapter.

## 4.2 Literature review

### 4.2.1 CEO-employee pay ratio

#### *4.2.1.1 The background to the CEO-employee pay ratio*

The CEO-employee pay ratio was mandated as an SEC disclosure (Section 953 (b) of the Dodd-Frank Act) starting in January 2018. The law requires firms to compare the CEO's compensation to the compensation of the median employee of the firm. This disclosure is made in SEC filings (i.e., DEF 14A (Proxy statement)), where details of the sample, data, calculation method and an explanation from management are included. Some entities, such as foreign private issuers, emerging growth companies, and smaller reporting companies, are exempt from reporting the ratio. The SEC expects "investors can use the pay ratio information to determine the "fairness" of a company's compensation structure, which in turn would inform investors' advisory Say-on-Pay votes."[20] To reduce disclosure costs, the SEC permits some discretion in the ratio calculation, whereby firms can disclose a Supplementary Pay Ratio if necessary. For example, if firms have employees in foreign jurisdictions where it is illegal to disclose employee compensation, these employees' pay could be excluded from the pay ratio calculation (*Foreign Data Privacy Law Exemption*, up to 5% of total employee number). Another example is the *Cost of Living Adjustment,* where the employees' wages can be adjusted in-line with the cost of living if those employees live in a different jurisdiction from the CEO. In addition, firms are permitted to disclose a supplementary pay ratio, calculated by any method the firm chooses, such as excluding a one-time payment to the CEO.

[20] See letter from Senator Robert Menendez et al. to Michael Piwowar, Acting Chairman, U.S. SEC (Mar. 14, 2017), https://www.sec.gov/comments/pay-ratio-statement/cll3-1660758-148835.pdf

#### *4.2.1.2 Information provided by the CEO-employee pay ratio*

The CEO-employee pay ratio can provide material information for stakeholders, including shareholders, labour unions, executives, and rank-and-file employees. On the one hand, and in line with the SEC's (2015) argument, institutional investors, labour unions and investor advocacy groups believe the pay ratio provides additional meaningful information regarding CEO compensation, which aids in casting a vote in Say-on-Pay[21]. For example, in the proxy voting guideline, the American Federation of Labor and Congress of Industrial Organizations states that executive compensation should be compared with industry peers and employees they hire for the purpose of fiduciary voting[22]. Meanwhile, the Council of Institutional Investors, a non-profit association of pension funds, recognises that whether executive compensation packages are effective and reasonable depends on several factors, including how much they pay their other employees.[23]

On the other hand, disclosure of the pay ratio can be harmful to firms if, by informing on how significant the pay disparity is, rank-and-file employees are disincentivised. As the Equity Theory predicts, if employees perceive a higher pay ratio as a signal of unfair treatment relative to peer firms, they will engage in costly behaviours such as shirking, sabotage, or frequent

[21] See Securities and Exchange Commission (SEC). Pay ratio disclosure. (Aug. 5, 2015), https://www.sec.gov/rules/final/finalarchive/finalarchive2015.shtml

[22] See AFL-CIO (2012). Proxy voting guidelines: Exercising authority, restoring accountability, https://aflcio.org/sites/default/files/2017-03/proxy_voting_2012.pdf

[23] See a comment letter from the Council of Institutional Investors to SEC, https://www.sec.gov/comments/s7-07-13/s70713-296.pdf

voluntary turnover (Adams, 1965, Cowherd and Levine, 1992). Wade et al. (2006) argue that CEO compensation is viewed as a salient reference by rank-and-file employees to evaluate whether their payment is "fair". Smith and Kuntz (2013) state that rank-and-file employees are highly likely to "become disillusioned" by extreme pay disparity. Thus, disclosure of the pay ratio could be used as a fairness measurement by employees, resulting in harmful consequences for the firm (Akerlof and Yellen, 1990, Crawford et al., 2021, Hicks, 1963).

Similarly, industry trade organisations and, primarily, business-related groups critique the disclosure requirement of the pay ratio[24]. They argue that constructing the ratio is costly, with no material, significant, additional information added, given that CEO compensation is included in other SEC filings. Additionally, as is in a comment letter from Exxon Mobil[25], Malcolm Farrant, vice president of human resources, argues that there are no adverse effects from a large pay ratio. The pay disparity is the result of compensating CEOs' "individual performance and specific job requirement". This view aligns with the Talent Assignment Theory, which posits that pay disparity can be seen as a result of a firm's strategy to secure and compensate superior CEO talent (Cheng et al., 2017b). Given that different levels exist in the organisational hierarchy, each higher level requires additional degrees of employee talent and ability. Thus, employees should be compensated on an escalating scale congruent with their skillset.

[24] See Securities and Exchange Commission (SEC). Pay ratio disclosure. (Aug. 5, 2015), https://www.sec.gov/rules/final/finalarchive/finalarchive2015.shtml

[25] See SEC Comments on Pay Ratio Disclosure https://www.sec.gov/comments/s7-07-13/s70713-568.pdf

In the end, the SEC supported the disclosure of the pay ratio despite the debate providing contradictory predictions on whether the pay ratio is beneficial or harmful for firms.

#### *4.2.1.3 The economic consequences of the CEO-employee pay ratio*

Extensive literature reports the economic consequences of the CEO-employee pay ratio and its mandatory disclosure, including its effect on firm performance, management and employee reactions to the disclosure, and the impact on shareholders (i.e., stock market returns and Say-on-Pay voting). The following sections will discuss these in detail.

Firm performance

The association between a large pay ratio and firm performance has been extensively examined with contradictory results. For example, with U.S. firms, the research finds that firm performance is enhanced by a large pay ratio, citing support for the Talent Assignment Theory but contrary to the Rent Extraction Theory (Cheng et al., 2017b, Mueller et al., 2017, Uygur, 2019). Faleye et al. (2013) find evidence that a large pay ratio is positively related to employee productivity, contrary to the Equity Theory's prediction. However, Rouen (2020) finds no significant association between the CEO-employee pay ratio and firm performance. Instead, Rouen finds a negative relationship between unexplained CEO pay to median employee pay ratio and firm performance. A similar negative relationship is found by Elkins (2016) and

Green and Zhou (2019), whereas Balsam et al. (2019) find a concave relationship between the pay ratio and firm performance.

On the international front, Banker et al. (2016) find a positive relationship between within-firm pay disparity and firm performance in China, supporting the Talent Assignment Theory in that firm performance is largely driven by a pay premium for executive talent. However, using Korean data, Shin et al. (2015) find a large pay ratio is negatively associated with firm performance, both in the operating and stock market, which supports the Equity Theory. It is worth noting that studies commonly use Tobin's Q or ROA as proxies for firm performance.

However, the results from these empirical studies need to be interpreted with care. For example, once Rouen (2020) separated the pay ratio into explained, and unexplained components, the association found in many papers that use a general pay ratio disappears (Cheng et al., 2017b, Mueller et al., 2017). Simply focusing on ROA or Tobin's Q might not be sufficient to determine the overall effect of the pay ratio on firm performance. For example, Bardos et al. (2021) find a negative association between the CEO-employee pay ratio and bond yield spreads, arguing that the correct design of an efficient CEO compensation package can reduce firms' financing costs and improve the operating result. Similarly, by linking the pay ratio to firms' labour investment efficiency, my study determines whether the disclosure benefits or harms firm performance.

Management and employee reactions

Boone et al. (2020a) find that both management and employees react differently to the mandatory disclosure of the CEO-employee pay ratio, especially for a high and unexpected pay ratio. They find that management tries to window-dress a high pay ratio by providing a longer discretionary narrative with spin language, while if the pay ratio is unexpectedly high, employees exhibit lower productivity. Interestingly, management's spin language does not affect employees' reactions.

Jung et al. (2018a) find that firms that pay excess compensation to CEOs are more likely to provide a supplementary pay ratio, while firms with better corporate governance are less likely to disclose a supplementary pay ratio. Unexpectedly, some firms disclose a supplementary pay ratio higher than the required pay ratio which Jung et al. (2018a) argue is because of firms trying to inform stakeholders about their tournament incentive considerations.

Shareholder reactions

Shareholders react to the mandatory disclosure of the pay ratio in two ways: on the stock market and through Say-on-Pay voting. By examining the first-time disclosure of the pay ratio in the U.S. market, Pan et al. (2020) find that firms exhibit lower abnormal market returns from announcing higher pay ratios, especially if firms' shareholders are more adversely affected. They also find that inequality-averse shareholders rebalance their portfolios away from firms

with high pay ratios to firms with more reasonable pay ratios. That study indicates that equity markets are concerned about high CEO-employee pay ratios.

For effect on Say-on-Pay voting, Boone et al. (2020a) find a significant positive relationship between high pay ratios and increased dissent voting in Say-on-Pay. The association remains even after the proxy advisor recommends a "For" vote. The adverse effect caused by a large pay ratio on dissent voting is stronger if firms have a higher proportion of institutional ownership. These findings indicate that the CEO-employee pay ratio plays a part in informing firms' shareholders, management and employees, leading to economic consequences for firms.

### 4.2.2 Stock price crash risk

#### *4.2.2.1 The definition and implications of a stock price crash risk*

Chen et al. (2001) define a stock price crash risk as the negative skewness in the distribution of individual stocks' daily returns. In their setting, crash risk identifies higher stock return distribution moments. In other words, crash risk captures extreme negative stock returns, different from the general negative expected returns (Kim et al., 2011b, Callen and Fang, 2015a). Chen et al. (2001) and Kim and Zhang (2014) find that stock price crash risk can potentially present vital implications for portfolio management and asset pricing Models. For example, shareholders require higher risk compensation if a stock has more negative skewness, suggesting that negative skewness is seen as a risk factor for pricing (Harvey and Siddique, 2000, Conrad et al., 2013). Given turmoils in the stock market (e.g., the global financial crisis),

this “risk factor” is even more significant for retail shareholders as they typically have limited principal and only a small number of stocks in their portfolio (Barber and Odean, 2013).

#### *4.2.2.2 Reasons why the stock price might crash*

Based on Agency Theory, Jin and Myers (2006) establish a Model that explains the cause of stock price crashes, that being bad news hoarding by managers. In the agency theoretical framework, information asymmetry between firm owners and insiders allows executives to “manage” how to release stock price-sensitive information. The reasons why managers try to hide bad news are many, such as meeting incentive compensation criteria (Benmelech et al., 2010), reducing the likelihood of potential legal concerns from the bad news or maintaining the share price at a certain level (Kothari et al., 2009).

Jin and Myers (2006) detail how managers withhold bad news. Because of information asymmetry, managers can choose not to fully disclose their investment and operational decisions, which enables them to “save” a portion of free cash flow from profitable investments. This extra cash flow can be used to absorb temporary losses from other investments that are non-profitable, which might be viewed as bad news in the eyes of market participants. In this scenario, managers manipulate the financial report to limit firm-specific bad news in the market. However, if bad news accumulates to a certain threshold that managers can no longer control,

they tend to give up and release all bad news to the market at once. When the “lump sum” of bad news hits the market, stock prices drop, leading to a crash.

Empirical studies support the bad news hoarding theory. Analysing data from 40 countries, Jin and Myers (2006) find that firms in countries that allow more opaque financial reporting are more likely to have stock price crashes. Hutton et al. (2009) found similar evidence in the US market that opaque firms are more prone to stock price crashes. Further, Callen and Fang (2015a) find that firms that restate their financial reports are more likely to experience stock price crashes, believing this result verifies the link between bad news hoarding and a stock price crash. They argue that it is fairly certain that managers in restatement firms were hiding negative information as released restatements cited material misstatements of accounting data (i.e., revenues or expense).

#### *4.2.2.3 The determinants of stock price crash risk*

Given the significance for shareholders, the literature identifies a series of determinants of stock price crash risk. They can be categorised into five major areas: financial reporting, executive compensation, capital market characteristics, corporate governance, and informal institutional mechanisms.

For financial reporting, Francis et al. (2016) find that firms with real earnings management (a proxy for managerial opportunism) have a significantly higher chance of experiencing a stock price crash the following year. This research complements the studies by Jin and Myers (2006) and Hutton et al. (2009), whose work is based on accruals management, another proxy for managerial opportunism. Chen et al. (2017) find that a higher degree of earnings smoothing is associated with higher stock price crash risk, especially when managers conceal bad news. However, if firms conducting earnings smoothing are followed by more analysts or are held by larger institutional shareholders, the risk of a stock price crash is lower. Kim et al. (2011b) provide evidence of a significant positive association between firm tax avoidance and stock price crash risk. Their finding supports the argument that aggressive tax strategies and planning, as opportunistic behaviour, can be used to facilitate managerial rent extraction and conceal negative information leading to crash risk. DeFond et al. (2015) find that non-financial firms that voluntarily adopt international financial reporting standards (IFRS) have lower stock price crash risk since IFRS requires a higher level of transparency. Kim et al. (2014) find that firms' corporate social responsibility performance is significantly and negatively associated with stock price crash risk. Their finding supports the argument that firms committed to a higher transparency standard can allay bad news hoarding behaviour.

For executive compensation, Kim et al. (2011a) find that a chief financial officer's (CFO's) incentive compensation has a significant, positive relationship with stock price crash risk. This relationship is more pronounced for firms with a high level of financial leverage. They find a

similar association for chief executive officers (CEOs), but the link is weaker. Jia (2018b) finds that the pay gap between CEOs and other executives viewed as a promotion-based tournament incentive, which has a significant and positive association with stock price crash risk. Their evidence supports the argument that a tournament incentive can elicit detrimental managerial behaviours to increase the probability of winning the tournament, such as tax aggressiveness and real earnings management, which are determinants of a stock price crash risk.

However, contradictory evidence is found in Chinese data; Sun, Habib and Huang's (2019) study show a significant negative association between tournament incentives and stock price crash risk. They argue that cash-based compensation in China disincentivises executives to withhold bad news. Overall, evidence of the impact of executive compensation on stock price crash risk is limited. For example, the possible rent extracted by CEOs (proxies by a large CEO-employee ay ratio) may potentially affect the risk of a stock price crash.

A CEO's idiosyncratic characteristics also play a role in predicting stock price crash risk. Kim et al. (2016b) find that firms with over-confident CEOs are more likely to experience crashes in their stock price, indicating managerial style can shape CEOs' decisions about bad news hoarding. Andreou et al. (2017) posit that firms with CEOs who receive more financial incentives early in their career are more likely to withhold bad news, leading to future crashes. Chen et al. (2021) reveal that firms led by CEOs with early-life disaster experience are more likely to experience stock price crashes. They argue that experiencing an early-life disaster can

potentially increase risk tolerance, which includes the risk of withholding bad news, and inevitably their firms have a higher risk of stock price crashes.

Regarding capital market characteristics, Chen et al. (2001) find that six months moving average of trade volume can predict the stock price crash risk. They argue that trade volume reflects disagreement among investors. If some are aware of pending bad news, they will trade before the disclosure and, therefore, a firm's stock trading ends with a higher volume between informed and uninformed investors. Chang et al. (2017) reveal a significant, positive association between stock liquidity and stock price crash risk; the effect increases when firms are held by more transient shareholders, implying that the financial market itself can incentivise managers to withhold bad news. They argue that managers fear releasing bad news if their firm is held by more transient investors (better liquidity of firms' stock) who might have a greater likelihood of selling after the disclosure. Consistent with this view, Callen and Fang (2015b) posit that stock short selling is positively related to a future stock price crash risk. The argument is that some short sellers detect the negative information hidden by managers and start taking short positions to benefit from future price crashes.

Corporate governance also predicts stock price crash risk since more robust corporate governance contributes to better financial report quality and helps reduce crash risk (Larcker et al., 2007). Andreou et al. (2016) find that firms with larger insider ownership, larger board size and clearly defined corporate governance policies can help to reduce stock price crash risk.

Callen and Fang (2013) posit a significant negative association between institutional shareholder stability and stock price crash risk, indicating that external monitoring by long-term shareholders mitigates managers' bad news hoarding behaviour. By investigating a unique database in China, Xu et al. (2013) find that an increase in a firm's analyst coverage leads to an increase in stock price crash risk; the effect is more noticeable when analysts are affiliated with investment banks. They argue that higher analyst coverage imposes pressure on managers to meet or beat analysts' forecasts, which incentivises managers to withhold bad news and focus on short-term results. Callen and Fang (2017) provide evidence that auditor tenure is negatively associated with stock price crash risk because increased tenure allows auditors to better understand client-specific information and, therefore, makes it easier to deter bad news hoarding behaviours.

Recent research investigates some informal institutional mechanisms as determinants of stock price crash risk, such as political connections, religiosity and internet searching. Using a sample of Chinese listed firms, Lee and Wang (2017) provide evidence that the presence of politically connected directors in state-owned entries exacerbates the stock price crash risk. However, including politicians as directors in privately owned listed firms can mitigate stock price crash risk. Callen and Fang (2015a) find that firms headquartered in counties in the USA with a higher level of religiosity have lower stock price crash risk. The result supports the argument that religion is a social norm that can limit managers' bad news hoarding behaviours. By conducting a quasi-natural experiment, Xu et al. (2021) find that, after Google unexpectedly

withdrew its search operation in China, listed firms' stock price crash risk increased by around 19%, supporting the theory that internet searching promotes shareholders' information processing.

Although the literature has found numerous determinants for stock price crash risk, limitations exist. For example, the possible rent extracted by CEOs incentivized by their compensation package (proxied by a large CEO-employee pay ratio) in influencing stock price risk has been overlooked but may influence the risk of a stock price crash. In the following section, I elaborate on this link in detail.

### 4.2.3 Theories that link stock price crash risk and the CEO-employee pay ratio

The literature suggests that bad news hoarding is the primary cause of stock price crashes (Kim et al., 2011b, Kim et al., 2011a, Callen and Fang, 2015a, Habib et al., 2018). The argument is that managers tend to withhold bad news from investors because of personal interests, such as meeting incentive compensation criteria (Kim et al., 2011a) or competing for a promotion (Jin and Myers, 2006). Concomitantly, if managers successfully limit the flow of negative information into the market, we should observe an asymmetric distribution of stock price returns (Jin and Myers, 2006, Kothari et al., 2009). However, once bad news accumulates above a threshold that managers cannot control, they tend to give up (Callen and Fang, 2015a).

Therefore, all the negative information is immediately revealed to the stock market. Consequently, we observe a large drop in stock price (a crash).

For the pay ratio, research finds that the stock market reacts to the announcement of a large pay ratio (Pan et al., 2020). For example, firms announcing larger CEO-employee pay ratios have noticeably lower abnormal returns around disclosure time. However, whether a large pay ratio leads to a stock price crash in the long run is unclear. In other words, does a large pay ratio exacerbate the bad news hoarding by managers, especially the CEO? Two theories: the Talent Assignment Theory and the Rent Extraction Theory, provide different predictions for the impact of a large pay ratio on the stock price crash risk.

#### *4.2.3.1 The Talent Assignment Theory*

The Talent Assignment Theory suggests that the CEO-employee pay ratio can be seen as a result of a firm's strategy to secure superior CEO talent (Cheng et al., 2017b). The argument is that firms with complex structures require a governance framework across incremental work levels to maintain a higher state of functioning; such a framework then demands a concomitant level of ability and talent to fill positions within the hierarchy. Logically, the employees in the hierarchy should be compensated on an escalating scale congruent with their skillset, position and level of responsibility. The CEO, who is top of the hierarchy, should be paid proportionately for their talent and ability leading to a larger pay gap compared with rank-and-

file employees. Based on this argument, a large pay gap between rank-and-file employees and the CEO is reasonable in larger and more complex firms. Therefore, given that talented CEOs are competent and knowledgeable, they should always make better investment decisions. As a result, talented CEOs can achieve better-operating results from profitable investments, which investors see as good news. In these circumstances, talented CEOs will have less bad news to withhold and, therefore, a lower chance of a stock market crash. Moreover, managers tend to leak or reveal the good news to investors immediately (Graham et al., 2005, Kothari et al., 2009), ), so overall, talented CEOs should have less share price sensitive information withheld.

Demerjian et al. (2013) find that competent or talented CEOs can integrate and synthesise firm financial information into reliable estimates and better judgment, leading to a higher quality of financial reporting. Subsequently, talented CEOs have a lower chance of strategically managing or hiding stock price sensitive information (i.e., earnings) by manipulating accrual estimates in financial reports. In summary, if the Talent Assignment Theory is valid, we expect that a large pay ratio leads to a lower probability of a stock price crash risk.

#### *4.2.3.2 The Rent Extraction Theory*

The Rent Extraction Theory states that executives such as the CEO are more likely to capture rent in larger firms where more potential rent is available (Bebchuk et al., 2011, Bebchuk and Fried, 2004, Mueller et al., 2017, Rouen, 2020). Because it is impossible for rank-and-file

employees to extract significant rent, rent-seeking behaviour potentially increases executives' compensation resulting in a larger pay ratio. Based on the Rent Extraction Theory, two possible paths exist to predict the relationship between a large pay ratio and a stock price crash risk.

First, Chalmers et al. (2006) find that executives use the channel of incentive compensation to extract rent successfully from the firm, an example of which is granted options. Doing so requires CEOs to fulfil specific criteria to benefit from the compensation package. This creates an incentive for CEOs to use their power and authority to engage in short-sighted and risky investments that can temporarily boost operating results (Hutton et al., 2009) to meet the criteria based on their preference. However, some of these high-risk investments are likely to fail, incentivising CEOs to conceal the bad news to minimise its effects on operating results or stock price (Armstrong et al., 2013b). Studies find that CEOs tend to withhold the bad news by manipulating accruals in financial reports (Hutton et al., 2009); taking aggressive tax strategies (Kim et al., 2011b); or even conducting fraudulent activities (Haß et al., 2015). As bad news accumulates, it becomes unsustainable for CEOs to withhold it in the long run. Inevitably and suddenly, CEOs give up hoarding bad news and let the news be revealed to the stock market all at once, leading to a price crash (Callen and Fang, 2015a).

Another prediction from the Rent Extraction Theory for bad news hoarding is empire building. To successfully extract rent from the firm, executives are required to "build their empire" by receiving support from other co-workers (i.e., other executives and middle-level managers) to

gain more power and more rent (Stein, 2003). A paramount approach for CEOs to gain support from others is to maintain the esteem of their peers (Callen and Fang, 2015a). Demonstrably, serial bad news for firms does not help CEOs preserve their reputation; therefore, CEOs might be incentivised to conceal the news. Ball (2009) argues that it can be a primary reason for managers to hoard bad news by manipulating financial reports to maintain their co-workers' esteem. As elaborated before, once bad news accumulates beyond a threshold, CEOs cannot stop the news from becoming public and, finally, the stock price crashes. Overall, if a large pay ratio reflects CEO rent extraction, then we should expect an increase in the risk of a stock price crash in the long run.

## 4.3 Hypothesis development

Given that Talent Assignment Theory suggests that pay disparity reflects CEOs' ability and performance, I expect firms with more pay disparity to have lower stock price crash risk. That is because talented CEOs should achieve better-operating results and, therefore, less bad news to hide. If the theory is valid, we should observe a significant and negative association between stock price crash risk and the pay ratio. By contrast, if the association is positive or insignificant, we do not find enough evidence to support the Talent Assignment Theory. Based on this argument, the following hypothesis is made:

*$H_1$: The CEO-employee pay ratio as a reflection of a CEO's ability and performance is negatively associated with a stock price crash risk.*

The Rent Extraction Theory predicts that executives are incentivised to extract rent through their compensation package (Chalmers et al., 2006), by engaging in short-sighted and risky investments to boost short-term profit (Hutton et al., 2009). Once some of these high-risk investments fail, they are prone to hide the results to meet the criteria for the remuneration package, which leads to the bad news hoarding. Inevitably, once the accumulated bad news is too much for CEOs to control, it will be revealed to the stock market at once, leading to a price crash. If the theory is valid, pay disparity as a reflection of managerial rent extraction leads to a higher stock price crash risk. Thus, overall, I should observe a positive relationship between

the CEO-employee pay ratio and the stock price crash risk. Consistent with this argument, the following hypothesis is proposed:

*$H_2$: The CEO-employee pay ratio as a reflection of managerial rent extraction is positively associated with stock price crash risk.*

## 4.4 Research methodology

### 4.4.1 Sample and data

To test my hypotheses, I calculate a firm's CEO-employee pay ratio based on the method provided by Faleye et al. (2013). For robustness tests, I hand collect recent years (2017-2020) CEO-employee pay ratio (disclosed by firms) from the Electronic Data Gathering, Analysis, and Retrieval system (EDGAR) provided by SEC. I collect other data from several databases: financial data and CEO-employee pay ratio (calculated) from Compustat; stock return data from CRSP; institutional ownership data from the Thomson Financial Institutional Holdings (13f) database; and executive compensation data from ExecuComp. The sample ranges from the fiscal year 1992 to 2020 because the ExecuComp database started recording data in 1992. The final sample consists of 2975 firm-year observations after merging all databases. I winsorize all continuous variables at the 1st and 99th percentiles to mitigate the effect of outliers.

### 4.4.2 Measurement of the stock price crash risk

Prior literature provides three main measures for firm-specific stock price crash risk (Jin and Myers, 2006, Hutton et al., 2009). These measures are based on firm-specific daily returns, calculated as the regression residuals from the marketing Model of Chen et al. (2001). Using firm-specific returns ensures that crash risk captured from the stock returns is not affected by broad market movements (Habib et al., 2018). The three measures of stock price crash risk I use in this study are: (1) the negative coefficient of skewness of firm-specific daily returns

(NCSKEW); (2) the down-to-up volatility of firm-specific daily returns (DUVOL); and (3) the difference between the numbers of days with negative extreme firm-specific daily returns (CRASH_COUNT).

Following Chen et al. (2001), I estimate the firm-specific residual daily returns by running the regression of the expanded market and industry index Model for each firm and year:

$$r_{j,t} = \alpha_j + \beta_{1,j} r_{m,t-1} + \beta_{2,j} r_{i,t-1} + \beta_{3,j} r_{m,t} + \beta_{4,j} r_{i,t} + \beta_{5,j} r_{m,t+1} + \beta_{6,j} r_{i,t+1} + \varepsilon_{j,t} \quad (7)$$

where: $r_{j,t}$ is the return on firm j on day t; $r_{m,t}$ is the return on the CRSP value-weighted market return on day t; and $r_{i,t}$ is the return on the value-weighted industry index based on 2-digit SIC codes. Following Dimson (1979), I include lead and lad terms for value-weighted market and industry indices to correct for nonsynchronous trading.

The firm-specific daily return, $R_{j,t}$, is defined as the natural log of one plus the residual return ($R_{j,t} = \ln(1+\varepsilon_{j,t})$) from Model (1) above. The primary purpose of the log transformation of the raw residual returns is to reduce the positive skew in the returns distribution and to ensure symmetry (Chen et al., 2001).

The first measurement of stock price crash risk is the negative coefficient of skewness of firm-specific daily returns (NCSKEW), calculated as the negative of the third moment of individual stock's firm-specific daily returns and normalising it by the standard deviation of firm-specific daily returns raised to the third power. Hence, for each firm's stock j in year t is:

$$NCSKEW_{j,T} = -[n(n-1)^{\frac{3}{2}} \sum R_{j,t}^3] \; / \; [(n-1)(n-2)(\sum R_{j,t}^2)^{3/2}] \qquad (8)$$

where n is the number of observations of firm-specific daily returns during the fiscal year T. The measure is multiplied by minus one for a more straightforward explanation that a higher value corresponds to greater crash risk or, in other words, the stock being more "crash prone" (Callen and Fang, 2015a).

The second measurement of stock price risk is the down-to-up volatility of firm-specific daily return (DUVOL), calculated as:

$$DUVOL_{J,T} = \log\left((n_u - 1) \sum_{down} w_{j,t}^2 \; / \; (n_d - 1) \sum_{up} w_{j,t}^2\right) \qquad (9)$$

where $n_u$ and $n_d$ are the number of up and down days during the fiscal year T. Up and down is defined as whether the firm-specific stock return of the day is above (below) the mean of the period. After that, I calculate the standard deviation for up and down days separately. Finally, I calculate the log ratio of the standard deviations between the two groups (up and down). A higher value of DUVOL indicates a stock being more "crash prone". As Chen et al. (2001) suggest, DUVOL does not include the third moment, enabling it to be less affected by extreme daily returns.

The third measurement of stock price crash risk is the difference between the number of days with negative extreme firm-specific daily returns (CRASH_COUNT), calculated as the number of days that firm-specific daily returns exceed 3.09 standard deviations above and below the mean firm-specific daily returns over the fiscal year T. The figure 3.09 is chosen because it captures frequencies of 0.1% in the normal distribution (Hutton et al., 2009). CRASH_COUNT is estimated as the downside frequencies less the upside frequencies. Like the other two measurements, a higher value of CRASH_COUNT indicates greater stock price crash risk.

In the following empirical tests, I use one year ahead of all three measurements as the dependent variable, NCSKEW_LEAD, DUVOL_LEAD and CRASH_COUNT_LEAD.

### 4.4.3 Measurement of the CEO-employee pay ratio

Following Faleye et al. (2013), Przychodzen and Gómez-Bezares (2021) and Alan et al. (2020), I generate the CEO-employee pay ratio from firms' financial data. I define average ordinary employee compensation as the total employee expense (*xlr* from Compustat), minus the total executive compensation (sum of all executives' *TDC1* from ExecuComp), and divide that by the number of employees (*emp* from Compustat). I then generate the CEO-employee pay ratio as the natural log of dividing CEO total compensation (*TDC1* from ExecuComp) by the average ordinary employee compensation.

For robustness purposes, I also manually collect recent firms' CEO-employee pay ratios (2017-2020) from the DEF 14A proxy statement recorded in the Electronic Data Gathering, Analysis, and Retrieval system (EDGAR) provided by SEC.

### 4.4.4 A Model to test the hypothesis

To test my hypothesis that a causal relationship between the CEO-employee pay ratio and stock price crash risk exists, I use Model (4) in the baseline regression:

$$CRASH\_RISK_{j,t+1} = \beta_0 + \beta_1 LN\_PAY\_RATIO_{j,t} + \sum_k \alpha_k CONTROLS_{j,t}^{k} + YEAR_{FE} + INDUSTRY_{FE} + \varepsilon_{i,t} \quad (10)$$

where $CRASH\_RISK_{j,t+1}$ is calculated by NCSKEW_LEAD, DUVOL_LEAD or CRASH_COUNT_LEAD. All regressions include industry (2-digit SIC) and year fixed effects; all standard errors are clustered by firm.

### 4.4.5 Control variables

Following Chen et al. (2001), Jin and Myers (2006), Callen and Fang (2015a), Chang et al. (2017), Xu et al. (2021) and Dang et al. (2022), I control for the following variables: $NCSKEW_t$, the past stock price crash risk calculated as the negative coefficient of skewness for firm-specific daily returns in fiscal year T; $DTURN_t$, a proxy for the heterogeneity calculated as the difference between average monthly stock turnover over fiscal year T and the average monthly stock turnover over fiscal year T-1; $KUR_t$, the kurtosis of firm-specific daily returns in fiscal year T; $SIGMA_t$, the standard deviation of firm-specific daily returns in fiscal year T; $RET_t$, the past stock returns calculated as the cumulative firm-specific daily returns in fiscal year T; $MB_t$, the market to book ratio at the end of fiscal year T; $LEV_t$, calculated as the total liability scaled by total assets at the end of fiscal year T; SIZE, calculated as the log of total assets at the end of fiscal year T; ROE, the return on equity ratio calculated as income before extraordinary items divided by the equity at the end of fiscal year T; $DA_t$, firm-specific earnings management calculated as the absolute value of discretionary accruals estimated from the modified Jones Model (Dechow et al., 1995). To mitigate the potential effects of outliers, I

winsorize all continuous variables at the 1% and 99% percentiles. Details of the variables' definitions can be found in the Appendix.

### 4.4.6 Identification tests

Omitted variables could cause endogeneity concerns in this study. Although several variables found to be significant in the literature have been included in the baseline tests, it is possible that a variable may be missing that could affect the pay ratio and stock price crash risk simultaneously. As a result, associations found in this chapter may be spurious without carefully addressing the endogeneity issues. In the following section, I choose several techniques to mitigate these concerns. The techniques are firm fixed effects; change of specification; two-stage estimation with instrumental variables; impact threshold of compounding variables (ITCV); and entropy balancing.

#### *4.4.6.1 Firm fixed effects*

Firms may have distinct characteristics that could affect the pay ratio. These unobservable and time-invariant characteristics could lead to a spurious association between the pay ratio and stock price crash risk (Sun et al., 2019, Jia, 2018b, Bao et al., 2021). To alleviate the impact of any firm time-invariant characteristics on my baseline regressions, I use firm fixed effects in addition to year fixed effects in the baseline regressions. If I observe similar, significant

relationships to previous regressions, my baseline results are less likely to be affected by unobservable and time-invariant firm characteristics.

#### *4.4.6.2 Change of specification*

Following Jia (2018b) and Xu et al. (2021), in the baseline regression the dependent variable (stock price crash risk) is regressed on the test variable (CEO-employee pay ratio) along with other controls shown in the literature to be relevant. It is worth noting that proxies (i.e., negative conditional skewness of firm-specific daily returns over the fiscal year NCKEW) used for stock market crash risk are one-period-ahead of the test and control variables. To mitigate endogeneity concerns, I change the dependent variable from stock price crash risk (i.e., NCKEW_LEAD) to the change of stock price crash risk between year *t+1* and year *t+2* (i.e., DELTA_NCKEW). Similarly, the main test variable and control variables are changed between year *t* and year *t+1* (Jia, 2018a, Jia, 2018b). Based on the Talent Assignment theory, I expect an increase in the pay gap is associated with a decrease in future firm-specific crash risk. However, according to the Rent Extraction Theory, I should observe an increase in the pay gap is related to an increase in future firm-specific crash risk

#### *4.4.6.3 Two-stage estimation with instrumental variables*

To mitigate endogeneity concerns, I use two-stage least squares (2SLS) estimation with instrumental variables. Following Hsu (2009) and Rouen (2020), I choose the detrended firm-

level R&D growth as an instrumental variable for the CEO-employee pay ratio. The instrumental variable is calculated as the natural log of R&D in fiscal year t-1, after deducting the average logged R&D in fiscal years t-2 to t-5. Once firms start expanding their business, they require more talented executives. To attract those talented executives, firms are offering higher compensation to them (Gabaix and Landier, 2008, Trevor et al., 2012). Meanwhile, while firms are expanding rapidly, they are required to allocate more resources to R&D to support their growth. Based on this argument, the pay ratio is expected to be related to the firm-level R&D growth (detrended), which reflects a shock to firms' growth opportunities. However, if a firm's R&D growth has been detrended, it captures a growth shock in one fiscal year only. Therefore, it is unlikely that the detrended R&D growth is related to a CEO's bad news hoarding behaviour, which requires a long-term effort.

#### *4.4.6.4 The impact threshold of the confounding variable*

Larcker and Rusticus (2010) argue that it is meaningful to address how severe a missing variable could be to overturn the relationship found in baseline regressions. Control variables used in the tests may be insufficient to identify causality. Following Frank (2000) and Sualihu et al. (2021a), I apply the impact threshold of the confounding variable (ITCV) approach to address this concern. This approach evaluates how significant an omitted variable could be related to the main test variables (i.e., the pay ratio) and the dependent variable (i.e., NCSKEW_LEAD, DUVOL_LEAD, CRASH_COUNT_LEAD) that will make the test

variables statistically insignificant. A larger impact threshold indicates that a plausible omitted variable would be less likely to make my test variables statistically insignificant.

#### *4.4.6.5 Entropy balancing (EB)*

Given that the CEO-employee pay ratio has a large standard deviation and a wide gap between the mean and median value in the sample, firms with larger pay ratios may differ significantly from those with smaller pay ratios because of some unique characteristics. These differences may cause covariate imbalance between the two types of firms and raise the concern of self-selection bias. I apply entropy balancing (EB) to achieve covariate balancing to overcome this bias. To do so, I first create a dummy variable, HIGH_LN_PAY_RATIO_D, to separate my sample into treatment and control groups (equal to one if a pay ratio is higher than the sample median LN_PAY_RATIO, and zero otherwise). Following that, I match firms with the above-median pay ratio (treatment) with those with the below-median pay ratio (control) on all control variables from the baseline estimation, which outputs continuous weights for the two groups. In this study, weighted control is achieved by ensuring each mean, variance and skewness is equalised between treatment and weighted control groups. Once the weight is retained, a weighted OLS regression is run to test possible associations with ineffective labour investment for the CEO-employee pay ratio that has not been weighted. I expect the EB regression results to be consistent with the baseline regressions.

## 4.5 Results

### 4.5.1 Descriptive statistics and univariate results

Table 4-1 presents the descriptive statistics of the variables included in the main regression. My main measures of stock price crash risk, NCSKEW_LEAD, DUVOL_LEAD and CRASH_COUNT_LEAD, have mean (median) values of 0.09 (-0.02), -0.04 (-0.06) and -0.22 (0), respectively. These findings of stock price crash risk are generally consistent with those observed by Jia (2018b), Chang et al. (2017) and Li and Zhan (2019), who have a median value of NCSKEW_LEAD of -0.018, -0.028 and -0.017, respectively. It is worth noting that the descriptive statistics of stock price crash risk vary in different studies because of diverse time frames (e.g., from 1962 to 2007 in Kim and Zhang (2014)) or focus on individual industries (e.g., bank industry in Dang et al. (2022)). Therefore the results in this study may not be directly comparable to theirs.

My main test variables' mean and median values for the CEO-employee pay ratio (PAY_RATIO) are 112.06 and 54.19, respectively. These results reveal that, on average, CEOs' compensation is 112 times that of the median employee pay. The value varies significantly between firms, evidenced by a standard deviation of 160.23 and a large mean to median gap. Because of limited data, prior studies' sample size varies from 162 observations (Crawford et al., 2021) to 2303 observations (Pan et al., 2020), the pay ratio has an even broader spread of summary statistics in different studies. However, the results in this chapter, with 2975 firm-year observations, align with most prior research. Notably, Cheng et al. (2017b) report that

mean and median values of the pay ratio of 103.2 and 78.8, respectively, and Pan et al. (2020) find that the pay ratio has a mean and median value of 145 and 65, respectively.

The summary statistics of the other control variables are generally consistent with recent research such as Chen et al. (2021), Kim et al. (2011a) and Dang et al. (2022). For example, in this study, the means of NCSKEW; SIGMA; ROA; and MTB are 0.14; 0.02; 0.05; and 3.31, respectively, which are comparable to those presented by Chen et al. (2021) (i.e., 0.136; 0.034; 0.054; and 3.732, respectively).

**Table 4-1 Descriptive Statistics**

This table provides the descriptive statistics for all variables in Model (10) over the entire sample period from 1992 to 2020.

| Variable | n | Mean | S.D. | Min | 0.25 | Mdn | 0.75 | Max |
|---|---|---|---|---|---|---|---|---|
| NCSKEW_LEAD | 2976 | 0.09 | 1.55 | -5.62 | -0.5 | -0.02 | 0.54 | 5.2 |
| DUVOL_LEAD | 2975 | -0.04 | 0.32 | -1.04 | -0.23 | -0.06 | 0.13 | 0.84 |
| CRASH_COUNT_LEAD | 2978 | -0.22 | 1.58 | -4 | -1 | 0 | 1 | 3 |
| PAY_RATIO | 2978 | 112.06 | 160.23 | 3.78 | 24.13 | 54.19 | 132.01 | 874.6 |
| LN_PAY_RATIO | 2978 | 4.03 | 1.17 | 1.5 | 3.18 | 3.99 | 4.88 | 6.79 |
| NCSKEW | 2978 | 0.14 | 1.41 | -5.43 | -0.47 | -0.02 | 0.54 | 5.23 |
| DTURN | 2978 | 0.01 | 0.1 | -0.76 | -0.02 | 0 | 0.03 | 0.77 |
| RET_MEAN | 2978 | 0.0 | 0.0 | -0.01 | 0.0 | 0.0 | 0.0 | 0.01 |
| SIGMA | 2978 | 0.02 | 0.01 | 0.01 | 0.01 | 0.02 | 0.03 | 0.15 |
| LEV | 2978 | 0.26 | 0.2 | 0 | 0.11 | 0.24 | 0.37 | 1.02 |
| ROA | 2978 | 0.05 | 0.11 | -1.88 | 0.03 | 0.06 | 0.1 | 0.49 |
| MTB | 2978 | 3.31 | 4.83 | -11.31 | 1.47 | 2.41 | 4 | 32.24 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DA | 2978 | 0.04 | 0.33 | -1.04 | -0.03 | 0.01 | 0.06 | 1.91 |
| SIZE | 2978 | 7.72 | 1.54 | 2.04 | 6.6 | 7.61 | 8.77 | 11.75 |

Table 4-2 presents the Pearson correlation coefficients for all variables in the main regressions. As elaborated before, the three measurements (NCSKEW_LEAD, DUVOL_LEAD and CRASH_COUNT_LEAD) of stock price crash risk have a broad spread of summary statistics. However, in recent studies, they exhibit a stronger correlation. For instance, NCSKEW_LEAD has a significant, positive correlation with DUVOL_LEAD, with a correlation coefficient reported as 0.96 in Jia (2018b), 0.9 in Callen and Fang (2015a) and 0.88 in Chen et al. (2021). In line with those findings, my correlation coefficient between NCSKEW_LEAD and DUVOL_LEAD is 0.937 at the 1% significance level, indicating these two measurements are

**Table 4-2 The Pearson correlation coefficients for the variables in Model 2**

This table provides the Pearson pair-wise correlations between all variables in Model (4). ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

| | | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) | NCSKEW_LEAD | 1 | | | | | | | | | | | | |
| (2) | DUVOL_LEAD | 0.937*** | 1 | | | | | | | | | | | |
| (3) | CRASH_COUNT_LEAD | 0.498*** | 0.660*** | 1 | | | | | | | | | | |
| (4) | LN_PAY_RATIO | 0.038** | 0.059*** | 0.047** | 1 | | | | | | | | | |
| (5) | NCSKEW | 0.040** | 0.033* | 0.007 | -0.016 | 1 | | | | | | | | |
| (6) | DTURN | 0.028 | 0.016 | 0.014 | 0.051*** | 0.015 | 1 | | | | | | | |
| (7) | RET_MEAN | 0.038** | 0.082*** | 0.068*** | 0.103*** | -0.418*** | 0.014 | 1 | | | | | | |
| (8) | SIGMA | -0.013 | -0.032* | -0.040** | -0.107*** | 0.082*** | 0.240*** | -0.197*** | 1 | | | | | |
| (9) | LEV | -0.024 | -0.025 | -0.013 | 0.196*** | -0.03 | 0.090*** | -0.068*** | 0.089*** | 1 | | | | |
| (10) | ROA | 0.033* | 0.066*** | 0.072*** | 0.180*** | -0.023 | -0.083*** | 0.196*** | -0.395*** | -0.148*** | 1 | | | |
| (11) | MTB | 0.056*** | 0.059*** | 0.049*** | 0.145*** | -0.015 | 0.035* | 0.137*** | -0.072*** | -0.106*** | 0.113*** | 1 | | |
| (12) | DA | -0.009 | -0.015 | -0.013 | 0.089*** | 0.025 | 0.024 | -0.005 | -0.017 | 0.029 | 0.013 | 0.049*** | 1 | |
| (13) | SIZE | 0.012 | 0.007 | 0.023 | 0.313*** | 0.002 | 0.009 | 0.004 | -0.337*** | 0.254*** | 0.079*** | 0.072*** | -0.014 | 1 |

estimated correctly, though based on a different methodology. The results in Table 4-2 also reveal that there is a positive, significant correlation between the CEO-employee pay ratio (LN_PAY_RATIO) and stock price crash risk (NCSKEW_LEAD, DUVOL_LEAD and CRASH_COUNT_LEAD), indicating that firms with a large pay gap between the CEO and median employees are generally associated with a higher chance of a stock price crash.

### 4.5.2 The impact of the pay ratio on stock price crash risk

Table 4-3 shows the main results for the association between CEO-employee pay ratio and stock price crash risk after controlling for other relevant determinants from recent literature. From Columns 1 to 3, I regress stock price crash risk (NCSKEW_LEAD, DUVOL_LEAD, and CRASH_COUNT_LEAD) on the CEO-employee pay ratio (LN_PAY_RATIO), with firm-level controls, year and industry fixed effects. The results reveal that the coefficients on LN_PAY_RATIO are significantly positive at the 1% level for regressions with the dependent variables NCSKEW_LEAD, and DUVOL_LEAD, and at the 10% level for CRASH_COUNT_LEAD. This result indicates that a larger CEO-employee pay ratio is associated with a higher level of stock price crash risk, suggesting that a large pay gap between the CEO and the median employee increases the risk of a future price crash. This result is consistent with the Rent Extraction Theory (hypothesis 2) that predicts a positive relationship between the pay ratio and stock price crash risk, where CEOs' rent extraction behaviour exacerbates bad news hoarding. However, the result contradicts the Talent Assignment Theory

## Table 4-3 CEO-employee pay ratio and stock price crash risk

This table presents results from OLS regressions that address the effect of the CEO-employee pay ratio on stock price crash risk. Column 1 shows the results of regressing the negative coefficient of skewness of firm-specific daily returns (NCSKEW) on the CEO-employee pay ratio and control variables. Column 2 shows the results of regressing the down-to-up volatility of firm-specific daily return (DUVOL) on the CEO-employee pay ratio and control variables. Column 3 shows the results of regressing the difference between the number of days with negative extreme firm-specific daily returns (CRASH_COUNT) on the CEO-employee pay ratio and control variables. All control variables are defined in Appendix A. All regressions include year and industry fixed effects. Year and industry indicator coefficients are omitted from the Table. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics are in parentheses.

| | (1)<br>NCSKEW_LEAD | (2)<br>DUVOL_LEAD | (3)<br>CRASH_COUNT_LEAD |
|---|---|---|---|
| LN_PAY_RATIO | 0.1031*** | 0.0216*** | 0.0816* |
| | (3.0381) | (3.0531) | (1.7331) |
| NCSKEW | 0.0473** | 0.0114** | 0.0246 |
| | (2.1352) | (2.3215) | (1.2369) |
| DTURN | 0.4351 | 0.0704 | 0.3906 |
| | (1.5299) | (1.2058) | (1.6371) |
| RET_MEAN | 51.0701 | 17.5177** | 49.9329*** |
| | (1.3937) | (2.7066) | (2.8872) |
| SIGMA | 4.1100 | 0.0402 | -3.0311 |
| | (1.0440) | (0.0605) | (-1.1953) |
| LEV | -0.2102 | -0.0378 | -0.0853 |
| | (-1.3435) | (-1.1544) | (-0.4422) |
| ROA | 0.3354 | 0.1098 | 0.6576* |
| | (0.9934) | (1.3313) | (1.9873) |
| MTB | 0.0141*** | 0.0022** | 0.0077 |
| | (4.2297) | (2.4911) | (1.0438) |
| DA | -0.0092 | -0.0117 | -0.0542 |
| | (-0.0859) | (-0.5622) | (-0.7658) |
| SIZE | -0.0018 | -0.0049 | -0.0126 |
| | (-0.0847) | (-0.9918) | (-0.4792) |

| | | | |
|---|---|---|---|
| Constant | -0.3977* | -0.0886** | -0.3999** |
| | (-1.9179) | (-2.6210) | (-2.4680) |
| Observations | 2,975 | 2,974 | 2,977 |
| Adjusted R-squared | 0.0181 | 0.0435 | 0.0235 |
| Year FE | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes |
| Cluster Industry | Yes | Yes | Yes |

(hypothesis 1) that the CEO-employee pay ratio is a reflection of the CEOs' ability and predicts a negative relationship between the pay ratio and stock price crash risk.

### 4.5.3 Addressing endogeneity concerns

#### *4.5.3.1 Firm fixed effects*

My baseline regressions present a solid, notable positive association between the CEO-employee pay ratio and stock price crash risk. However, as discussed earlier, some firm time-invariant characteristics could lead to spurious associations in the analysis. To mitigate the impact of possible time-invariant characteristics, I apply firm fixed effects on all three baseline regressions in Table 4-3.

## Table 4-4 CEO-employee pay ratio and stock price crash risk with firm fixed effects

This table presents results from OLS regressions that address the effect of the CEO-employee pay ratio on stock price crash risk. Column 1 shows the results of regressing the negative coefficient of skewness of firm-specific daily returns (NCSKEW) on the CEO-employee pay ratio and control variables. Column 2 shows the results of regressing the down-to-up volatility of firm-specific daily return (DUVOL) on the CEO-employee pay ratio and control variables. Column 3 shows the results of regressing the difference between the number of days with negative extreme firm-specific daily returns (CRASH_COUNT) on the CEO-employee pay ratio and control variables. All control variables are defined in Appendix A. All regressions include year and firm fixed effects. Year and firm indicator coefficients are omitted from the Table. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics are in parentheses.

| | (1)<br>NCSKEW_LEAD | (2)<br>DUVOL_LEAD | (3)<br>CRASH_COUNT_LEAD |
|---|---|---|---|
| LN_PAY_RATIO | 0.2163*** | 0.0431** | 0.1591** |
| | (2.9170) | (2.4636) | (2.0581) |
| NCSKEW | -0.0515* | -0.0079 | -0.0286 |
| | (-1.9170) | (-1.3379) | (-1.0399) |
| DTURN | 0.3373 | 0.0544 | 0.2631 |
| | (1.3843) | (1.0861) | (1.0689) |
| RET_MEAN | 30.3946 | 13.3903* | 34.1536 |
| | (0.8552) | (1.9946) | (1.6447) |
| SIGMA | 2.0757 | -0.4348 | -3.0814 |
| | (0.2987) | (-0.4632) | (-0.8263) |
| LEV | 0.1243 | 0.0152 | -0.0211 |
| | (0.4018) | (0.2606) | (-0.0781) |
| ROA | 0.8350 | 0.2128 | 0.7278 |
| | (1.0776) | (1.2812) | (1.1458) |
| MTB | 0.0160*** | 0.0033*** | 0.0154** |
| | (3.5768) | (3.5238) | (2.2564) |
| DA | -0.0009 | -0.0099 | -0.0630 |
| | (-0.0081) | (-0.4719) | (-0.8911) |
| SIZE | 0.4133*** | 0.0816*** | 0.2557*** |
| | (5.1941) | (5.2009) | (4.1518) |

| | | | |
|---|---|---|---|
| Constant | -4.1285*** | -0.8540*** | -2.8275*** |
| | (-5.9631) | (-5.9637) | (-5.0312) |
| Observations | 2,952 | 2,951 | 2,954 |
| Adjusted R-squared | 0.0351 | 0.0653 | 0.0358 |
| Year FE | Yes | Yes | Yes |
| Firm FE | Yes | Yes | Yes |
| Cluster Industry | Yes | Yes | Yes |

Table 4-4 presents all baseline regressions with a firm fixed effect. Similar to the baseline estimation, Column 1 shows that the coefficient of LN_PAY_RATIO is significantly positive at the 1% level with a larger coefficient compared to the one in the baseline regression. The results in Columns 2 and 3 reveal that the positive association between the pay ratio and the other two measures are also significantly positive (at the 5% level). Overall, Columns 1 to 3 suggest that time-invariant firm characteristics do not affect the baseline regressions.

#### *4.5.3.2 Change of specification*

As elaborated in section 4.4.6.2, I change the specification of dependent and main test variables in the baseline regression to further mitigate the endogeneity concerns. However, as Jia (2018b) suggests, the variation of the pay gaps between the CEO and other employees could be relatively small between each two years. Therefore, I apply a two-year window to calculate the change of each variable. Specifically, the change of the three measures of crash risk is between

year t+1 to year t+3, and the change of LN_PAY_RATIO and all control variables is between year t to year t+2.

### Table 4-5 CEO-employee pay ratio and stock price crash risk: Changed specification

This table presents results from OLS regressions that address the effect of the changes in the CEO-employee pay ratio on the changes in stock price crash risk. Column 1 shows the results of regressing the changes in the negative coefficient of skewness of firm-specific daily returns (NCSKEW) on the changes in the CEO-employee pay ratio and control variables. Column 2 shows the results of regressing the changes in down-to-up volatility of firm-specific daily return (DUVOL) on the changes in the CEO-employee pay ratio and control variables. Column 3 shows the results of regressing the changes in the difference between the number of days with negative extreme firm-specific daily returns (CRASH_COUNT) on the changes in the CEO-employee pay ratio and control variables. DELTA_NCSKEW, DELTA_DUVOL and DELTA_CRASH_COUNT are measured between year t+1 and year t+3. The main test and control variables are measured between year t and year t+2. All control variables are defined in Appendix A. All regressions include year and industry fixed effects. Year and industry indicator coefficients are omitted from the Table below. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics are in parentheses.

| | (1)<br>DELTA_NCSKEW | (2)<br>DELTA_DUVOL | (3)<br>DELTA_CRASH_COUNT |
|---|---|---|---|
| DELTA_PAY_RATIO | 0.2636*** | 0.0582*** | 0.2499** |
| | (3.4985) | (3.4158) | (2.4773) |
| DELTA_NCSKEW_LAD | 0.0574*** | 0.0102** | 0.0108 |
| | (3.9614) | (2.6302) | (0.4207) |
| DELTA_DTURN | 0.8697** | 0.1268* | 0.4432 |
| | (2.3994) | (1.7802) | (1.5638) |
| DELTA_RET_MEAN | -13.0590 | 5.2410 | -9.0264 |
| | (-0.5023) | (0.9870) | (-0.3940) |
| DELTA_SIGMA | -5.0018 | -2.6524* | -9.0136 |
| | (-0.4631) | (-1.7293) | (-1.2913) |
| DELTA_LEV | 0.2973 | 0.0266 | -0.0689 |
| | (0.4771) | (0.2129) | (-0.1346) |
| DELTA_ROA | 0.8719* | 0.1487* | 0.5963 |
| | (1.7471) | (1.7034) | (1.2357) |

| | | | |
|---|---|---|---|
| DELTA_MTB | 0.0373*** | 0.0072*** | 0.0207** |
| | (6.9371) | (4.6959) | (2.4863) |
| DELTA_DA | -0.0486 | -0.0236 | -0.1769 |
| | (-0.3156) | (-0.8216) | (-1.5149) |
| DELTA_SIZE | 1.0172*** | 0.1948*** | 0.5867*** |
| | (8.1020) | (8.6023) | (3.8571) |
| Constant | 0.2914*** | 0.0508*** | 0.1277*** |
| | (10.7522) | (10.5483) | (4.0789) |
| Observations | 2,235 | 2,233 | 2,237 |
| Adjusted R-squared | 0.0449 | 0.0574 | 0.0155 |
| Year FE | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes |
| Cluster Industry | Yes | Yes | Yes |

Table 4-5 presents the results in detail. From Columns 1 to 3, I find a significant and positive coefficient on LN_PAY_RATIO, consistent with results found in Table 4-3. This result reconfirms that an increased pay gap between CEO and median employees is associated with an increase in future crash risk.

#### *4.5.3.3 Two-stage estimation with instrumental variables*

To further address the missing variable concerns, I adopt a two-stage instrumental variable approach to re-run the main regressions in Table 4-3. Following Crawford et al. (2021), I select detrended firm-level R&D growth (DETREND_RD_GROWTH) as an appropriate instrumental variable for the CEO-employee pay ratio (LN_PAY_RATIO). In the first stage, I regress DETREND_RD_GROWTH on LN_PAY_RATIO with all controls included in the

baseline regression. The results are reported in Table 4-6. Column 1 shows a significant (at the 1% level) relationship between DETREND_RD_GROWTH and LN_PAY_RATIO. This result indicates that detrended firm-level R&D is a significant determinant of the pay ratio in my sample.

In the second stage, I re-run the baseline regression using the predicted values of LN_PAY_RATIO from the first stage. Table 4-6, Columns 2, 3 and 4, present the second stage estimates. The coefficients of LN_PAY_RATIO are significantly positive at the 5% level as predicted, showing that, after controlling for endogeneity, the association between the CEO-employee pay ratio and stock price crash risk is still positive and statistically significant.

To identify whether the instrument variable is weak or over-identifies the endogenous variable, I conduct the instrument relevance test (Cragg and Donald, 1993) and over-identification test (Sargan, 1958). In terms of testing the weak instrumental variable (for Column 2), the Cragg-Donald Wald F-statistic of the two-stage regression is 8.91, higher than the 20% level Stock-Yogo weak IV test critical value (maximal IV size) 6.66. Similar results are shown in Columns 3 and 4, indicating that the instrumental variable is not weak (Cragg and Donald, 1993). Since only one instrumental variable is included in the two-stage regression, the Hansen J-statistic is 0, indicating an absence of over-identification. In summary, the results from the 2SLS regression confirm that

Table 4-6 CEO-employee pay ratio and stock price crash risk: IV 2SLS regressions

This table presents the results of two-stage least-squares (2SLS) regressions that address the effect of the CEO-employee pay ratio on stock price crash risk, with detrended firm-level R&D (DETREND_RD_GROWTH) as the instrument variable. In the first stage estimation, I regress the CEO-employee pay ratio on the instrumental variable and control variables. In the second stage estimation, I regress stock price crash risk (NCSKEW, DUVOL and CRASH_COUNT) on the predicted pay ratio with control variables. All control variables are defined in Appendix A. All estimations include year and industry fixed effects. Year and industry indicator coefficients are omitted from the Table below. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics are in parentheses.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | First Stage | Second Stage | | |
| | LN_PAY_RATIO | NCSKEW_LEAD | DUVOL_LEAD | CRASH_COUNT_LEAD |
| DETREND_RD_GROWTH | 0.2707*** | | | |
| | (0.0907) | | | |
| LN_PAY_RATIO *instructed* | | 1.6367** | 0.3850** | 2.5684** |
| | | (2.1320) | (2.2347) | (2.3499) |
| NCSKEW | 0.0565** | -0.0985* | -0.0223* | -0.1149 |
| | (0.0283) | (-1.9182) | (-1.8972) | (-1.2754) |
| DTURN | 0.6093 | -1.8828 | -0.3731 | -2.2193** |
| | (0.4675) | (-1.3469) | (-1.6443) | (-2.2664) |
| RET_MEAN | 45.8492* | 55.3812 | 13.8203 | 11.2194 |
| | (25.8744) | (1.0049) | (1.1164) | (0.1795) |
| SIGMA | -0.7260 | 2.0458 | -0.4562 | 6.3703 |

| | | | | |
|---|---|---|---|---|
| | (3.9730) | (0.2503) | (-0.2317) | (0.5832) |
| LEV | 0.1843 | -0.0190 | 0.0125 | 0.0906 |
| | (0.1833) | (-0.0441) | (0.1189) | (0.1227) |
| ROA | -0.0003 | 0.4275 | 0.0984 | 0.6640 |
| | (0.2145) | (1.0275) | (1.1877) | (1.0328) |
| MTB | 0.0096* | -0.0045 | -0.0029 | -0.0345* |
| | (0.0050) | (-0.3055) | (-0.8975) | (-1.7941) |
| DA | 0.1178 | 0.5990* | 0.0526 | 0.0613 |
| | (0.1545) | (1.9294) | (0.9260) | (0.1479) |
| SIZE | 0.3780*** | -0.6798** | -0.1631** | -0.9527** |
| | (0.0291) | (-2.0000) | (-2.0694) | (-2.0073) |
| Observations | 552 | 552 | 552 | 552 |
| Adjusted R-squared | 0.671 | 0.6863 | 0.5755 | 0.1818 |
| Year FE | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes |
| Cluster Industry | Yes | Yes | Yes | Yes |

there is a cause-effect relationship between the CEO-employee pay ratio and stock price crash risk.

#### *4.5.3.4 The impact threshold of the confounding variable*

Although the impact threshold of a confounding variable (ITCV) is not a foolproof way to solve all endogenous concerns in empirical studies (Sualihu et al., 2021a), Larcker and Rusticus (2010) argue that ITCV can show how severely a missing variable could overturn the relationship found in the baseline estimation. Ideally, the larger the ITCV of the test variable, the lower the chance of a plausible omitted variable overturning the test variable to be statistically insignificant. By using the "konfound" command in STATA (Xu et al., 2019) after the main baseline regressions in Table 4-3, Column 1, the ITCV procedure provides a score of 0.143 for the LN_PAY_RATIO. This result reveals that the correlation between a confounding variable and LN_PAY_RATIO and NCSKEW_LEAD must be greater than 14.31% (i.e., 0.0205^0.5) to overturn the baseline result. The ITCV procedure also provides the percentage bias that would invalidate the inference that, in this study, is 35.46%. In other words, 1055 cases (out of the sample of 2975) would have to be replaced with cases for which there is a zero effect. Similar results are found for the other main baseline regressions in Table 4-3, Column 2. The ITCV procedure provides scores of 0.1442 for LN_PAY_RATIO, indicating that the correlation between a confounding variable and LN_PAY_RATIO has to be greater than 14.42% (i.e., 0.0208^0.5) to overturn the baseline result. In other words, 35.78% or 1064 observations (out of the sample of 2974) would have to be replaced with cases for which there

is a zero effect. Overall, these results from the ITCV procedure reveal that the positive association between LN_PAY_RATIO and stock price crash risk is unlikely to be caused by a corrected omitted variable. However, it is worth noting that the ITCV procedure enhances causal inference in this study but does not prove causality.

#### *4.5.3.5 Entropy balancing*

As presented in the summary statistics, the CEO-employee pay ratio has a large standard deviation and a wide gap between the mean and median values in the sample. Therefore, firms with larger pay ratios may differ noticeably from those with smaller pay ratios because of several unique characteristics. These differences may cause covariate imbalance between the two types of firms and raise concerns of self-selection bias. I use entropy balancing (EB) to achieve covariate balancing to overcome any bias. Specifically, I generate a dummy variable, HIGH_LN_PAY_RATIO_D, to separate my sample into treatment and control groups (equal to one if a pay ratio is higher than the sample median LN_PAY_RATIO 3.99, and zero otherwise). I then match the above-median pay ratio (treatment) firms with those with below-median pay ratio (control) on all control variables from the baseline regression, which outputs continuous weights for the two groups. In this study, weighted control is achieved by ensuring each mean, variance and skewness is equalised between treatment and weighted control groups. Once the weight is retained, a weighted OLS regression is run to test possible associations with stock price crash risk for the CEO-employee pay ratio that has not been weighted.

Table 4-7 CEO-employee pay ratio and stock price crash risk: After EB weighting

This table presents results from OLS regressions that address the effect of the CEO-employee pay ratio on stock price crash risk by weighted control observations after EB. Column 1 shows the results of regressing the negative coefficient of skewness of firm-specific daily returns (NCSKEW) on the CEO-employee pay ratio and control variables. Column 2 shows the results of regressing the down-to-up volatility of firm-specific daily return (DUVOL) on the CEO-employee pay ratio and control variables. Column 3 shows the results of regressing the difference between the number of days with negative extreme firm-specific daily returns (CRASH_COUNT) on the CEO-employee pay ratio and control variables. All control variables are defined in Appendix A. All regressions include year and industry fixed effects. Year and industry indicator coefficients are omitted from the Table. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics are in parentheses.

| | (1)<br>NCSKEW_LEAD | (2)<br>DUVOL_LEAD | (3)<br>CRASH_COUNT_LEAD |
|---|---|---|---|
| LN_PAY_RATIO | 0.1206*** | 0.0240*** | 0.0522 |
| | (3.6901) | (3.4017) | (0.9590) |
| NCSKEW | 0.0655*** | 0.0178*** | 0.0817*** |
| | (2.8920) | (3.1466) | (2.8560) |
| DTURN | 0.5201 | 0.0848 | 0.5790 |
| | (1.6124) | (0.9745) | (1.3429) |
| RET_MEAN | 42.0149 | 18.5728** | 95.2261*** |
| | (1.1532) | (2.6474) | (3.1732) |
| SIGMA | 4.9796 | 0.0558 | -4.2857 |
| | (1.6117) | (0.0795) | (-1.1209) |
| LEV | -0.3330** | -0.0591* | -0.0286 |
| | (-2.5311) | (-1.7519) | (-0.1122) |
| ROA | 0.4106 | 0.1356 | 0.7221 |
| | (0.6196) | (1.0649) | (1.5285) |
| MTB | -0.0013 | -0.0011 | -0.0065 |
| | (-0.2458) | (-0.8660) | (-0.7570) |
| DA | -0.0555 | -0.0187 | 0.0002 |
| | (-0.4502) | (-0.7290) | (0.0028) |
| SIZE | 0.0013 | -0.0048 | -0.0109 |
| | (0.0453) | (-0.7161) | (-0.3035) |

| | | | |
|---|---|---|---|
| Constant | -0.4471** | -0.0838** | -0.2204 |
| | (-2.0535) | (-2.0820) | (-0.8735) |
| Observations | 2,975 | 2,974 | 2,975 |
| Adjusted R-squared | 0.0297 | 0.0632 | 0.0445 |
| Year FE | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes |
| Cluster Industry | Yes | Yes | Yes |

In Table 4-7, Columns 1 to 3 present the result of Models in the baseline regression when all control variables have been weighted. This result agrees with the unweighted OLS regressions shown in Table 4-3, and the significance level remains at 1% level for NCSKEW_LEAD and DUVOL_LEAD. However, the third measure of crash risk, CRASH_COUNT_LEAD, becomes insignificant[26]. The significant coefficients found in Columns 1 and 2 confirm the positive association between the CEO-employee pay ratio and stock price crash risk. Overall, the EB approach reduces the endogeneity concern that firms with a high pay ratio are systematically different to those with a low pay ratio. It also verifies my baseline result that firms with a higher pay ratio tend to have more future stock price crashes.

[26] For consistency, the EB regressions have Year and Industry fixed effects included. Once repeated the same tests with Year and Firm fixed effects, the p-value of CRASH_COUNT_LEAD is 0.101, very close to the 10% level of significance.

## 4.6 Cross-sectional tests

The previous empirical tests show a robust positive effect of the CEO-employee pay ratio on stock price crash risk. In this Section, I further analyse the possible economic mechanism that could drive this effect. Specifically, I examine how the relationship between the CEO-employee pay ratio and stock price crash risk varies with the choice of CEO incentive compensation packages and the quality of corporate governance.

### 4.6.1 The role of CEO incentive compensation packages

Agency Theory argues that incentive compensation for executives is an effective mechanism to align the interests of shareholders and managers. However, studies also find that different designs of incentive compensation packages for managers can induce self-serving behaviour that could be harmful to firms (Andreou et al., 2016). For example, a large amount of granted stock options might significantly change managers' risk-taking behaviour, which can directly affect firms' investment choices (Kim et al., 2011a). As a result of risky investments, as discussed earlier, managers might try to manipulate financial reporting to withhold bad news to meet criteria in the compensation package. For example, Kim et al. (2011a) find that both CEOs' and CFOs' option portfolios positively affect firms' future stock price crash risk. Interestingly, in their research, both the CEO's and CFO's stock portfolio has no effect on firms' crash risk, indicating that two different incentives (stocks vs options) might affect managers' bad news hoarding differently. However, given a large pay ratio, it is unclear whether a CEO's

incentive compensation design plays a role in future stock price crash risk. Answering this question could shed light on the compensation design to improve corporate governance.

To investigate the effect of CEO incentive compensation on the association between the CEO-employee pay ratio and stock price crash risk, I include three main measures of CEO incentive compensation. Specifically, I measure CEO total compensation, CEO options granted and CEO stock granted in fiscal year t. In the spirit of Dang et al. (2022), I generate dummy variables CEO_TDC_D, CEO_OPTION_D and CEO_STOCK_D, as ones for firms with above-median values for CEO total compensation, CEO option granted and CEO stock granted in the sample, respectively. Then I re-run my baseline regressions but conditioning on CEO compensation. The results are presented in Table 4-8.

Table 4-8, Columns 1 to 3 show that, within the sample, CEO total compensation does not play a role in affecting the relationship between pay ratio and crash risk, as evidenced by CEO_TDC_D and its interaction term with LN_PAY_RATIO being insignificant. Similar results can be found for the CEO options granted in Columns 4 to 6, in which CEO_OPTION_D and its interaction term with LN_PAY_RATIO are insignificant. This result implies that, given a large CEO-employee pay ratio, granting more options to CEOs has no impact on next year's stock price crash risk compared with those granting fewer. However,

Columns 7 and 8[27] show that, given a large CEO-employee pay ratio, firms granting their CEOs more stock have less future stock price crash risk, as evidenced by a significant and negative coefficient of the interaction term between CEO_STOCK_D and LN_PAY_RATIO. This result suggests that firms could mitigate future crash risk when CEO compensation and its gap with the median employee wage is constantly growing.

The literature explains why granted options and stock might affect CEOs' behaviour differently (i.e., risk-taking, bad news hoarding). Although both granted options and stock bestow ownership to executives with upside potential of the share price (Sualihu et al., 2021a), only granted stock exposes executives to potential downside risk (Hou et al., 2020). When executives hold a large number of granted stock, bad news hoarding may not be an option because any future stock price crash could hurt them.

[27] In Column (9), the p-value of the interaction term CEO_STOCK_D* LN_PAY_RATIO is 0.127 which is very close to the 10% significance level.

## Table 4-8 The role of CEO incentive compensation in future stock price crash risk

This table presents results from OLS regressions that address the role of CEO incentive compensation on the effect of the CEO-employee pay ratio on stock price crash risk. I include three main measures of CEO incentive compensation: CEO total compensation, CEO options granted and CEO stock granted in fiscal year T. In Columns 1 to 3, I generate the dummy variable CEO_TDC_D equal to one for firms with above-median values for CEO total compensation and zero otherwise. In Columns 4 to 6, I generate the dummy variable CEO_OPTION_D equal to one for firms with above-median values for CEO option granted and zero otherwise. In Columns 7 to 9, I generate the dummy variable CEO_STOCK_D equal to one for firms with above-median values for CEO stock granted and zero otherwise. All control variables are defined in Appendix A. All regressions include year and firm fixed effects. Year and firm indicator coefficients are omitted from the Table below. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics are in parentheses.

| | (1) NCSKEW_LEAD | (2) NCSKEW_LEAD | (3) NCSKEW_LEAD | (4) NCSKEW_LEAD | (5) NCSKEW_LEAD | (6) NCSKEW_LEAD | (7) NCSKEW_LEAD | (8) NCSKEW_LEAD | (9) NCSKEW_LEAD |
|---|---|---|---|---|---|---|---|---|---|
| LN_PAY_RATIO | 0.3135*** | 0.0554*** | 0.2402*** | 0.2581*** | 0.0510*** | 0.1746** | 0.2846*** | 0.0573*** | 0.2002** |
| | (3.2230) | (2.8248) | (2.6370) | (2.9444) | (2.8860) | (2.2644) | (3.2813) | (3.3200) | (2.5572) |
| CEO_TDC_D | -0.2081 | -0.1062 | -0.3892 | | | | | | |
| | (-0.5044) | (-1.3348) | (-1.0321) | | | | | | |
| CEO_TDC_D*LN_PAY_RATIO | -0.0132 | 0.0126 | 0.0275 | | | | | | |
| | (-0.1377) | (0.6765) | (0.3051) | | | | | | |
| CEO_OPTION_D | | | | 0.1229 | 0.0258 | 0.0229 | | | |
| | | | | (0.3685) | (0.3829) | (0.0823) | | | |
| CEO_OPTION_D*.LN_PAY_RATIO | | | | -0.0511 | -0.0099 | -0.0173 | | | |
| | | | | (-0.6645) | (-0.6307) | (-0.2623) | | | |
| CEO_STOCK_D | | | | | | | 0.4959* | 0.1067* | 0.5932** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | (1.7442) | (1.9041) | (2.0807) |
| CEO_STOCK_D*LN_PAY_RATIO | | | | | | | -0.1090* | -0.0230* | -0.0962 |
| | | | | | | | (-1.7499) | (-1.8431) | (-1.4138) |
| NCSKEW | -0.0536* | -0.0083 | -0.0309 | -0.0516* | -0.0079 | -0.0285 | -0.0524* | -0.0081 | -0.0297 |
| | (-1.8540) | (-1.4806) | (-1.2605) | (-1.7999) | (-1.4257) | (-1.1786) | (-1.8202) | (-1.4462) | (-1.2332) |
| DTURN | 0.3503 | 0.0568 | 0.2740 | 0.3416 | 0.0551 | 0.2655 | 0.3189 | 0.0504 | 0.2357 |
| | (1.2405) | (0.9255) | (0.8805) | (1.2129) | (0.8963) | (0.8525) | (1.1263) | (0.8185) | (0.7497) |
| RET_MEAN | 28.6397 | 13.2874** | 33.1028 | 29.8726 | 13.2838** | 34.1087 | 28.7545 | 13.0210** | 32.8825 |
| | (1.0504) | (2.5486) | (1.4376) | (1.0915) | (2.5787) | (1.4953) | (1.0587) | (2.5283) | (1.4491) |
| SIGMA | 1.8119 | -0.4975 | -3.2511 | 2.2032 | -0.4124 | -3.0289 | 2.3020 | -0.3764 | -2.8049 |
| | (0.3212) | (-0.5153) | (-0.9281) | (0.3940) | (-0.4306) | (-0.8663) | (0.4151) | (-0.3909) | (-0.8056) |
| LEV | 0.1067 | 0.0077 | -0.0510 | 0.1157 | 0.0136 | -0.0237 | 0.1456 | 0.0195 | -0.0005 |
| | (0.3387) | (0.1253) | (-0.1763) | (0.3682) | (0.2214) | (-0.0840) | (0.4644) | (0.3189) | (-0.0018) |
| ROA | 0.8295 | 0.2153* | 0.7331 | 0.8444 | 0.2142* | 0.7335 | 0.8150 | 0.2089 | 0.7138 |
| | (1.3520) | (1.6898) | (1.2966) | (1.3790) | (1.6797) | (1.3024) | (1.3244) | (1.6343) | (1.2714) |
| MTB | 0.0158** | 0.0032** | 0.0150* | 0.0159** | 0.0033** | 0.0154* | 0.0156** | 0.0032** | 0.0151* |
| | (2.3110) | (2.1966) | (1.7304) | (2.2833) | (2.2652) | (1.7823) | (2.2686) | (2.2329) | (1.7455) |
| DA | -0.0050 | -0.0105 | -0.0666 | 0.0016 | -0.0095 | -0.0614 | -0.0049 | -0.0108 | -0.0642 |
| | (-0.0453) | (-0.4927) | (-0.7703) | (0.0145) | (-0.4467) | (-0.7069) | (-0.0442) | (-0.5057) | (-0.7387) |
| SIZE | 0.4119*** | 0.0825*** | 0.2581*** | 0.4131*** | 0.0815*** | 0.2561*** | 0.4043*** | 0.0797*** | 0.2473*** |
| | (4.6565) | (5.0900) | (3.0698) | (4.7350) | (5.0946) | (3.0546) | (4.5742) | (4.9368) | (2.8897) |
| Constant | -4.3637*** | -0.8838*** | -3.0324*** | -4.2380*** | -0.8755*** | -2.8620*** | -4.3818*** | -0.9083*** | -3.0877*** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (-6.1580) | (-6.8021) | (-4.4174) | (-5.6415) | (-6.4218) | (-4.2514) | (-5.9796) | (-6.7196) | (-4.5723) |
| Observations | 2,952 | 2,951 | 2,954 | 2,952 | 2,951 | 2,954 | 2,952 | 2,951 | 2,954 |
| Adjusted R-squared | 0.0362 | 0.0666 | 0.0370 | 0.0344 | 0.0645 | 0.0347 | 0.0352 | 0.0655 | 0.0368 |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cluster Firm | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

### 4.6.2 The role of corporate governance

Corporate governance is a signal of better monitoring (Larcker et al., 2007) that could significantly reduce agency costs and improve firm performance (Core et al., 1999). Although Faleye et al. (2013) find that corporate governance does not determine the CEO-employee pay ratio, Andreou et al. (2016) reveal that transient institutional ownership and independent directors on the board can directly affect stock price crash risk. It is unclear whether there is a mechanism through which strong corporate governance could drive the association between the CEO-employee pay ratio and stock price crash risk. In other words, I intend to examine whether better corporate governance can reduce stock price crash risk given a large CEO-employee pay ratio.

To test this conjecture, I follow previous studies and apply four corporate governance proxies: total and dedicated institutional ownership (An and Zhang, 2013, Chang et al., 2017); the entrenchment index (E-index) (Bebchuk et al., 2009) and the percentage of independent directors on board.

Bushee (1998) argues that dedicated shareholders tend to monitor firms more closely in the longer term, significantly limiting myopic managerial behaviour. Following this argument, I calculate investor turnover (INV_TURN) to proxy institutional investors' horizons. The lower the INV_TURN of a firm, the more long-term institutional investors (dedicated investors) the

firm has. The E-index, which ranges from 0 to 6, measures the managerial entrenchment level based on provisions that prevent shareholder governance and a hostile takeover (Bebchuk et al., 2009). A lower E-index indicates stronger corporate governance because there are fewer anti-takeover provisions and less prevention of shareholder governance (Jung et al., 2014).

I then use the dummy variables DED_OWN_D, INS_OWN_D, and IND_DERE_D for firms with above-median values for dedicated institutional ownership, overall institutional ownership and the percentage of independent directors on board, respectively. Meanwhile, in line with Sualihu et al. (2021a), I construct a dummy variable, GOODGOV_D, that equals one if the E-index is less than its sample median of three and zero otherwise. For these dummy variables, if they equal one, then they indicate a stronger firm corporate governance. Like in the previous Section, I run regressions conditional on all the governance proxies identified above. The results are presented in Table 4-9.

## Table 4-9 The role of corporate governance in the risk of future stock price crashes

This table presents results from OLS regressions that address the effect of the CEO-employee pay ratio on stock price crash risk on the role of corporate governance. I include three main measures of CEO incentive compensation: total and dedicated institutional ownership, the entrenchment index (E-index), and the percentage of independent directors on the board. In Columns 1 to 3, I generate the dummy variable DED_OWN_D as one for firms with above-median values for dedicated institutional ownership and zero otherwise. In Columns 4 to 6, I generate the dummy variable INS_OWN_D as one for firms with above-median values for total institutional ownership and zero otherwise. In Columns 7 to 9, I generate the dummy variable GOOD_GOV_D as one for firms with above-median values for E-index and zero otherwise. In Columns 10 to 12, I generate the dummy variable IND_DERE_D as one for firms with above-median values for the percentage of independent directors on board and zero otherwise. All control variables are defined in Appendix A. All regressions include year and firm fixed effects. Year and firm indicator coefficients are omitted from the Table below. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics is in parentheses.

| | (1) NCSKEW_LEAD | (2) DUVOL_LEAD | (3) CRASH_COUNT_LEAD | (4) NCSKEW_LEAD | (5) DUVOL_LEAD | (6) CRASH_COUNT_LEAD | (7) NCSKEW_LEAD | (8) DUVOL_LEAD | (9) CRASH_COUNT_LEAD | (10) NCSKEW_LEAD | (11) DUVOL_LEAD | (12) CRASH_COUNT_LEAD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LN_PAY_RATIO | 0.2107*** | 0.0411*** | 0.1434** | 0.1777** | 0.0364** | 0.1473* | 0.4683*** | 0.0860*** | 0.2531** | 0.1568 | 0.0374* | 0.1961** |
| | (3.0245) | (2.9603) | (2.3228) | (1.9847) | (1.9834) | (1.7720) | (3.4057) | (3.0840) | (2.0128) | (1.5199) | (1.8441) | (2.2149) |
| DED_OWN_D | -0.1311 | -0.0572 | -0.5227 | | | | | | | | | |
| | (-0.3240) | (-0.6828) | (-1.4308) | | | | | | | | | |
| DED_OWN_D*.LN_PAY_RATIO | 0.0681 | 0.0201 | 0.1355 | | | | | | | | | |
| | (0.7820) | (1.1022) | (1.5824) | | | | | | | | | |
| INS_OWM_D | | | | -0.1248 | -0.0167 | -0.0696 | | | | | | |
| | | | | (-0.3697) | (-0.2338) | (-0.1998) | | | | | | |
| INS_OWM_D*LN_PAY_RATIO | | | | 0.0569 | 0.0099 | 0.0175 | | | | | | |
| | | | | (0.7303) | (0.5999) | (0.2118) | | | | | | |
| GOODGOV_D | | | | | | | 0.1824 | 0.0439 | 0.8509 | | | |
| | | | | | | | (0.2980) | (0.3601) | (1.3826) | | | |
| GOODGOV_D*LN_PAY_RATIO | | | | | | | -0.0696 | -0.0199 | -0.2295* | | | |
| | | | | | | | (-0.4955) | (-0.7250) | (-1.7426) | | | |
| IND_DERE_D | | | | | | | | | | -0.2475 | -0.0150 | 0.2708 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | (-0.6096) | (-0.1918) | (0.7737) |
| IND_DERE_D*LN_PAY_RATIO | | | | | | | | | | 0.0699 | 0.0067 | -0.0443 |
| | | | | | | | | | | (0.7805) | (0.3919) | (-0.5523) |
| NCSKEW | -0.0533* | -0.0083 | -0.0303 | -0.0519* | -0.0080 | -0.0286 | -0.0463 | -0.0082 | -0.0133 | -0.0522* | -0.0079 | -0.0276 |
| | (-1.8731) | (-1.4920) | (-1.2468) | (-1.8141) | (-1.4381) | (-1.1811) | (-1.2451) | (-1.0767) | (-0.3628) | (-1.8151) | (-1.4155) | (-1.1347) |
| DTURN | 0.3303 | 0.0531 | 0.2609 | 0.3281 | 0.0522 | 0.2645 | 1.0130*** | 0.1381 | 0.1707 | 0.3348 | 0.0548 | 0.2721 |
| | (1.1772) | (0.8683) | (0.8448) | (1.1579) | (0.8484) | (0.8442) | (2.8779) | (1.5771) | (0.2847) | (1.1893) | (0.8953) | (0.8788) |
| RET_MEAN | 29.3447 | 13.1453** | 32.8169 | 29.4492 | 13.1645** | 34.0860 | 68.7914 | 20.0793** | 117.0851** | 30.4185 | 13.3621** | 33.9093 |
| | (1.0798) | (2.5462) | (1.4357) | (1.0849) | (2.5544) | (1.4927) | (1.5608) | (2.0408) | (2.2267) | (1.1188) | (2.5895) | (1.4820) |
| SIGMA | 2.1411 | -0.4266 | -3.0168 | 2.5222 | -0.3296 | -3.0614 | -4.4011 | -0.9682 | -2.7447 | 2.2353 | -0.4398 | -3.3998 |
| | (0.3821) | (-0.4450) | (-0.8727) | (0.4528) | (-0.3475) | (-0.8902) | (-0.4410) | (-0.4819) | (-0.2824) | (0.3986) | (-0.4576) | (-0.9774) |
| LEV | 0.1250 | 0.0128 | -0.0588 | 0.1330 | 0.0166 | -0.0190 | 0.0422 | -0.0076 | -0.2810 | 0.1478 | 0.0159 | -0.0560 |
| | (0.3914) | (0.2055) | (-0.2014) | (0.4256) | (0.2718) | (-0.0669) | (0.0581) | (-0.0533) | (-0.5424) | (0.4703) | (0.2587) | (-0.1963) |
| ROA | 0.8363 | 0.2136* | 0.7380 | 0.8521 | 0.2166* | 0.7297 | 1.0357 | 0.4144** | 0.3608 | 0.8389 | 0.2120* | 0.7096 |
| | (1.3727) | (1.6916) | (1.3260) | (1.3945) | (1.7110) | (1.2990) | (1.0989) | (2.1299) | (0.3502) | (1.3742) | (1.6720) | (1.2704) |
| MTB | 0.0157** | 0.0032** | 0.0150* | 0.0161** | 0.0033** | 0.0154* | 0.0141 | 0.0039 | 0.0293** | 0.0161** | 0.0033** | 0.0153* |
| | (2.3047) | (2.2644) | (1.7273) | (2.3052) | (2.2790) | (1.7847) | (1.2540) | (1.5267) | (2.0708) | (2.3173) | (2.2806) | (1.7644) |
| DA | -0.0039 | -0.0108 | -0.0690 | -0.0019 | -0.0101 | -0.0632 | 0.0360 | -0.0045 | -0.1259 | 0.0007 | -0.0097 | -0.0635 |
| | (-0.0354) | (-0.5084) | (-0.8105) | (-0.0173) | (-0.4747) | (-0.7353) | (0.2205) | (-0.1483) | (-1.0238) | (0.0059) | (-0.4563) | (-0.7414) |
| SIZE | 0.4126*** | 0.0812*** | 0.2527*** | 0.4004*** | 0.0787*** | 0.2558*** | 0.6195** | 0.1267** | 0.3915 | 0.4181*** | 0.0828*** | 0.2630*** |
| | (4.6854) | (5.0655) | (3.0104) | (4.5779) | (4.9003) | (2.9648) | (2.5611) | (2.4872) | (1.5011) | (4.7882) | (5.0877) | (3.0932) |
| Constant | -4.1188*** | -0.8458*** | -2.7354*** | -3.9579*** | -0.8231*** | -2.7841*** | -6.7892*** | -1.3897*** | -4.1873** | -3.9612*** | -0.8497*** | -3.0924*** |
| | (-5.8030) | (-6.5290) | (-4.0909) | (-5.4659) | (-6.2682) | (-4.1023) | (-3.4008) | (-3.3567) | (-1.9896) | (-5.1212) | (-5.7923) | (-4.1880) |
| Observations | 2,952 | 2,951 | 2,954 | 2,952 | 2,951 | 2,954 | 1,058 | 1,058 | 1,058 | 2,952 | 2,951 | 2,954 |
| Adjusted R-squared | 0.0348 | 0.0651 | 0.0356 | 0.0346 | 0.0648 | 0.0347 | 0.0505 | 0.0673 | 0.0133 | 0.0343 | 0.0644 | 0.0349 |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Firm FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Cluster Firm | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Columns 1 to 12 report that the coefficients of nearly all interaction terms between the CEO-employee pay ratio and each governance proxy are insignificant, indicating that corporate governance does not affect the association of the CEO-employee pay ratio on stock price crash risk. This result supports the evidence in the study by Faleye et al. (2013) that corporate governance does not play a role in the pay disparity between CEO and median employees.

## 4.7 The channel of bad news hoarding

In this Section, I investigate the main channel driving my main findings, specifically bad news hoarding. Rent Extraction Theory predicts that a large CEO-employee pay ratio is the consequence of CEO rent-seeking behaviour. CEOs are prone to engaging in risky investments to successfully extract rent to fulfil their incentive compensation criteria. However, some of these high-risk investments inevitably fail, incentivising CEOs to conceal this bad news to minimise its effects on operating results. Consequently, CEOs manipulate financial reports to hoard bad news. To directly examine this economic channel, I employ a commonly used measure of information hoarding in this test: firm-level conditional conservatism in financial reporting (CSCORE) (Dang et al., 2022). CSCORE indicates firms' tendency to either accelerate the recognition of losses (bad news) or delay the recognition of gains (good news) (Basu, 1997). Firms with a larger CSCORE are recognised to be more conservative. Kim et al. (2016a) find that firms with a higher accounting conservatism have significantly less bad news hoarding. I calculate CSCORE by following the method developed by Khan and Watts (2009).

Firstly, following Dang et al. (2022), I regress bad news hoarding (proxies by CSCORE) on the CEO-employee pay ratio (LN_PAY_RATIO) along with some firm-specific controls as in Li and Zhan (2019). Table 4-10, Column 1 presents the result that LN_PAY_RATIO is negatively associated with CSCORE with a 5% significance level, indicating that firms with a larger pay ratio have less accounting conservatism. This result is in line with Bao et al. (2021), who find that larger pay ratios are associated with lower financial reporting quality.

Secondly, also following Dang et al. (2022), I apply mediation analysis to measure the magnitude of the economic impact through this channel. Conditioning on the results from Columns 2 to 4, the products of the paths' coefficients are 0.0024 (= -0.004*-0.602), 0.001 (= -0.004*-0.173) and 0.003 (= -0.004*-0.66) for NCSKEW_LEAD, DUVOL_LEAD and CRASH_COUNT_LEAD, respectively. These results represent 2.33%, 4.63% and 3.68% of the effect of within-firm pay disparity captured by the coefficient of LN_PAY_RATIO, respectively, in Table 4-3. In sum, these results provide solid evidence that the impact of LN_PAY_RATIO does occur via the bad news hoarding channel.

## Table 4-10 The relationships between CEO-employee pay ratio and bad news hoarding

This table presents results from OLS regressions that address the role of bad news hoarding, i.e., conditional conservatism. Column 1 shows the results of regressing bad news hoarding (proxied by CSCORE) on the CEO-employee pay ratio (LN_PAY_RATIO) along with LEV, ROA, MB and SIZE as controls. Column 2 shows the results of regressing the negative coefficient of skewness of firm-specific daily returns (NCSKEW) on the CEO-employee pay ratio and CSCORE. Column 3 shows the results of regressing the down-to-up volatility of firm-specific daily return (DUVOL) on the CEO-employee pay ratio and CSCORE. Column 4 shows the results of regressing the difference between the number of days with negative extreme firm-specific daily returns (CRASH_COUNT) on the CEO-employee pay ratio and CSCORE. All control variables are defined in Appendix A. All regressions include year and industry fixed effects. Year and industry indicator coefficients are omitted from the Table. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics are in parentheses.

| | (1)<br>C_SCORE | (2)<br>NCSKEW_LEAD | (3)<br>DUVOL_LEAD | (4)<br>CRASH_COUNT_LEAD |
|---|---|---|---|---|
| LN_PAY_RATIO | -0.0039** | 0.1010*** | 0.0210*** | 0.0793* |
| | (-2.1494) | (2.9682) | (2.9885) | (1.7055) |
| C_SCORE | | -0.6024* | -0.1727** | -0.6601 |
| | | (-1.8460) | (-2.3677) | (-1.6779) |
| NCSKEW | | 0.0458** | 0.0110** | 0.0231 |
| | | (2.1176) | (2.3062) | (1.1793) |
| DTURN | | 0.4201 | 0.0660 | 0.3759 |
| | | (1.4268) | (1.0840) | (1.5297) |
| RET_MEAN | | 50.7666 | 17.4383*** | 49.3985*** |
| | | (1.3907) | (2.7089) | (2.8557) |
| SIGMA | | 4.3985 | 0.1205 | -2.7755 |
| | | (1.1253) | (0.1844) | (-1.1171) |
| LEV | 0.9199*** | 0.3414 | 0.1203 | 0.5190 |
| | (114.4104) | (0.8880) | (1.3947) | (1.0823) |
| ROA | -0.0391** | 0.3217 | 0.1058 | 0.6413* |
| | (-2.1378) | (0.9211) | (1.2367) | (1.8698) |
| MTB | -0.0144*** | 0.0054 | -0.0003 | -0.0018 |
| | (-19.9707) | (1.1822) | (-0.3093) | (-0.2890) |
| DA | | -0.0091 | -0.0117 | -0.0539 |

| | | | | |
|---|---|---|---|---|
| | | (-0.0868) | (-0.5736) | (-0.7696) |
| SIZE | -0.1231*** | -0.0753 | -0.0259** | -0.0932 |
| | (-45.2598) | (-1.4350) | (-2.1576) | (-1.5091) |
| Constant | 0.9361*** | 0.1533 | 0.0695 | 0.2065 |
| | (47.9285) | (0.3680) | (0.8293) | (0.5091) |
| Observations | 2,977 | 2,975 | 2,974 | 2,977 |
| Adjusted R-squared | 0.9316 | 0.0187 | 0.0451 | 0.0242 |
| Year FE | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes |
| Cluster Industry | Yes | Yes | Yes | Yes |

To provide further evidence of the bad news hoarding channel, I follow the method of Li and Zhan (2019) and investigate whether bad news caused by weakening firm performance can worsen stock price crash risk. Li and Zhan (2019) argue that firms might suffer stock price crashes because of current inflated profits becoming unsustainable in the future, which disappoints investors and analysts, represented by a negative earnings surprise. Inflated current profits could signal that some negative information has been withheld by managers (or a greater likelihood of a bubble forming), inevitably leading to a future stock price crash (Dang et al., 2022). In the same vein, I predict that the impact of a large CEO-employee pay ratio on the increasing risk of a stock price crash is more relevant for firms with decreasing profits that exceed investors' expectations.

To test this conjecture, I use earnings surprise (SURPRISE) as a proxy for profitability. It is calculated as the difference between actual earnings and the median individual analyst forecasts divided by year-end stock price (Dang et al., 2022). Then I generate a dummy variable, SURPRISE_D, to equal one if a firm's current fiscal year's earnings surprise is less than the sample median and zero otherwise. I also generate a dummy variable. SURPRISE_LEAD_D, equal to one if a firm's next fiscal year's earnings surprise is less than the sample median and zero otherwise. When SURPRISE_D and SURPRISE_LEAD_D equal one, they indicate a negative earnings surprise, given that the median value of SURPRISE_D and SURPRISE_LEAD_D are both zero. Finally, I run regressions based on the two proxies of firm profitability.

The results are shown in Table 4-11. Columns 1 to 3 show that the interaction term between SURPRISE_D and LN_PAY_RATIO is insignificant, revealing that the current year's earnings surprise does not affect the association between the CEO-employee pay ratio and stock price crash risk. However, as shown in Column 4, the interaction term between SURPRISE_D and LN_PAY_RATIO is significantly positive with a relatively large coefficient, indicating that firms with future negative earnings surprises are prone to higher stock price crash risks, given a large CEO-employee pay ratio. Overall, the evidence in Table 4-11 suggests that stock price crash risk can be caused by weakening future firm performance, consistent with the bad news hoarding channel.

## Table 4-11 CEO-employee pay ratio and bad news hoarding: Earnings surprises

This table presents results from OLS regressions that address the role of bad news hoarding, i.e., profitability. Profitability proxies of earning surprise (SURPRISE) are calculated as the difference between actual earnings and the median individual analyst forecast, divided by the year-end stock price. SURPRISE_D equals 1 if a firm's current fiscal year's earnings surprise is less than the sample median and 0 otherwise. SURPRISE_LEAD_D equals 1 if a firm's next fiscal year's earnings surprise is less than the sample median and 0 otherwise. Columns 1 and 4 show the results of regressing the negative coefficient of skewness of firm-specific daily returns (NCSKEW) on SURPRISE_D and SURPRISE_LEAD_D, respectively. Columns 3 and 5 show the results of regressing the down-to-up volatility of firm-specific daily return (DUVOL) on SURPRISE_D and SURPRISE_LEAD_D, respectively. Columns 4 and 6 show the results of regressing the difference between the number of days with negative extreme firm-specific daily returns (CRASH_COUNT) on SURPRISE_D and SURPRISE_LEAD_D, respectively. All control variables are defined in Appendix A. All regressions include year and firm fixed effects. Year and firm indicator coefficients are omitted from the Table. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics is in parentheses.

| | (1)<br>NCSKEW_LEAD | (2)<br>DUVOL_LEAD | (3)<br>CRASH_COUNT_LEAD | (4)<br>NCSKEW_LEAD | (5)<br>DUVOL_LEAD | (6)<br>CRASH_COUNT_LEAD |
|---|---|---|---|---|---|---|
| LN_PAY_RATIO | 0.2021*** | 0.0395*** | 0.1486** | 0.1675** | 0.0340** | 0.1533** |
| | (2.8172) | (2.7674) | (2.3320) | (2.3392) | (2.3647) | (2.4512) |
| SURPRISE_D | -0.1265 | -0.0419 | -0.1805 | | | |
| | (-0.5777) | (-0.9410) | (-0.7754) | | | |
| SURPRISE_D*LN_PAY_RATIO | 0.0419 | 0.0093 | 0.0209 | | | |
| | (0.7902) | (0.8722) | (0.3774) | | | |
| SURPRISE_LEAD_D | | | | 0.2462 | 0.0627 | 0.5743** |
| | | | | (1.2008) | (1.3768) | (2.2668) |
| SURPRISE_LEAD_D*LN_PAY_RATIO | | | | 0.0879* | 0.0151 | -0.0285 |
| | | | | (1.7871) | (1.3963) | (-0.4729) |

| | | | | | | |
|---|---|---|---|---|---|---|
| NCSKEW | -0.0531* | -0.0079 | -0.0264 | -0.0598** | -0.0096* | -0.0344 |
| | (-1.8110) | (-1.3852) | (-1.0719) | (-2.2020) | (-1.8186) | (-1.4488) |
| DTURN | 0.3244 | 0.0537 | 0.2750 | 0.3646 | 0.0596 | 0.2803 |
| | (1.1611) | (0.8818) | (0.8824) | (1.2377) | (0.9367) | (0.8905) |
| RET_MEAN | 32.6900 | 13.1595** | 29.0519 | 46.1917* | 16.7653*** | 46.9896** |
| | (1.2021) | (2.5732) | (1.2813) | (1.6990) | (3.2742) | (2.0306) |
| SIGMA | 2.0274 | -0.4586 | -3.2056 | 2.3334 | -0.4195 | -2.7312 |
| | (0.3607) | (-0.4781) | (-0.9323) | (0.4167) | (-0.4456) | (-0.7753) |
| LEV | 0.1174 | 0.0143 | -0.0192 | 0.1293 | 0.0166 | -0.0321 |
| | (0.3742) | (0.2339) | (-0.0677) | (0.4207) | (0.2771) | (-0.1135) |
| ROA | 0.8533 | 0.2083 | 0.6645 | 0.6770 | 0.1786 | 0.5892 |
| | (1.3718) | (1.6334) | (1.2003) | (1.1329) | (1.4391) | (1.0633) |
| MTB | 0.0160** | 0.0033** | 0.0152* | 0.0169** | 0.0035** | 0.0160* |
| | (2.3023) | (2.2560) | (1.7545) | (2.4971) | (2.4910) | (1.8781) |
| DA | -0.0052 | -0.0106 | -0.0630 | -0.0043 | -0.0105 | -0.0627 |
| | (-0.0471) | (-0.4976) | (-0.7359) | (-0.0414) | (-0.5168) | (-0.7312) |
| SIZE | 0.4104*** | 0.0816*** | 0.2598*** | 0.3755*** | 0.0738*** | 0.2287*** |
| | (4.6444) | (5.0404) | (3.1195) | (4.6463) | (4.9951) | (2.8075) |
| Constant | -4.0598*** | -0.8368*** | -2.7772*** | -3.8469*** | -0.7993*** | -2.7526*** |
| | (-5.6595) | (-6.4104) | (-4.1210) | (-5.7679) | (-6.5611) | (-4.1767) |

| | | | | | | |
|---|---|---|---|---|---|---|
| Observations | 2,952 | 2,951 | 2,954 | 2,952 | 2,951 | 2,954 |
| Adjusted R-squared | 0.0344 | 0.0645 | 0.0354 | 0.0651 | 0.0954 | 0.0508 |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Cluster Firm | Yes | Yes | Yes | Yes | Yes | Yes |

## 4.8 Robustness tests

### 4.8.1 Additional controls

As elaborated in the literature review, recent studies find that the pay gap between CEOs and other executives is positively associated with stock price crash risk. Jia (2018b) argues that the pay gap is viewed as a tournament for executives to chase promotion. As a result of this strong incentive, executives are tempted to indulge in unethical behaviour such as real earnings management, misreporting financial statements and becoming tax aggressive. Such misconduct has been found to cause stock price crashes. In contrast, investigating Chinese data, Sun et al. (2019) find a negative association between the pay gap (CEO-other executives) and stock price crash risk, arguing that cash-based compensation in China constrains executives' ability to manipulate financial reports and, therefore, mitigates future stock price crash risk. It is worth noting that there is no available research examining the exact relationship between the two pay gaps, i.e., the CEO-employee pay gap (this study's main focus) and the CEO-other executives pay gap. In practical terms, the two pay gaps may have some connection because a large CEO-other executives pay gap indicates a large pay for the CEO, which might lead to a large CEO-employee pay ratio. To ensure my results are not affected by the omission of the CEO-other executives pay gap, and following Jia (2018b) and Sun et al. (2019), I generate two measures of the CEO-other executive pay gap, PAY_GAP_MEDIAN, calculated as the natural log of the difference between the total compensation of a firm's CEO and the median value of total compensation of other executives in the current fiscal year, and PAY_GAP_MAX calculated as the natural log of the difference between the total compensation of a firm's CEO and the maximum value of total compensation of other executives in current fiscal year.

The results reported in Table 4-12, Columns 1 to 6, show that the main test variable LN_PAY_RATIO remains significantly positive at the 5% level for DUVOL_LEAD and CRASH_COUNT_LEAD, and at the 10% level for NCSKEW_LEAD. These results indicate that the impact of the CEO-employee pay ratio on stock price crash risk is unaffected when the CEO-other executive pay gap is included as a control.

## Table 4-12 The CEO-employee pay ratio and stock price crash risk: An additional control with the CEO-other executive pay gap

This table presents results from OLS regressions that address the effect of the CEO-employee pay ratio on stock price crash risk, controlling for an additional variable the CEO-other executive pay gap. PAY_GAP_MEDIAN is calculated as the natural log of the difference between the total compensation of a firm's CEO and the median value of total compensation of other executives, and PAY_GAP_MAX is calculated as the natural log of the difference between the total compensation of a firm's CEO and the maximum value of total compensation of other executives in the current fiscal year. Columns 1 and 4 show the results of regressing the negative coefficient of skewness of firm-specific daily returns (NCSKEW) on the CEO-employee pay ratio. Columns 2 and 5 show the results of regressing the down-to-up volatility of firm-specific daily returns (DUVOL) on the CEO-employee pay ratio. Columns 3 and 6 show the results of regressing the difference between the numbers of days with negative extreme firm-specific daily returns (CRASH_COUNT) on the CEO-employee pay ratio. All other control variables are defined in Appendix A. All regressions include year and industry fixed effects. Year and industry indicator coefficients are omitted from the Table below. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics are in parentheses.

| | (1) NCSKEW_LEAD | (2) DUVOL_LEAD | (3) CRASH_COUNT_LEAD | (4) NCSKEW_LEAD | (5) DUVOL_LEAD | (6) CRASH_COUNT_LEAD |
|---|---|---|---|---|---|---|
| LN_PAY_RATIO | 0.1047* | 0.0262** | 0.1373** | 0.0964* | 0.0255** | 0.1353** |
| | (1.7818) | (2.4853) | (2.5118) | (1.7080) | (2.3414) | (2.3458) |
| PAY_GAP_MEDIAN | 0.0127 | -0.0015 | -0.0502 | | | |
| | (0.2466) | (-0.1610) | (-1.2916) | | | |
| PAY_GAP_MAX | | | | -0.0031 | -0.0039 | -0.0486 |
| | | | | (-0.1092) | (-0.6884) | (-1.1843) |
| NCSKEW | 0.0448* | 0.0112* | 0.0234 | 0.0424* | 0.0099* | 0.0148 |
| | (1.7750) | (2.0135) | (1.0530) | (1.9291) | (1.8407) | (0.6171) |
| DTURN | 0.3479 | 0.0511 | 0.3397 | 0.2711 | 0.0277 | 0.1335 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | (1.3241) | (1.0169) | (1.5102) | (0.8843) | (0.5162) | (0.5700) |
| RET_MEAN | 53.1418 | 17.4940** | 47.7596*** | 51.9779 | 17.2958** | 63.0185*** |
| | (1.3756) | (2.6088) | (2.8936) | (1.3046) | (2.6400) | (3.2390) |
| SIGMA | 5.0587 | 0.2339 | -2.7300 | 5.4333 | 0.2217 | -0.2930 |
| | (1.1320) | (0.2955) | (-0.8519) | (1.1782) | (0.3051) | (-0.0888) |
| LEV | -0.1687 | -0.0307 | -0.0694 | -0.3102* | -0.0547 | -0.1838 |
| | (-1.0354) | (-0.8847) | (-0.3776) | (-1.9788) | (-1.5660) | (-1.0128) |
| ROA | 0.2746 | 0.0954 | 0.5533* | 0.0348 | 0.0475 | 0.5339* |
| | (0.8472) | (1.2205) | (1.8740) | (0.1054) | (0.6568) | (1.7211) |
| MTB | 0.0177*** | 0.0029*** | 0.0096 | 0.0166*** | 0.0028*** | 0.0074 |
| | (4.0107) | (3.2038) | (1.2646) | (2.8100) | (2.7388) | (1.0481) |
| DA | -0.0422 | -0.0182 | -0.0793 | -0.0167 | -0.0126 | -0.0629 |
| | (-0.3887) | (-0.8473) | (-1.1238) | (-0.1503) | (-0.5780) | (-0.8460) |
| SIZE | -0.0057 | -0.0048 | -0.0040 | 0.0132 | -0.0022 | 0.0092 |
| | (-0.2194) | (-0.8128) | (-0.1355) | (0.6457) | (-0.4282) | (0.3018) |
| | | | | | | |
| Constant | -0.5098 | -0.1053* | -0.3448 | -0.4455* | -0.0941** | -0.4629* |
| | (-1.4895) | (-1.7717) | (-1.3484) | (-1.7456) | (-2.2624) | (-2.0217) |
| | | | | | | |
| Observations | 2,852 | 2,851 | 2,854 | 2,493 | 2,492 | 2,495 |
| Adjusted R-squared | 0.0178 | 0.0430 | 0.0208 | 0.0164 | 0.0393 | 0.0164 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Cluster Industry | Yes | Yes | Yes | Yes | Yes | Yes |

### 4.8.2 Hand-collected CEO-employee pay ratio

In previous studies, I calculate the CEO-employee pay ratio based on firms' financial data. For robustness, in this additional test, I hand-collect recent years' (2017-2020) CEO-employee pay ratio (released by firms) from the Electronic Data Gathering, Analysis, and Retrieval system (EDGAR) provided by SEC. Although hand-collected data can provide more observations in a single year, the relatively narrow year range (4 years) limits some tests in this study, such as the change of specification test that requires several years' variation for all variables. Therefore, I follow previous studies to use the calculated CEO-employee pay ratio as the main test variable in previous studies (Faleye et al., 2013, Crawford et al., 2021, Bao et al., 2021). However, a concern is raised: Does the calculated pay ratio represent the hand-collected pay ratio disclosed directly by firms? To answer this question, I compare the summary statistics of the calculated pay ratio and the hand-collected pay ratio from 2017 to 2020 under the condition that all other control variables are available to run the regression. The results are shown in Table 4-13. As we can see from the Table, except for the hand-collected pay ratio that has a larger maximum, the value of the mean, median and standard deviation is similar between the two samples, indicating the calculated pay ratio fairly represents the hand-collected pay ratio in this study.

**Table 4-13 Summary statistics of the hand-collected and calculated CEO-employee pay ratio**

This table presents the summary statistics of the calculated pay ratio, and the hand-collected pay ratio from 2017 to 2020, assuming all other control variables are available to run the regression.

| Variable | n | Mean | S.D. | Min | 0.25 | Mdn | 0.75 | Max |
|---|---|---|---|---|---|---|---|---|
| LN_PAY_RATIO_CAL | 379 | 4.34 | 1.16 | 1.5 | 3.61 | 4.29 | 5.16 | 6.79 |
| LN_PAY_RATIO_HD | 5956 | 4.42 | 1.18 | 1.31 | 3.68 | 4.45 | 5.18 | 7.37 |

To provide further evidence of robustness, I re-run the baseline regression in Table 4-3 by replacing the calculated pay ratio with the hand-collected pay ratio. The results are presented in Table 4-14. Columns 1 to 3 show that LN_PAY_RATIO_HD is significantly positive at the 5% level with NCSKEW_LEAD and at the 1% level with DUVOL_LEAD and CRASH_COUNT_LEAD. This result agrees with the main findings in Table 4-3. Overall, replacing the calculated pay ratio with the hand-collected pay ratio in the baseline regression confirms the positive association between the CEO-employee pay ratio and stock price crash risk.

## Table 4-14 Hand-collected CEO-employee pay ratio and stock price crash risk

This table presents results from OLS regressions that address the effect of the hand-collected CEO-employee pay ratio on stock price crash risk. Column 1 shows the results of regressing the negative coefficient of skewness of firm-specific daily returns (NCSKEW) on hand-collected CEO-employee pay ratio and control variables. Column 2 shows the results of regressing the down-to-up volatility of firm-specific daily return (DUVOL) on hand-collected CEO-employee pay ratio and control variables. Column 3 shows the results of regressing the difference between the number of days with negative extreme firm-specific daily returns (CRASH_COUNT) on hand-collected CEO-employee pay ratio and control variables. All control variables are defined in Appendix A. All regressions include year and industry fixed effects. Year and industry indicator coefficients are omitted from the Table below. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. T-statistics are in parentheses.

| | (1)<br>NCSKEW_LEAD | (2)<br>DUVOL_LEAD | (3)<br>CRASH_COUNT_LEAD |
|---|---|---|---|
| LN_PAY_RATIO | 0.0419** | 0.0131*** | 0.0694*** |
| | (2.3414) | (3.1341) | (3.1963) |
| NCSKEW | 0.0240 | 0.0069* | 0.0200* |
| | (1.2875) | (1.9814) | (1.8489) |
| DTURN | 0.1229 | 0.0242 | 0.2110 |
| | (0.4729) | (0.3905) | (0.6789) |
| RET_MEAN | 58.9846*** | 19.9998*** | 64.8087*** |
| | (4.9977) | (8.9867) | (5.1890) |
| SIGMA | -7.6634*** | -2.4128*** | -9.7808*** |
| | (-2.8964) | (-4.0140) | (-3.2982) |
| LEV | -0.0650 | -0.0242 | -0.2002* |
| | (-0.6610) | (-1.1292) | (-1.6981) |
| ROA | -0.1611 | 0.0074 | 0.0210 |
| | (-1.6265) | (0.2965) | (0.0918) |
| MTB | 0.0010 | 0.0013** | 0.0054* |
| | (0.5178) | (2.5735) | (1.9577) |
| DA | 0.0227 | 0.0046 | 0.0529 |
| | (0.5416) | (0.3704) | (0.5650) |
| SIZE | 0.0116 | 0.0034 | 0.0288 |
| | (0.5924) | (0.7235) | (1.1987) |
| Constant | 0.0919 | -0.0152 | -0.2915 |

| | | | |
|---|---|---|---|
| | (0.5378) | (-0.3933) | (-1.3815) |
| Observations | 5,956 | 5,956 | 5,956 |
| Adjusted R-squared | 0.0171 | 0.0498 | 0.0333 |
| Year FE | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes |
| Cluster Industry | Yes | Yes | Yes |

## 4.9 Conclusion

This chapter examines the association between the CEO-employee pay ratio and firms' stock price crash risk. Two competing theories are relevant to explain the relationship between the CEO-employee pay ratio and stock price crash risk. The Talent Assignment Theory predicts a negative relationship because a larger pay ratio reflects the CEO's ability and performance; therefore, a talented CEO will have less bad news to hide. In contrast, the Rent Extraction Theory proposes a positive relationship given CEOs are able to extract rent from the company. To do so, CEOs are more likely to engage in risky investments to fulfil their incentive compensation criteria. But given some of these high-risk investments eventually fail, CEOs are tempted to conceal bad news to minimise its effect on operating results.

My results are consistent with the Rent Extraction Theory. After controlling for a series of firm characteristics in the estimation, the results show a statistically significant positive association between the CEO-employee pay ratio and stock price crash risk. The findings remain robust after using additional tests to evaluate endogeneity concerns. First, I re-run the baseline regressions with firm fixed effects to alleviate the impact of any firm time-invariant characteristics. Secondly, I apply a specification change to confirm the same relationship between the change in crash risk and changes in the CEO-employee pay ratio and controls. Thirdly, I apply a two-stage least squares estimation with instrumental variables to mitigate omitted variable bias and reverse causality concerns. Fourthly, I use entropy balancing to overcome a possible selection bias between firms with high and low pay ratios. Fifthly, I introduce an additional variable, the CEO-other executive pay gap, to control for alternative explanations. Finally, using hand-collected CEO-employee pay ratio data from 2017 to 2020,

I again confirm the main finding that a causal effect exists between the CEO-employee pay ratio and stock price crash risk.

In a further cross-sectional study, I find that firms granting more stock to their CEOs have less stock price crash risk, given a large CEO-employee pay ratio. However, better corporate governance does not affect the relationship between the CEO-employee pay ratio and stock price crash risk. I also test the mediation effect of financial reporting quality. I find evidence that conditional conservatism mediates the positive relationship between the CEO-employee pay ratio and stock price crash risk.

The findings in this chapter provide several contributions to the current literature. First, they provide further evidence on whether the CEO-employee pay ratio can increase shareholders' knowledge about the top executive's pay and stock price crash risk; firms with a larger CEO-employee pay ratio have a higher chance of stock price crash. Therefore, the mandated disclosure of the CEO-employee pay ratio can benefit firms' shareholders who use the information in the pay ratio to evaluate the potential risk of their investment. Secondly, this chapter adds to the literature on the determinants of stock price crash risk because limited studies have considered the effect of executive compensation on the stock price crash risk. Boards can benefit from this research by making informed decisions in designing CEO compensation packages, especially when a firm has suffered several recent price crashes.

## Appendix: Variable Definitions

| Variable | Definition (Variable source is in bracket) |
|---|---|
| PAY_RATIO | CEO-employee pay ratio, calculated from firms' financial data. I define average ordinary employee compensation as the total labour expense (*xlr* from Compustat), deduct total executive compensation (sum of all executives' *TDC1* from ExecuComp) divided by the total employee number (*emp* from Compustat). |
| LN_PAY_RATIO | Natural logarithm of PAY_RATIO |
| NCSKEW | The negative coefficient of skewness of firm-specific daily returns over the fiscal year (CRSP) |
| NCSKEW_LEAD | Lead value of NCSKEW (CRSP) |
| DUVOL | The log of the ratio of the standard deviation of firm-specific daily returns for the "down-day" sample to standard deviation of firm-specific daily returns for the "up-day" sample over the fiscal year (CRSP) |
| DUVOL_LEAD | Lead value of DUVOL |
| CRASH_COUNT | The number of firm-specific daily returns exceeding 3.09 standard deviations below the mean firm-specific daily return over the fiscal year, minus the number of firm-specific daily returns exceeding 3.09 standard deviations above the mean firm-specific daily return over the fiscal year, with 3.09 chosen to generate frequencies of 0.1% in the normal distribution. (CRSP) |
| CRASH_COUNT_LEAD | Lead value of CRASH_COUNT |
| DTURN | The detrended average monthly stock turnover in the current fiscal year, calculated as the average monthly share turnover in year t minus the average monthly share turnover in t-1, where monthly share turnover is calculated as the monthly share trading volume divided by the number of shares outstanding over the month. (CRSP) |
| RET_MEAN | The average of firm-specific daily returns over the current fiscal year (CRSP) |
| SIGMA | The standard deviation of firm-specific daily returns over the current fiscal year (CRSP) |
| MTB | The market value of equity divided by the book value of equity in the current fiscal year (Compustat) |
| SIZE | Natural logarithm of a firm's total assets (Compustat) |
| LEV | The book value of debt divided by book value of total assets measured at the end of the current fiscal year (Compustat) |
| ROA | The operating income before depreciation divided by total assets, measured at the end of the fiscal year (Compustat) |

| | |
|---|---|
| DA | Accounting report quality measured in light of the Dechow and Dichev (2002) Model. The Model regresses the working capital accruals on one-year-lagged, current, and one-year-ahead CFO, the change in revenue, and PP&E. I use the Model cross-sectionally by industry-year and store the residuals. I then calculate the standard deviation of residuals over years t-5 to t-1, and times by negative one. (Compustat) |

# Chapter 5: Conclusion

## 5.1 A summary of the findings

This thesis presents an in-depth analysis of two aspects of CEO compensation in publicly listed U.S. firms, namely Say-on-Pay voting for CEO compensation and within-firm pay disparity represented by the CEO-employee pay ratio. In Chapter 2, I demonstrate that disagreements between ISS recommendations and shareholder Say-on-Pay voting results are due to institutional shareholders' investment horizons. In Chapters 3 and 4, I examine and find that the CEO-employee pay ratio significantly affects firms' labour investment efficiency and stock price crash risk.

First, I identify that the institutional shareholder investment horizon is the cause of disagreements between ISS recommendations and shareholder Say-on-Pay voting results. My findings reveal that firms with more short-term institutional shareholder owners disagree more with ISS when considering compensation components. In particular, short-term institutional shareholders strategically choose option grants and salary payments as preferable forms of executive compensation even when excessive, leading to disagreements with ISS recommendations. I also find that long-term institutional shareholder ownership does not cause the disagreement, indicating that they rely on their independent research in casting their vote. These findings remain robust when I mitigate plausible endogeneity concerns from missing variable and selection biases through a two-stage estimation with instrumental variables, falsification tests and entropy balancing. In a further study, I include an alternative measurement of the dependent variable, and my results remain consistent.

Second, I find that firms with larger CEO-employee pay ratios have lower labour investment efficiency. My results show a significant and negative relationship between the CEO-employee pay ratio and labour investment efficiency. In further tests, I find that this relationship is more relevant when firms are over-investing in labour. To address potential endogeneity concerns, I use firm fixed effects, falsification tests and entropy balancing in my baseline estimations; my results remain robust. To boost confidence in the robustness, I include ten additional controls extracted from recent literature to rule out alternative explanations and further address missing variable bias. These controls include corporate governance, institutional shareholders' investment horizon, corporate social responsibility, firms' cost of capital and degree of financial constraints. Again, my findings remain constant after incorporating these additional controls.

Third, I document a significant and positive association between the CEO-employee pay ratio and firms' stock price crash risk. This finding indicates that a larger pay ratio leads to a higher chance of a stock price crash. In cross-sectional analysis, I find that a higher amount of stock grants in executive compensation reduces firms' stock price crash risk when the pay ratio is large. My baseline findings remain consistent after addressing endogeneity concerns through firm fixed effects, a two-stage estimation with instrumental variables, change of specification and entropy balancing. In addition, I consider additional controls and replace the pay ratio with hand-collected data for my baseline tests. Again, my results remain robust.

## 5.2 Contributions to the literature

This study makes a number of contributions to the corporate finance literature. First, it identifies the institutional shareholder investment horizon as the cause of disagreements between ISS recommendations and shareholder Say-on-Pay voting results. Prior research mostly assumes an alignment between ISS recommendations and shareholder voting decisions, trying to evaluate the general effect of ISS recommendations on voting results (Iliev and Lowry, 2015, Ertimur et al., 2013, Larcker et al., 2015). However, to the best of our knowledge, this is the first research to investigate potential determinants of the disagreement.

Second, this thesis provides new evidence to show how short-term institutional shareholders actively engage in corporate governance. Recent research reveals that actively engaging in voting is not in line with short-term shareholders' interests, preferring to sell their shares in the open market rather than vote (Duan and Jiao, 2016). My results show that short-term institutional shareholders strategically choose excessive option grants and salary payments as preferable components in executive compensation packages, driving disagreements with ISS recommendations.

Third, this thesis offers novel evidence that adds value to the debate about the mandatory disclosure of the CEO-employee pay ratio. Market participants (e.g., industry trade organisations; business-related groups) argue that compulsory disclosure of the pay ratio does not inform shareholders because similar information is released in other financial statements. Nevertheless, the results in this thesis underline the influence of the pay ratio on firms' labour investment efficiency; a larger pay ratio reduces firms' labour investment efficiency.

Fourth, this thesis adds to the debate on whether there are financial implications from the disclosure of the CEO-employee pay ratio. Extant research presents conflicting results when investigating the influence of the CEO-employee pay ratio on firm performance. (Cheng et al., 2017a, Elkins, 2016). However, this thesis reports a clear significant and negative association between the CEO-employee pay ratio and labour investment efficiency. This result can potentially assist stakeholders' investment decisions, especially when firms' labour investment efficiency is low.

Fifth, this thesis contributes to the literature by providing novel evidence that may protect shareholder welfare by wisely managing stock price crash risk in the long run. This thesis documents a significant and positive relationship between the CEO-employee pay ratio and stock price crash risk, indicating that firms with a larger pay ratio have a higher chance of a future stock price crash. Nevertheless, the detrimental effect of a large pay ratio on stock price crash risk can be reduced if firms grant more stock in executive compensation packages.

Sixth, this thesis adds to the growing literature on the determinants of stock price crash risk regarding executive compensation. Existing research provides limited evidence of the influence of top executives' compensation on stock price crash risk (Jia, 2018b). This thesis, however, documents that the CEO-employee pay ratio is a relevant determinant of stock price crash risk; larger pay ratios incentivise CEOs to hold back bad news leading to a stock price crash. Boards can use this finding to better design executive compensation packages.

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