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The Effect of Outside Directors' Equity Compensation on Labor Investment Efficiency

CHOI, Ka Sing

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STUDENT'S NAME: CHOI Ka Sing

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This is to certify that the above student's thesis has been examined by the following panel members and has received full approval for acceptance in partial fulfillment of the requirements for the degree of Doctor of Business Administration.

Chairman: Prof Aristotelis STOURAITIS
Professor, Department of Accountancy, Economics and Finance, HKBU
(Designated by Dean of School of Business)

Internal Members: Dr Byron SONG
Head & Associate Professor, Department of Accountancy, Economics and Finance, HKBU
(Designated by Programme Director of Doctor of Business Administration)

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External Members: Dr Haina SHI
Associate Professor
Department of Accounting, Fudan University
China

Prof Boochun JUNG
Professor
School of Accountancy, University of Hawai'i at Mānoa
USA

In-attendance: Dr ZHOU Gaoguang
Associate Professor, Department of Accountancy and Law, HKBU
[Principal Supervisor]

ZHAO Xiaodong
Assistant Professor, Department of Accountancy and Law, HKBU
[Co-supervisor]

Issued by Graduate School, HKBU

The Effect of Outside Directors' Equity Compensation on Labor Investment Efficiency

CHOI Ka Sing

A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Business Administration

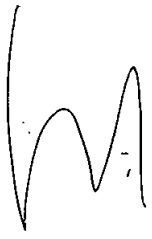
Principal Supervisor:
Dr. ZHOU Gaoguang (Hong Kong Baptist University)

July 2023

DECLARATION

I hereby declare that this thesis represents my own work which has been done after registration for the degree of DBA at Hong Kong Baptist University, and has not been previously included in a thesis or dissertation submitted to this or any other institution for a degree, diploma or other qualifications.

I have read the University's current research ethics guidelines, and accept responsibility for the conduct of the procedures in accordance with the University's Research Ethics Committee (REC). I have attempted to identify all the risks related to this research that may arise in conducting this research, obtained the relevant ethical and/or safety approval (where applicable), and acknowledged my obligations and the rights of the participants.



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ABSTRACT

This study is motivated by two strands of the literature: corporate labor investment efficiency and director equity compensation. Labor cost is economically significant, and inefficiency in labor investment harms firm financial performance. Although outside directors play an important role in monitoring and advising labor investment, there is relatively scant literature on how they affect labor investment efficiency. Outside directors' equity compensation has increased substantially since the adoption of the Sarbanes–Oxley Act (SOX); whether equity compensation can improve outside directors' governance performance remains controversial. My research aims to fill in this gap by examining the effect of outside directors' equity compensation on corporate labor investment efficiency.

Drawing on the literature, I argue that equity compensation can incentivize outside directors to provide both monitoring and advisory roles in a way that increases the efficiency of labor investment. However, outside directors are also agents, and equity compensation may incentivize them to collude with self-serving executives who have incentives to deviate from the optimal labor investment level for their private benefits, e.g., rent seeking and empire building. As a result, the relationship between outside director's equity compensation and labor investment efficiency is ex ante unclear, and I empirically examine this research question.

I use a sample of U.S. firms during the period from 2006 to 2019 for my analysis. I find that a higher proportion of equity compensation in outside directors' total compensation is associated with a smaller absolute difference between the actual and expected net hiring, i.e., higher efficiency in labor investment. The result is economically significant. A one standard deviation increase in outside director's equity compensation is associated with a decrease in inefficient labor investment of 5.11%. My findings are robust to alternative proxies for outside directors' equity compensation and labor investment efficiency, alternative explanations, and endogeneity tests. Moreover, firms with a higher proportion of equity compensation for outside directors reduce both overinvestment (over-hiring) and underinvestment (over-firing and under-hiring) in labor.

I also incorporate directors' characteristics by using new measures of weighted average of outside directors' equity compensation. Although the incentives, capabilities, and effectiveness of outside directors on monitoring and advising can vary with their individual characteristics, I provide evidence that equity

compensation for outside directors can improve labor investment efficiency when directors' characteristics are incorporated in the weighted measures.

In addition, I provide results that support the substitution hypothesis of alternative governance mechanisms. Although outside directors' equity compensation can mitigate labor investment inefficiency, the impact is less pronounced for firms with greater institutional ownership or CEO ownership. The impact of outside directors' equity compensation is stronger for firms operating in human-capital-intensive industries than in other industries, suggesting that outside directors' equity compensation plays a significant role in improving labor investment efficiency for the firms with keen labor competition and high labor adjustment costs. I also find that the negative effect of outside directors' equity compensation on labor investment inefficiency is more pronounced for complex firms that require a higher level of monitoring than for other firms.

Finally, I provide evidence that equity compensation incentivizes outside directors to cut labor costs and employees in response to economic downturns. Overall, my findings contribute to the debate on the effectiveness of director equity compensation by showing its non-trivial benefits.

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1. Introduction

Investing in labor is an important investment by a firm and labor cost is economically significant. Bernanke (2004) estimates that corporate labor cost is approximately two thirds of production cost. The Annual Survey of Manufacturers reports that payroll and employee fringe benefits in the U.S. manufacturing sector increased from $784 billion in 2008 to $839 billion in 2016, whereas capital expenditure increased only slightly from $166 billion to $168 billion during the same period[1]. Despite the importance of labor investment, there is relatively scant literature on labor investment efficiency compared with the many studies on capital investment (Jung, Lee, and Weber, 2014; Sualihu, Rankin, and Haman, 2021). In addition, there is a paucity of recent research on directors' compensation, with a few exceptions (e.g., Deutsch, Keli, and Laamanen, 2007; Deutsch 2007; Sengupta and Zhang, 2015; Hope, Lu, and Saiy, 2019; Chan, Chen, Huang, and Liang, 2023). Motivated by the above factors, my research aims to fill this gap by empirically examining the effect of outside directors' equity compensation on labor investment efficiency.

Labor investment can be regarded as more efficient when it has a lower deviation from the optimal level justified by economic fundamentals. Roychowdhury, Shroff, and Verdi (2019) suggest that several factors can lead to a deviation of labor investment from its optimal level. The first factor is the moral hazard problem arising from information asymmetry between principals and agents. For example,

[1] The numbers in 2008 are available at http://www.census.gov.manufacturing.asm/index.html, and those in 2016 are available at http://www.census.gov/content/census/en/data/tables/2016/econ/asm/2016-asm.html.

self-interested managers may engage in empire-building activities (i.e., invest in labor beyond the optimum) because the expansion of staff is a source of security, power, status, prestige, and professional achievement (Williamson, 1963). The second factor is adverse selection, which arises from information asymmetry between shareholders and potential investors. Firms facing financial frictions may avoid issuing new securities at a discount (Jung et al., 2014) and thus relinquish profitable projects (i.e., invest in a level of labor inputs that falls below the optimum). The third factor is related to managers' information sets. Managers may invest inefficiently (overinvest or underinvest in labor) because they do not have channels to learn about information that is useful to labor decisions (Ben-Nasr and Alshwer, 2016).

Owing to the importance of labor investment and the likelihood of inefficiency in labor investment, several studies examine the determinants of labor investment efficiency. These studies show that labor investment efficiency is affected by accounting quality (Jung et al., 2014), stock price informativeness (Ben-Nasr and Alshwer, 2016), CEO–director ties (Khedmati et al., 2020), institutional investment horizons (Ghaly et al., 2020), and CEO equity compensation (Sualihu et al., 2021). Nevertheless, the question of whether and how directors' compensation influences labor investment efficiency remains underexplored in the literature. My research is fairly closely related to that of Sualihu et al. (2021), who study CEO equity compensation. I extend Sualihu et al. (2021) by focusing on outside directors' equity compensation and adding to the debate on the appropriate forms of outside directors' compensation (e.g., Archambeault et al., 2008; Chan et al., 2023). Although, similar to Sualihu et al. (2021), I investigate the relationship between equity compensation and labor investment efficiency, I do so in the

context of outside directors, whereas they focus on CEOs. Notably, various studies (e.g., Deutsch et al., 2011) argue that risk aversion and behaviors differ between outside directors and CEOs. For instance, Ertugrul and Hegde (2008) find that higher equity compensation for outside directors can lower the average yield spreads of corporate bonds, whereas CEO equity compensation has an insignificant effect on the average yield spreads. Whereas risk-averse executives may increase short-term earnings by reducing labor investment (Sualihu et al., 2021), it is possible that outside directors represent stakeholders and are therefore likely to "side with" employees (Vafeas and Vlittis, 2018). Although equity compensation increases the pay of outside directors and may encourage them to adjust corporate employment policies to improve shareholder's wealth (e.g., layoffs), these directors may not support the initiatives that CEOs are willing to support because of the potential impact on the stakeholders.

Outside directors are important in employee settings and they can affect corporate employment decisions such as layoffs and employee benefits. Perry and Shivdasani (2005) show that firms with an outside-dominated board are more likely to initiate employee layoffs when the firms experience a material decline in performance. Similarly, Yawson (2006) finds that corporate layoff decisions and the proportion of outside directors are positively associated. Directors are pension plan fiduciaries, and a high proportion of outside directors increases the likelihood of defined benefit pension plan freezes (Vafeas and Vlittis, 2018). Although prior studies demonstrate that outside directors matter for employee-related decisions, to the best of my knowledge, no studies examine how outside directors' equity compensation affects labor investment.

Outside directors play both monitoring and advisory roles and compensation affects their efforts in pursuing these roles. I propose that outside directors' equity compensation can influence the efficiency of labor investment in at least two ways. First, outside directors have fiduciary duties to monitor managerial activities (Fama, 1980) and equity compensation incentivizes them to perform this duty effectively and efficiently because it aligns shareholders' and directors' interests (Hillman and Daiziel, 2003). As a result, outside directors' equity compensation can help mitigate inefficient labor investment, such as empire-building problems caused by ineffective monitoring of managers. Enhanced monitoring can be manifested in many ways, including by affecting CEO turnover (Perry, 2000) and management disclosure decisions (Sengupta and Zhang, 2015). For example, outside directors' equity compensation can incentivize directors to encourage the executives to improve their voluntary disclosures, such as by increasing the frequency and accuracy of management earnings forecasts; in turn, this lowers the cost of capital by reducing the information asymmetry between managers and outside fund providers (Sengupta and Zhang, 2015). Second, outside directors play an advisory role in corporate decisions. Directors' experience can facilitate knowledge transfer on management practices (Giannetti, Liao, and Yu, 2015) and the connections of outside directors can facilitate valuable information flows among firms (Fracassi and Tate, 2002). Provision of equity compensation to outside directors incentivizes them to share information with the board and expand the managers' information set, which can result in better informed labor decisions. Consequently, high outside directors' equity compensation can enhance labor investment efficiency.

Conversely, as outside directors have private incentives, they may encourage myopic activities that increase short-term profitability to raise the value of their

stockholdings (Sengupta and Zhang, 2015). Furthermore, outside directors may receive higher compensation if they are loyal to the CEO than if they challenge the CEO (Fedaseyeu et al., 2018), suggesting that equity-based compensation may lead outside directors to avoid challenging management (Sharma, 2011). Thus, outside directors given equity compensation may fail to monitor managers effectively, including in relation to the employment policies of the firm. As a result, the impact of outside directors' equity compensation on labor investment efficiency is ex ante unclear.

Similar arguments can be put forward for non-labor investments, with research investigating the effect of outside directors' equity compensation on corporate investments, such as research and development (R&D) and acquisition (Deutsch, 2007; Deutsch et al., 2007). However, the findings of such research cannot be meaningfully applied to labor investment, despite the investigation of labor being of particular interest, for the following reasons. First, the adjustment costs of labor investments tend to be lower than those associated with non-labor investment (Jung et al., 2014; Khedmati et al., 2020). For instance, R&D and capital investment involves substantial amounts of investment with infrequent adjustments, whereas labor costs are adjusted relatively frequently and easily (Sualihu et al., 2021). As labor investment is likely to be one of the first inputs to be cut with a reported accounting loss (Pinnuck and Lills, 2007), it is important to investigate whether outside directors' equity compensation can limit the potential inefficiency of labor investment (e.g., underinvestment). Second, labor is an important input (Jung et al., 2014) in determining a firm's competitive success (Pfeffer, 1996) and its market value (Belo, Gala, and Salomao, 2022), but firms do not own labor (in contrast with their physical capital), as their employees may leave if they find other

opportunities (Khedmati et al., 2020). Belo et al. (2022) present evidence of the importance of labor inputs on firm value, and report a significant decline in the contribution of physical capital to firm value between the 1970s to the 2010s. Third, although equity compensation, such as option grants, may provide incentives for outside directors to steer corporate decision-making toward taking risks (Linn and Park, 2005; Deutsch, 2007), the risk levels of the various types of corporate investments (e.g., capital vs. labor vs. R&D) differ (e.g., Bhagat and Welch, 1995). As a result, the effect of outside directors' equity compensation on other types of investment might not be meaningfully extrapolated to labor investment. My research aims at addressing this gap in the literature by investigating the relationship between outside directors' equity compensation on labor investment efficiency.

I use a sample of U.S. firms during the period from 2006 to 2019 to examine the relationship between outside directors' equity compensation and labor investment efficiency. I collect data on director compensation from ExecuComp and match the data with other directors' characteristics provided by Institutional Shareholder Services. After calculating the sum of stock and option compensation as a proportion of total compensation for each outside (i.e., independent) director of a firm, I measure the outside directors' equity compensation for a firm by the average of these ratios for all the outside directors in the firm (Sengupta and Zhang, 2015). The proxy for labor investment is actual net hiring (the percentage change in the number of employees). Labor investment is more efficient when there is a smaller absolute difference between the actual and expected net hiring based on fundamental economic factors (e.g., Pinnuck and Lillis, 2007). I report strong evidence that a higher percentage of outside director' equity compensation in

total compensation is associated with more efficient labor investment. The relationship is economically significant. An increase of one standard deviation in outside director's equity compensation is associated with a decrease in inefficient labor investment of 5.11%.

Next, I separate the data into overinvestment and underinvestment in labor, and examine whether outside directors' equity compensation would mitigate or exacerbate these specific forms of inefficiency in labor investment. Overinvestment (vs. underinvestment) in labor occurs when the observed net hiring is greater (less) than the predicted level. Overinvestment could occur if managers prefer to enjoy a "quiet life" and retain the status quo even when there is a need (e.g., with unprofitable projects) to reduce the number of employees (Ghaly et al., 2020). As hiring increases business costs, managers may underinvest in labor to meet earnings targets when they experience pressure from myopic investors (e.g., Sualihu et al., 2021). As these two forms of inefficiencies can be caused by different factors and induce different outcomes for firms, I investigate the impacts of outside directors' equity compensation on overinvestment and underinvestment. In addition, I follow Jung et al. (2014) by separating overinvestment into over-hiring and under-firing, and underinvestment into under-hiring and over-firing[2]. I find that with the exception of under-firing, outside directors' equity compensation can mitigate the remaining specific forms of labor investment inefficiency.

[2] The over-hiring (under-firing) subsample consists of those firms experiencing overinvestment when expected net hiring is positive (negative). The under-hiring (over-firing) subsample consists of those firms experiencing underinvestment when expected net hiring is positive (negative).

I address potential endogeneity issues to enhance the robustness of my results. All my main specifications are lead–lag, which alleviates endogeneity concerns arising from reverse causality. However, the correlated omitted variable problem remains. To address this issue, I employ the two-stage least squares (2SLS) approach, and construct a first-stage instrumental variable using the industry median equity compensation (%) of outside directors (Lahlou and Navatte, 2017). To mitigate the endogeneity concerns arising from measurement errors, I use alternative proxies for outside directors' equity compensation (e.g., Kim, Kwak, Lee, and Suk, 2019) and alternative inefficient net hiring measures (e.g., Ghaly et al., 2020). Furthermore, I control for alternative explanations, such as the financial crisis (Khedmati et al., 2020), in additional tests. Overall, my results remain robust.

I conduct an analysis using the weighted average of outside directors' equity compensation. Although multiple scholars document that the incentives and capabilities of directors to monitor and advise can vary with their individual characteristics (e.g., Masulis et al., 2018; Chen et al., 2019), such studies pay little attention to how the directors' characteristics influence the effectiveness of outside directors' equity compensation. To incorporate this concern, I provide different measures of the weighted average outside directors' equity compensation based on directors' characteristics and positions that can affect monitoring (e.g., gender) and advisory functions (e.g., number of directorships). Overall, I find that outside directors' equity compensation mitigates the inefficiency of labor investment when the directors' characteristics are incorporated in the weighted measures.

To further understand the relationship between outside directors' equity compensation and the efficiency of labor investment, I examine the effects of the potential moderators, including institutional ownership, CEO ownership, human capital intensity, firm complexity, and female directors by conducting cross-sectional analyses.

Outside directors are not the only monitors of a firm (Cordeiro, Veliyath, and Romal, 2007) and evidence shows that ownership (i.e., who owns the corporate securities) affects organizational efficiency (Jensen, 1993). Therefore, I am motivated to hypothesize about the interplay between outside directors' equity compensation and ownership, in particular, the influence of institutional ownership and CEO ownership on the relationship between outside directors' equity compensation and labor investment efficiency.

First, large institutional investors have both the capacity and the incentives to monitor managers (Shleifer and Vishny, 1986; Jensen, 1993). For instance, Ghaly et al., (2020) show that institutional investors can improve labor investment efficiency. Moreover, prior research (e.g., Hope et al., 2019) documents that there are interdependent effects of outside directors' equity compensation and other alternative governance mechanisms such as institutional investors. Thus, I predict that the effect of outside directors' equity compensation on labor investment efficiency may depend on institutional ownership. As expected, I find that both outside directors' equity compensation and institutional ownership can enhance the efficiency of labor investment, and that the impact of outside directors' equity compensation is weaker when institutional ownership is higher, suggesting a substitution effect for these two mechanisms.

Second, CEOs are the decision-makers for important corporate investments (e.g., Hambrick and Mason, 1984; Kim and Lu, 2011). The demand for monitoring CEOs is lower if they have greater equity ownership and few (considerable) agency problems (Jensen and Meckling, 1976). For instance, CEO ownership and other forms of governance can be substitutes for mitigating agency problems (Kim and Lu, 2011). Supporting the notion that high CEO ownership can mitigate agency problems (e.g., Jensen, 1993), I find that a higher level of CEO ownership leads to less inefficiency in labor investment. Consistent with the substitution hypothesis, I report evidence that there is a smaller negative effect of outside directors' equity compensation on labor investment inefficiency when CEO ownership is higher. In my study, I extend the literature by examining how institutional ownership and CEO ownership interact with outside directors' equity compensation to affect corporate labor investment.

In addition, I hypothesize about and investigate the moderating role of the human capital intensity of a firm in affecting the relationship between labor investment efficiency and outside directors' equity compensation. Firms that operate in highly labor-intensive industries generally employ labor with high skills and expertise, which also results in the firms incurring high adjustment costs for the high-skilled labor (Hamermesh and Pfann, 1996; Cao and Rees, 2020). As a result, firms with high human-capital intensity face keen competition in the labor market, and it is more difficult for them to adjust labor efficiently than it is for firms with lower human-capital intensity (Cao and Rees, 2020). Therefore, I expect that outside directors' equity compensation will play a more important role for firms that operate in human-capital-intensive industries than for other firms. Consistently

with this, I show that outside directors' equity compensation plays a greater role in reducing inefficiency for firms that are more human-capital intensive.

I also hypothesize and present results concerning whether firm complexity affects the association between outside directors' equity compensation and the efficiency of labor investment. More complex firms may find it easier to engage in suboptimal corporate investment decisions, such as empire building (Jensen, 1986), because they face larger information asymmetries (Ghaly et al., 2020), and are more difficult to monitor (Farrell et al., 2008). I find that complex firms suffer from higher inefficiency in labor investment than less complex firms, but that high outside directors' equity compensation can mitigate the labor investment inefficiency more for complex firms than it can for less complex firms. This result is consistent with the view that equity compensation can incentivize outside directors to monitor and advise executives (e.g., Jensen, 1993).

Moreover, I hypothesize about and examine the potential moderating effect of female directors on the impact of outside directors' equity compensation on the efficiency of labor investment. Governance can be more effective for firms with a greater representation of female directors on their board than for firms with fewer (or no) female directors (Adams and Ferreira, 2009), and hence female directors may enhance labor investment efficiency (Sun and Zhang, 2021). However, I report insignificant impacts of female directors and the corresponding moderating effect. These findings may support the notion that female directors do not significantly affect labor investment efficiency when the firm is strongly monitored (Sun and Zhang, 2021).

Finally, I investigate how outside directors' equity compensation affects labor cost stickiness and firms' employment level stickiness because self-interested executives who engage in empire-building activities may not reduce labor costs or lay off their workers in response to a decrease in sales revenue when corporate governance is weak (Prabowo et al., 2018). I report that firms with higher outside directors' equity compensation provide a timelier response in mitigating agency problems, and that this affects not only the corporate employment level but also the firms' labor costs.

My study contributes to the literature in a number of aspects. First, this study enriches the director compensation literature. The literature is inconclusive regarding the impact of directors' compensation on corporate decisions and performance (e.g., Perry 2000; Sharma, 2011; Sengupta and Zhang, 2015). I extend the research to a new area of corporate labor decisions, and provide evidence that outside directors' equity compensation can mitigate inefficiency in corporate labor investment. Moreover, my measures of the weighted average outside directors' equity compensation enrich the line of research on director compensation by incorporating the directors' characteristics (e.g., tenure and gender), which are an important factor in the effectiveness of monitoring and advisory functions (e.g., Byrd et al., 2010; Chen et al., 2019). Second, I enrich the relatively scant literature on labor investment (e.g., Jung et al., 2014; Sualihu et al., 2021), and provide evidence that equity compensation incentivizes outside directors to perform their role in mitigating labor investment inefficiency. Third, I add to the sticky costs literature by examining how outside directors' equity compensation influences the relationship between the stickiness of employment level and revenue growth for corporations. Prior studies focus on selling, general and administrative costs

(Anderson et al. 2003), with some recent studies (e.g., Khedmati et al., 2020) examining the labor cost stickiness based on staff expenses in the labor investment literature.

My research is closely related to Sualihu et al., (2021), who study CEO equity compensation, in the sense that both their study and mine investigate the relationship between equity compensation and labor investment efficiency. However, my paper differs from Sualihu et al. (2021) in key ways and thus makes different contributions to the literature. First, studies show that outside directors tend to be less risk averse than CEOs partly because the overall income of an outside director is less dependent on the focal firm than that of the CEO (e.g., Deutsch et al., 2011). Thus, it is important to consider that whether the impact of equity compensations for outside directors is different from the impact of CEO equity compensation on labor investment efficiency. For instance, Lim and McCann (2014) argue that high values of option compensation increase CEOs' risk aversion, which reduces their risk taking, particularly given that the CEOs already bear excessive employment and compensation risks. However, for influential outside directors, option compensation can enhance risk-taking propensities, leading these directors to increase their monitoring of and support for risky but valuable projects. Second, CEO equity compensation is a direct incentive mechanism that affects the behaviors of the CEO in terms of maximizing firm value, and director equity compensation is an indirect incentive mechanism to enhance the effectiveness of monitoring; therefore, the two mechanisms operate in different ways with different channels (Kim et al., 2019). It is necessary to analyze director compensation and CEO compensation separately because the CEO's role of formulating and implementing strategies differs from the director's role of

monitoring and advising (Burns et al., 2021). Third, my findings partially complement the study by Sualihu et al. (2021) in the sense that greater stock compensation can lead to a higher efficiency in labor investment than lower stock compensation. However, I extend the study by Sualihu et al. (2021) in the sense that my results show that option compensation may not necessarily exacerbate inefficient labor investment. Instead, I show that the option compensation for outside directors can enhance labor investment efficiency. These contrasting results for option compensations for outside directors versus CEOs support the need to separately analyze the impacts of director compensation and CEO compensation (Burns et al., 2021). My findings provide further evidence that the impacts of CEO equity compensation and outside directors' equity compensation can differ, and add to the recent research (e.g., Chen et al., 2023) demonstrating that both stock and stock-option compensation for outside directors can benefit the firm.

My study provides several practical implications. There has been a dramatic increase in outside directors' equity compensation since the adoption of the Sarbanes–Oxley Act (SOX) (Linck et al., 2009). Therefore, it is important to determine whether the change is related to self-interested behavior (i.e., rent seeking) or to the provision of incentives for outside directors to enhance corporate performance and reduce inefficient decisions. My study provides evidence that outside directors' equity compensation has a positive impact for corporations through improving labor investment efficiency. This result contributes to the debate concerning whether equity is an appropriate form of compensation for outside directors. Although some studies show that that outside directors' equity compensation is related to positive outcomes (e.g., Perry 2000;

Sengupta and Zhang, 2015; Chan et al., 2023), others express concerns that equity compensation for outside directors may distort their monitoring function and that excess equity compensation may exacerbate board entrenchment (e.g., Archambeault et al., 2008; Boumosleh, 2009; Sharma, 2011; Dah and Frye, 2017). In addition, as labor expenses account for two thirds of production cost (Bernanke, 2004), it is important to manage labor cost efficiently to avoid negative corporate performance. My research presents robust results demonstrating that raising outside directors' equity compensation can mitigate inefficient labor investment, which supports the call for using equity compensation to incentivize outside directors (e.g., Jensen 1993).

The remainder of the paper is organized as follows. Chapter 2 provides the literature review and hypothesis development. Chapter 3 describes the methodology and research design. Chapter 4 summarizes the empirical findings and presents a discussion of the results. Chapter 5 contains the conclusion, contributions, and limitations of the research.

2. Literature Review and Hypothesis Development

This chapter provides a review of the relevant literature. Section 2.1 discusses the board of directors, which reviews the functions and roles of the board (2.1.1), reviews the definitions and summarizes the roles of outside directors (2.1.2), analyzes the outside directors' incentives (2.1.3), examines the determinants of outside directors' compensation (2.1.4), and discusses the outcomes of outside directors' equity compensation (2.1.5). Section 2.2 provides a review on labor investment efficiency. Section 2.3 develops my hypotheses.

2.1 Board of Directors

2.1.1 Functions and Roles of Boards of Directors

Corporate governance focuses on how fund providers ensure investment returns and protect firms against expropriation by insiders (Shleifer and Vishny, 1997; Claessens, 2006). To reduce the agency conflicts between managers and shareholders, corporate boards are formed as the apex internal control system. The main functions of a board of directors can be divided into two broadly defined roles. First, the board of directors monitors managerial activities, including compensating, firing, and hiring, and the CEO's activities (Fama, 1980; Jensen, 1993), which can mitigate moral hazard problems arising from information asymmetry. Second, the board of directors provides advice to managers to ensure informed decisions (Song and Thakor, 2006; Masulis, Wang, and Xie, 2012). Although directors have fiduciary duties to monitor and advise managers, they are also economic agents and have incentives to increase their own wealth at the expense of maximizing shareholders' interest.

Monitoring Role

The separation of management (agents) and ownership (principals) leads to moral hazard problems, whereby managers may hide information and fail to maximize shareholders' interests (Jensen and Meckling, 1976). Although managers initiate and implement strategic decisions, shareholders delegate the board of directors as the ultimate internal monitors of a firm (Fama, 1980). Specifically, the board monitors managers by ratifying their strategies, evaluating the managers, and

disciplining underperforming managers (Fama and Jensen, 1983). Consistent with this notion, prior studies show that effective boards can reduce moral hazard problems by mitigating the level of earnings management and reducing corporate over/underinvestment (Xie, Davidson, and DaDalt, 2003; Rajkovic, 2020).

Advisory Role

Directors' expertise and experience facilitate the provision of advice by the board to top management on strategic directions (e.g., Adams and Ferreira, 2007; Field and Mkrtchyan, 2017) such as the deployment of resources, mergers and acquisitions, dividend payouts, major strategic changes, and decisions concerning strategic alliances (e.g., Fields and Keys, 2003; Song and Thakor, 2006; Chan et al., 2023). For instance, prior research documents that firms with directors who are financial experts are more likely to use corporate hedging to lower firm risk than firms lacking such expert directors (Dionne and Triki, 2005), and that directors with strong acquisition experience enhances firms' acquisition performance and firm value (Field and Mkrtchyan, 2017). Apart from their human capital, such as their expertise and experience, directors possess social capital, such as social networks, which can enhance their advisory capacity (Field and Mkrtchyan, 2017) and provide access to various resources (Huang, Jiang, Lie, and Yang, 2014).

Directors' Private Incentives

Although the board represents the peak of decision-control systems to ratify and monitor important decisions in organizations (Fama and Jensen, 1983), directors can be self-serving agents (Deutsch, Keil, and Laamanen, 2007; Deutsch, Keil, and Laamanen, 2011) with "private benefit incentives" (Sengupta and Zhang, 2015) that may lead them to pursue their self-interest ahead of maximizing shareholders'

benefits. As a result, directors may not necessarily fulfill their fiduciary duties. Instead, they may even extract shareholders' wealth. In their seminal paper on agency problems, Jensen and Meckling (1976) quote Adam Smith (1776) in stating that we cannot expect directors, who manage other people's money, to have the same vigilance as if the money is on their own. Consistent with this notion, several studies show that directors who receive abnormally high pay are less likely to challenge CEOs than those who receive normal pay levels (Dah and Frye, 2017; Chen, Goergen, Leung, and Song, 2019).

In the next two subsections, I discuss the roles of outside directors (which enhance board independence and board capital) and the implications of their compensation.

2.1.2 Outside Directors: Definition and Roles

Definition of Outside Directors

A board consists of inside directors, such as executives or other employees, and outside directors, who are members of affiliated organizations or independent from the firm. There is no universal definition for the term "outside directors." Some scholars use the term to encompass all non-employee directors (e.g., Deutsch et al., 2007), others define outside directors as those directors who are not paid employees and have no family association with the firm (e.g., Mayers, Shivdasani, and Smith, 1997; Jackling and Johl, 2009), and others refer instead to independent directors (e.g., Sengupta and Zhang, 2015). Regardless of the definitions used, outside directors play significant roles in firm investments and decisions, such as lowering rent, wages, and salary expenditures for employees

(Mayers et al., 1997), affecting firm acquisition investment (Deutsch et al., 2007), improving firm performance (Jackling and Johl, 2009), improving the efficiency of R&D spending (Daiziel, Gentry, and Bowerman, 2011), and enhancing corporate investment efficiency (Rajkovic, 2020).

Roles and Uniqueness

Outside directors have two particular characteristics. First, they are more independent than insiders, which can enhance the monitoring role of the board (Fama, 1980). Second, outside directors can bring important human and social capital to the board to facilitate advice and counsel (Hillman and Dalziel, 2003). Although both outside and inside directors may provide the board with such forms of capital (Hillman and Dalziel, 2003), firms may prefer using outside directors because it is less expensive to hire an outside director than a full time executive (Deutsch and Ross, 2003).

Monitoring and Independence. Although it is possible for top managers to expropriate the wealth of shareholders if they gain control of the board, the inclusion of outside directors may decrease the probability of such expropriation activities (Fama, 1980). Outside directors are better placed than employee directors in monitoring such activities (Fama and Jensen, 1983; Choi, Park, and Yoo, 2007) because the former, in contrast with the latter, are not dependent on the CEO for their careers (Adams and Ferreira, 2007), resulting in outside directors being more independent than insider directors (Deutsch et al., 2007).

Empirically, several studies show that a higher percentage of outside directors on a board improves monitoring performance compared with firms with a lower

proportion of outside directors. An interesting case is corporate investments. While managers may underinvest (overinvest) in R&D (capital investment) because of managerial conservatism (empire building),[3] outside directors can help mitigate both agency problems (Lu and Wang, 2015). Furthermore, a higher percentage of outside directors on a board is related to higher CEO turnover for firms with performance problems (Weisbach, 1988), positive reactions to announcements of poison pills in the stock market (Brickley, Coles, and Terry, 1994), a lower occurrence and probability of earnings management (Xie et al., 2003), a lower cost of debt (Anderson, Mansi, and Reeb, 2004), and better acquisition performance (Walters, Kroll, and Wright; 2007).

The SOX and subsequent regulations require listed firms to establish boards with a majority of outside directors, explicitly state the skills and experiences that qualify each director for board, and to have a fully independent audit committee for the board. With the adoption of SOX in the U.S., the need for outside directors with relevant abilities and experience has risen (Sharma, 2011), and the board independence of U.S. listed firms has increased (Lawrence, Nguyen, and Upadhyay, 2021). Several scholars show that the implementation of SOX and related regulations increases the proportion of independent directors and thus enhances corporate transparency, increases CEO turnover sensitivity to performance, and leads to the implementation of other policies in favor of shareholders (Armstrong, Core, and Guay, 2014; Guo and Masulis, 2015; Lawrence et al., 2021).

[3] R&D tends to be riskier than capital investment (Lu and Wang, 2015).

Advising and Board Capital. Most outside directors are either managers or important decision agents in other companies (Fama and Jensen, 1983), and they can play their advisory role because of their human capital and social capital.

Outside directors can advise top managers to handle specialized decisions because of their expertise in related areas (Fama and Jensen, 1983). In line with this notion, prior studies show that outside directors effectively advise managers by using their expertise in lending and international business areas (Booth and Deli, 1999; Masulis et al., 2012). Moreover, outside directors can provide valuable information to the board and enhance the quality of decision-making. For example, outside directors who have investment banking experience use their networks and expertise to improve the screening of target firms and assist the acquirers in bargaining to achieve better acquisition terms (Huang et al., 2014). Similarly, outside directors with experience in Chinese firms can provide a value-enhancing advisory role in investment decisions, assisting U.S. firms to select their Chinese targets and partners (Chen et al., 2020).

Outside directors leverage their social capital, such as their social networks, to benefit firms (Hillman and Dalziel, 2003). For instance, outside directors with a large social network can assist firms in strategic decisions such as acquisitions (Huang et al., 2014). Those who have connections with outside fund providers (e.g., a working relationship or an outside directorship at a bank) can mitigate adverse selection in fund-raising activities, such as seasoned equity offerings (Becker-Blease and Irani, 2008). As a result, outside directors can help to reduce the underinvestment problems stemming from insufficient funding.

The Need for Motivation. It is important to incentivize outside directors to work for the firms' shareholders because outside directors are potentially self-serving agents (Deutsch et al., 2007; Deutsch et al., 2011). Supporting this notion, several scholars show that directors may expend little effort in advising and/or monitoring managers (Fracassi and Tate, 2012; Khedmati et al., 2020). Moreover, some studies find that outside directors do not have a positive effect on firm value or firm performance (e.g., Hermalin and Weisback, 1991; Minton, Taillard, and Willamson, 2011). Thus, appropriate motivation is required to incentivize outside directors to fulfill their duties.

2.1.3 Outside Directors' Incentives

There are several mechanisms that may motivate outside directors. In particular, most studies suggest that outside directors are incentivized by reputation and/or pay (e.g., Jensen, 1993).

Reputation

Outside directors are motivated to develop and maintain their reputation by performing well in their tasks, which can provide a positive signaling effect that they are experts (Fama and Jensen, 1983). Yermack (2004) demonstrates that outside directors have incentives to monitor firms effectively because this enhances their reputation and thus enables them to acquire additional directorships in other firms. Conversely, if a firm performs poorly, there is a high chance that the outside directors will resign to avoid damage to their reputations (Fahlenbrach, Low, and Stulz, 2010). Those with multiple directorships may devote more effort to the firms with relatively higher prestige than to less prestigious firms

(Masulis and Mobbs, 2014). Although outside directors care about their reputation, reputation alone may not be sufficient to mitigate agency problems (Holmstrom, 1999), and outside directors may devote insufficient effort to advising on and monitoring acquisitions because of their time constraints (Deutsch et al., 2007).

Compensation

Director compensation is an important incentive that motivates directors to fulfill their duties (Hillman and Dalziel, 2003). Outside directors are usually compensated in various forms, including cash, fees, and equity compensation. Adams and Ferreira (2008) show that a small financial reward, involving an average increase of $1,000 per board meeting, can reduce board attendance problems [4] by approximately 10% to 12%. Jensen (1993) argues that granting shareholdings to directors can incentivize them to perform their roles well, as they recognize that their decisions on the board will influence their own wealth as well as that of other shareholders; he suggests that options and other stock-based compensation can effectively motivate directors to pursue shareholders' interest. Similarly, Deutsch et al. (2007) argue that equity-based compensation provides incentives (additional to the reputational incentives) to outside directors that bring them into close alignment with shareholders' interests by linking the wealth of the directors to firm value. In addition, equity compensation can motivate outside directors to utilize their social and human capital to provide advice to firm managers (Hillman and Daiziel, 2003). Empirically, Yermack (2004) documents that the incentives of

[4] A director is assumed to have attendance problems if they fail to attend more than one-quarter of board meetings (Adams and Ferreira, 2008).

outside directors are derived mainly from accumulated equity compensation[5], and that firms with higher corporate investment opportunities grant more equity incentives to outside directors than firms lacking such opportunities. The increase in workloads and risk post-SOX may discourage potential outside directors from sitting on boards, and firms are paying greater total compensation with a higher proportion of equity to attract qualified outside directors than before SOX (Linck et al., 2009). However, some scholars (e.g., Stout, 2003) question whether equity compensation provides sufficient incentives to outside directors. For example, Stout (2003) argues that increasing the share price is a public good that invites free riding.

2.1.4 Determinants of Outside Director Compensation

Under the umbrella of agency theory, two perspectives can explain outside director compensation. First, CEOs may overpay directors to acquire directors' loyalty, which I refer to as the "entrenchment perspective." Second, compensation may be designed and adopted to improve efficiency of a firm, which I refer to as the "value-enhancing perspective."

[5] Yermack (2004) finds that for a $1,000 increase in a firm's market capitalization, the wealth of outside directors increases by 11 cents, of which increases in stock and option value account for 6.1 cents, thus representing the largest incentive. The second largest incentive comes from the potential increase in additional directorships, which accounts for 4.3 cents of the 11 cents. The performance incentive from directors' turnover is statistically significant, but it accounts for a very small proportion of the overall incentives.

Entrenchment Perspective

A fundamental premise of the agency theory-based perspectives is that outside directors and managers seek their own private benefits (self-interests). CEOs who intend to entrench themselves may make use of directors' compensation to obtain directors' loyalty (Fedaseyeu et al., 2018). Specifically, they may overpay directors, which can impair the independence of outside directors (e.g., Hope et al., 2019). For instance, outside directors may receive discretionary compensation (unrelated to board functions) when they have a personal connection with the CEO before joining the board, especially when CEOs are powerful (Fedaseyeu et al., 2018). Moreover, Hope et al. (2019) show that total director compensation is positively associated with related-party transactions. They decompose total compensation into "predicted" and "excessive" compensation and find that only the latter is associated with related-party transactions. The result suggests that board independence and the efficacy of board monitoring are undermined when directors are overpaid.

Value-Enhancing Perspective

High director compensation can be used to attract capable directors with better monitoring capacity than others (e.g., Hope et al., 2019) and thus improve corporate operational efficiency. In other words, outside director compensation is designed to alleviate the potential misalignment of interests between directors and shareholders (Bryan et al., 2000). Compensation, especially equity compensation, is one of the important incentives for outside directors to ensure that they provide proper monitoring and advice to firms.

The effectiveness of directors' compensation in providing proper incentives to directors depends on several factors, and different forms of compensation (e.g., equity, cash, and total compensation) offered to directors may have different determinants. As many scholars mention that equity compensation increases the alignment of interests between outside directors and shareholders (e.g., Jensen, 1993; Yermack 2004; Sengupta and Zhang, 2015), I focus my discussion on outside directors' equity compensation. There are many factors that can determine outside directors' equity compensation. Studies adopting an agency theory perspective (e.g., Bryan et al., 2000) focus on factors that include investment opportunities, the complexity and size of a firm, firm performance, and shareholder ownership. For example, large and complex firms grant outside directors more equity compensation (Bugeja et al., 2016) because these firms are difficult to monitor (Farrell, Friesen, and Hersch, 2008). Similarly, firms face increased information asymmetry problems when their investment opportunities expand (Bugeja et al., 2016), making them more likely to incentivize outside directors using equity compensation than firms without such information problems or investment opportunities (Linn and Park 2005; Dah and Frye, 2017). Furthermore, better performing firms pay higher equity compensation to outside directors than poorly performing firms (Dah and Frye, 2017), which is consistent with the extensive literature on pay-for-performance for executives. In addition, when executives have a high ownership stake in a firm, this may align the interests between managers and shareholders (Dah and Frye, 2017), which decreases the need for equity compensation for outside directors.

2.1.5 Outcomes of Outside Directors' Equity Compensation

Equity compensation may incentivize outside directors to diligently advise and monitor managers; however, outside directors may have reputational (Masulis and Mobbs, 2014) or other incentives (Yermack, 2004) that influence the effectiveness of equity compensation. Furthermore, the effectiveness of equity compensation may depend on other governance mechanisms (Cordeiro et al., 2007), such that outside directors who receive high equity compensation may not necessarily maximize (other) shareholders' wealth.

Positive Effect. Multiple scholars document that outside directors' equity compensation can have a positive effect on monitoring and/or advising. For example, it increases the chance of CEO turnover when the firm performance is poor (Perry, 2000), increases firm value (Fich and Shivdasani, 2005; Burns, Kapalczynski, and Wald, 2021), increases corporate disclosure and decreases cost of equity (Sengupta and Zhang, 2015), discourages related-party transactions (Hope et al. 2019), and improves the quality of strategic alliance decisions (Chan et al., 2023).

Inconclusive Effect. Acquisition decisions are highly risky and failure may adversely affect directors' reputations (Deutsch et al., 2007). Although equity compensation may align the interests of outside directors and shareholders (Hillman and Daiziel, 2003), the outside directors may have concerns about the uncertainty and risk to their reputations from strategic decisions such as acquisition activities (Deutsch et al., 2007). This reputation concern may offset the positive effect of equity compensation in motivating outside directors to maximize shareholders' benefits,

making the overall effect inconclusive. Deutsch et al. (2007) document an inverted U-shaped relationship between a firm's acquisition rate and outside directors' stock compensation. The potentially negative effect on reputation risk may outweigh the financial incentives when the level of stock compensation is low, although outside directors may be willing to engage in acquisition activities if they perceive that the potential gains of acquisitions may increase their wealth considerably when their stock compensation is at moderate level. However, outside directors may prefer to secure their accumulated stock-based wealth and avoid uncertainty when the stock compensation is high. As a result, there is a non-monotonic relationship between stock compensation and firms' acquisitions, and it is unclear whether high equity compensation can help align the interests of outside directors and shareholders in acquisition activities.

Prior studies document that managers tend to underinvest in R&D (David, Hitt, and Gimeno, 2001) and thus may underinvest in the number of employees required for R&D purposes. Although Deutsch (2007) finds that option compensation of outside directors increases the intensity (per employee) of R&D, this finding does not indicate whether the level of R&D is optimal for shareholders. On the one hand, a higher R&D intensity may imply that outside directors are motivated by stock-option compensation to perform their role as guardians of shareholder interests (Deutsch, 2007) because long-term investors may favor R&D (given its long-term nature) that may increase long-term performance, whereas managers may relatively enjoy safe short-term investments, which yield faster payoffs, to enhance their personal benefits, such as their reputation (David et al., 2001). On the other hand, a high percentage of stock options in total compensation may encourage outside directors to take more risks than otherwise, and this may lead firms to

adopt risky R&D strategies, which may not necessarily be optimal for shareholders (Deutsch, 2007).

Negative Effect and Self-Interest. As outside directors have their own interests, high equity compensation may not improve governance (Linck et al., 2009). For instance, Sharma (2011) finds a negative relation between a firm's propensity to pay cash dividends and outside directors' equity compensation, suggesting that increasing equity incentive compensation may exacerbate agency problems, i.e., result in excessive risk-taking (Bebchuk and Fried, 2003; Sharma, 2011).

Interdependent Effect. Although the literature examining the association between directors' equity compensation and monitoring performance presents mixed conclusions, another strand of literature focuses on how other governance mechanisms may interact with directors' equity compensation to affect monitoring outcomes. For instance, Cordeiro et al., (2007) document that outside directors' equity compensation improves firm performance to a greater extent when external monitoring is weaker, and Hope et al. (2019) show that the percentage of institutional holdings has a moderating effect on the relationship between related-party transactions and director compensation. Moreover, Kim et al. (2019) find that CEO equity compensation and outside directors' equity compensation are substitutes for each other in terms of their effects on the voluntary disclosure of management earnings forecasts.

2.2 Labor Investment Efficiency

The question of "To what extent is capital allocated to the right investments?" is a fundamental one in corporate finance (Stein, 2003). In a frictionless world with a perfect capital market, a firm would maximize its value by investing in all projects with a positive net present value (Modigliani and Miller, 1958; Stein 2003; Chen et al., 2011) and thus both labor and corporate investment should be efficient. However, in reality, the existence of agency costs and managerial learning can affect the efficiency of investment (Roychowdhury et al., 2019). The literature on the efficiency of labor investment focuses on two categories of determinants. First, to improve the efficiency of labor investment, firms can adopt mechanisms to mitigate the moral hazard and adverse selection problems that arise from asymmetric information. Second, decision makers can secure learning channels to improve their information set (e.g., information on future investment opportunities) to improve labor investment efficiency.

Agency Issues Arising from Information Asymmetry

Moral Hazard. Moral hazard problems arise when agents (e.g., managers) exploit their information advantage over the firm principals (e.g., shareholders) to pursue their private benefits (Jensen and Meckling, 1976). Increasing the flow and quality of information can help mitigate such problems. Investors and other outsiders may have less firm-specific knowledge than managers to estimate the appropriate numbers of employees, whereas the more-informed managers may have incentives to overinvest in labor (e.g., avoiding firing workers who are unproductive) to maintain and enhance their power instead of acting in the shareholders' interests by pursuing efficient labor investment. For instance, Jung

et al. (2014) find that good quality accounting information enables efficient contracting, which helps to reduce moral hazard problems and enhance the efficiency of labor investments, because the monitoring abilities of outsiders increase with the financial reporting quality.

In addition to accounting information, corporate governance plays a role in reducing agency problems and enhancing labor investment efficiency by monitoring managers (Le and Tran, 2021). Institutional investors who participate in long-term investment can accumulate firm-specific knowledge and manager-specific information; such information helps to lower the cost of monitoring managerial behaviors, and thus enhances the efficiency of labor investment (Ghaly et al., 2020). However, underinvestment may result from myopic pressure from investors for firms to meet short-term earnings target. Ghaly et al. (2020) document that long-term institutional investors enhance the efficiency of labor investment.

As well as institutional investment horizons (Ghaly et al., 2020), recent research shows that alternative external corporate governance mechanisms also affect labor investment efficiency. For instance, Lee and Mo (2020) find that analysts provide monitoring functions and improve labor investment efficiency, and Do and Le (2022) report that weakened shareholders' litigation rights increase agency problems and reduce labor investment efficiency.

Internal governance mechanisms also can affect labor investment efficiency. For example, Sualihu et al. (2021) investigate the effects of CEO equity compensation on labor investment efficiency. Both stock compensation and option compensation

are forms of equity-based compensation. Although equity compensation may align the interests of CEOs and shareholders, Sualihu et al. (2021) find that only the restricted stock granted to CEOs mitigates inefficient labor investment, whereas stock option compensation exacerbates it.

Although boards of directors are the apex of the internal control system (Jensen, 1993) that provides effective monitoring (e.g., Fama and Jensen, 1983), the incentives and capabilities of the directors and thus the corresponding effects on firm decisions and performance can vary with the directors' individual characteristics, such as gender (e.g., Chen et al., 2019). For instance, Sun and Zhang (2021) find that a board with higher representation of female directors can enhance corporate monitoring and lead to more efficient labor investment, and that the relationship is stronger for firms with weaker monitoring.

Board independence may also mitigate moral hazard problems. Although a strong connection between a CEO and outside directors may impair board independence, there are two potential opposing effects when there are strong CEO–director ties (Khedmati et al., 2020). On the one hand, CEO–director ties may reduce the degree of monitoring performed by the directors, and result in inefficient labor investment. On the other hand, CEO–directors ties may enhance information flows and improve the efficiency of labor investment. Empirically, Khedmati et al. (2020) document that CEO–director ties reduce the effectiveness of monitoring and reduce the efficiency of investment in labor.

Alternative internal governance mechanisms such as controlling shareholders and tournament incentives can also influence labor investment efficiency. Gu, Ni, and

Tian (2022) mention that large shareholders may pursue their own interests and seek to expropriate the minority shareholders' benefits. They investigate the potential influence of agency conflicts among shareholders on labor investment efficiency and find that for firms in China, the inefficiency of labor investment increases as controlling shareholder exploitation increases in severity in China. Li and Wang (2022) examine the effect of senior managers other than CEOs on labor investment efficiency by focusing on the tournament incentives of the managers, and discuss the two competing views. On the one hand, senior managers who are in a tournament situation may work harder than before because there is a potentially large difference in income for the winner (i.e., a large pay difference between the CEO and other executives), leading the executives to exert more effort than otherwise, and the tournament incentives may improve labor investment efficiency. On the other hand, tournament incentives may reduce team cohesion and create negative spillovers on labor investment. Li and Wang (2022) document that tournament incentives lead to inefficient labor investment, and that the link is weaker when the executives are less eager to compete in the tournament.

Adverse Selection. Adverse selection problems can lead to inefficient labor investment because managers and outside capital providers may have asymmetric information (Jung et al., 2014; Roychowdhury et al., 2019). In the context of fund-raising activities, potential investors may charge a high cost of capital and discount the stock price because of information risk. As raising funds is costly, managers may forgo projects with a positive net present value (i.e., underinvest in labor). As a result, increasing the availability of information may enhance labor investment efficiency even when managers already have incentives to work on behalf of the

shareholders. In other words, improving corporate disclosures can mitigate the asymmetric information between managers and capital providers and hence mitigate adverse selection problems (Ben-Nasr and Alshwer, 2016).

Learning Channel to Improve Information Set

Labor investment can be inefficient even in the absence of adverse selection and moral hazard problems. Roychowdhury et al. (2019) argue that investment decisions may not be efficient when managers face information uncertainty about the return and risk of a potential investment, a phenomenon labeled the managerial learning hypothesis. According to this hypothesis, managers can improve the efficiency of their decisions and increase firm value by learning new information, which includes information on future investment opportunities, product demand, and financing policies from a variety of channels, such as stock prices, financial reporting information, and peers (Roychowdhury et al., 2019). Managers, for example, may use stock price information when they make decisions on labor investment, and such information can reduce the inefficiency of labor investment (Ben-Nasr and Alshwer, 2016).

2.3 Hypothesis Development

The efficiency of labor investment can be improved by mitigating asymmetric information (Jung et al., 2014) and expanding managers' information sets (Ben-Nasr and Alshwer, 2016). Drawing on the literature, I argue that outside directors' equity compensation can influence the efficiency of labor investment as follows.

Outside directors' equity compensation can align the interests of stockholders and outside directors (Hillman and Daiziel, 2003) and motivate the directors to provide effective monitoring. As inefficiency in labor investment adversely affects stock value (Jung et al. 2014), it also influences the private benefits of outside directors, as well as those of other remote investors. Thus, outside directors who receive equity compensation have incentives to monitor the labor investment decision and enhance firm value. For instance, outside directors' equity compensation helps decrease the cost of equity (Sengupta and Zhang, 2015), which can help a firm to acquire finance and in turn increase the efficiency of labor investment (Ben-Nasr and Alshwer, 2016). It also helps increase the quality and quantity of corporate disclosures, such as voluntary management earnings forecasts (Sengupta and Zhang, 2015), which reduces the frictions arising from asymmetric information between shareholders and managers (Jung et al., 2014), and hence mitigates the potential underinvestment in labor and profitable projects caused by insufficient capital. In addition, compensating outside directors with equity can incentivize them to share their experience and information (Hillman and Daiziel, 2003), which are useful for labor investment decisions in the focal firms. The social network of outside directors can enable valuable information flows among firms (Fracassi and Tate, 2002) and outside directors can share their experience (Giannetti, et al., 2015), such as their management practices in dealing with labor investment efficiency in other firms. Thus, the connections and experience of outside directors can provide a learning channel for managers to improve their information set on the future information opportunities, and hence reduce the inefficiency of labor investment. Based on the above arguments, it is plausible that high equity compensation for outside directors can improve the efficiency of labor investment.

On the other hand, directors are also agents (Deutsch et al., 2007; Deutsch et al., 2011) and they may pursue their own benefits instead of the interests of shareholders. For instance, audit committee members who are granted short-term stock option compensation have a lower oversight quality because they focus on short-term performance (Archambeault et al., 2008). Furthermore, equity incentives for outside directors, such as stock options, can aggravate agency problems and lead the outside directors to avoid challenging managerial policies, such as dividend payout policies and high-risk investments (Sharma, 2011). Similarly, outside directors may not challenge a labor investment decision even if it deviates from the optimal investment level. Furthermore, managers who underinvest in labor to increase the internal funds available for their private consumption (Khedmati et al., 2020) or overinvest in labor to enhance their power may induce outside directors to side with them by granting them equity compensation.

With the conflicting arguments, the association between outside directors' equity compensation and labor investment efficiency is an open empirical question. Thus, I do not include a directional expectation concerning my research question; instead, I provide a null hypothesis.

Hypothesis 1a: The proportion of equity compensation in total compensation of outside directors is not related to the ***efficiency*** of labor investment.

Hypothesis 1b: The proportion of equity compensation in total compensation of outside directors is not related to ***overinvestment*** in labor.

Hypothesis 1c: The proportion of equity compensation in total compensation of outside directors is not related to ***underinvestment*** in labor.

Alternative governance mechanisms may have interdependent effects (e.g., Rediker and Seth, 1995; Cordeiro et al., 2007; Hope et al., 2019). Whereas equity compensation acts as an important internal governance mechanism that may provide incentives for outside directors to improve their monitoring of labor investment efficiency, other governance mechanisms, such as institutional ownership and CEO ownership, may influence the effectiveness of outside directors' equity compensation on labor investment efficiency.

Institutional investors can pressure managers to make decisions that would maximize shareholders' interest (Cornett et al., 2007), such as improving operating cash flow returns, increasing corporate tax avoidance, enhancing firm performance, and mitigating inefficiency of labor investment (Cornett et al., 2007; Khan, Srinivasan, and Tan, 2017; Lin and Fu, 2017; Ghaly et al., 2020). If institutional investors can monitor managerial activities, this may reduce the need for monitoring by outside directors. Thus, the effectiveness of equity compensation may be less pronounced in the presence of influential institutional investors. However, institutional investors may put pressure on managers to forgo profitable investment projects to boost short-term stock prices (Ghaly et al., 2020) and outside directors may need more incentives (e.g., equity compensation) to monitor managers. Therefore, the effectiveness of institutional ownership and outside directors' equity compensation may interact to affect firm policies. For instance, Cordeiro et al. (2007) find that outside directors' equity compensation has a positive effect on firm performance, but it is moderated by negative effects

associated with the external monitoring environment, such as institutional ownership. Furthermore, Hope et al. (2019) show an interdependent effect of director compensation and institutional ownership on related-party transactions. In line with the previous studies, institutional ownership is a potential moderator that can affect the association between labor investment efficiency and outside directors' equity compensation. Therefore, I put forward the following hypothesis:

> Hypothesis 2a: Institutional ownership moderates the impact of outside directors' equity compensation on labor investment efficiency.

In addition to external ownership factors, such as institutional shareholdings, CEO ownership can affect agency problems and the efficiency of labor investment. For instance, the relationship between institutional investment horizons and labor investment efficiency is sensitive to CEO ownership (Ghaly et al., 2020). If a high percentage of CEO ownership can align managers' and shareholders' interests, incentivized outside directors can reduce the effort that they devote to monitoring, and the effect of outside directors' equity compensation on labor investment efficiency will be less pronounced. Conversely, however, if CEOs who have greater equity ownership exercise their power to engage in opportunistic behaviors (Morck et al., 1988), firms will need to offer more incentives to outside directors to monitor their labor investment policies. Consistent with the interdependent relationship between CEO ownership and outside director equity compensation, Rediker and Seth (1995) document that the monitoring roles provided by outside directors have substitution effects with managerial ownership. In line with the research, I expect CEO ownership to affect the association between outside

directors' equity compensation and labor investment efficiency, leading to my next hypothesis:

> Hypothesis 2b: CEO ownership moderates the impact of outside directors' equity compensation on labor investment efficiency.

The human capital intensity of a firm may affect the impact of outside directors' equity compensation on the efficiency of labor investment. First, it may not be easy for a human-capital-intensive firm to adjust its labor investment efficiently owing to keen competition for labor in high-skilled sectors (Cao and Rees, 2020). Second, as firms with high human capital intensity possess higher labor skills, they face higher labor adjustment costs[6] (e.g., Hamermesh and Pfann, 1996; Cao and Rees, 2020). As a result, firms operating in a human-capital-intensive industry may need additional monitoring and advisory services compared with less human-capital-intensive firms. This will affect the association between labor investment efficiency and outside directors' equity compensation. Therefore, I form the following hypothesis:

> Hypothesis 2c: The human capital intensity of a firm moderates the impact of outside directors' equity compensation on labor investment efficiency.

[6] Investment in labor involves adjustment costs, such as the costs of transferring, maintaining, and replacing employees (Hamermesh, 1995). Other than wages, firms can incur significant costs on training and also searching, hiring, and firing employees (Ghaly et al., 2020).

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Complex firms (e.g., firms with multiple business segments) may engage in suboptimal investment decisions, such as empire building (Jensen, 1986), and they are associated with more risky investment outcomes than less complex firms (Bryan et al., 2000). Outside directors may not have the appropriate expertise and experience for complex firms (Bord, 1996) and it is relatively difficult to monitor these firms (Farrell, Friesen, and Hersch, 2008) because of their larger information asymmetries than those of simpler firms (Hoechle et al., 2012). Thus, complex firms may need to confront less efficient investment outcomes compared with simpler firms through various channels, such as empire building, and they may require higher quality outside directors to commit more time and engagement (Bugeja et al., 2016) than is the case for less complex firms. I expect that outside directors' equity compensation will have a strong impact that mitigates the inefficiency of labor investment for complex firms. This is because equity compensation can motivate high-quality outside directors to devote additional efforts to monitoring the potential asymmetric information problems and/or it can attract high-quality outside directors to provide advice, hence reducing the suboptimal labor investment decisions. Thus, I hypothesize:

> Hypothesis 2d: Firm complexity moderates the impact of outside directors' equity compensation on labor investment efficiency.

The effectiveness of a board of directors depends not only on directors' incentives, but also on other director-level characteristics. One of the most important characteristics is the board members' gender / the gender balance of the board. A board with female directors can enhance effective monitoring (Adams and Ferreira, 2009), reduce aggressive investment policies (Chen et al., 2019), improve

corporate performance, such as R&D (Chen et al., 2021), and improve labor investment efficiency for firms with poor governance quality (Sun and Zhang, 2021). Thus, outside directors may not need to spend much effort on monitoring corporate decisions such as those on labor investment for firms with a high representation of female directors. In other words, female directors may affect the association between labor investment efficiency and outside directors' equity compensation. Therefore, I form the following hypothesis:

> Hypothesis 2e: Female directors moderate the impact of outside directors' equity compensation on labor investment efficiency.

3. Methodology and Research Design

3.1 Key Measures

The key measures for my research are the efficiency of labor investment and outside directors' equity compensation. In this section, I discuss the primary proxies for these two key measures.

3.1.1 Measure of Labor Investment Efficiency

As a proxy for labor investment, I use net hiring, which is the percentage change in the number of employees. An inverse measure of labor investment efficiency (*Abnormal net hiring)* is the absolute difference between the expected net hiring and its actual level. I use the ordinary least squares method to measure expected net hiring by regressing net hiring with a list of fundamental economic variables

(e.g., Pinnuck and Lillis, 2007; Jung et al., 2014; Ben-Nasr and Alshwer, 2016; Khedmati et al., 2020; Sualihu et al., 2021), as shown in Equation (1):

$$\begin{aligned} Net\_Hiring = {} & \beta_0 + \beta_1 Sales\_Growth_{i,t} + \beta_2 Sales\_Growth_{i,t-1} + \beta_3 ROA_{i,t} \\ & + \beta_4 \Delta ROA_{i,t} + \beta_5 \Delta ROA_{i,t-1} + \beta_6 Return_{i,t} \\ & + \beta_7 Firm\_Size\_R_{i,t-1} + \beta_8 Quick_{i,t-1} + \beta_9 \Delta Quick_{i,t-1} \\ & + \beta_{10} \Delta Quick_{i,t} + \beta_{11} Leverage_{i,t-1} + \beta_{12} LossBIN1_{i,t-1} \\ & + \beta_{13} LossBIN2_{i,t-1} + \beta_{14} LossBIN3_{i,t-1} + \beta_{15} LossBIN4_{i,t-1} \\ & + \beta_{16} LossBIN5_{i,t-1} + \beta_{17} AUR_{i,t-1} + \beta_{18} CAPX_{i,t-1} \\ & + \beta_{19} AQC_{i,t-1} + \beta_{20} XRD_{i,t-1} + \beta_{21} lnGDPpc_{i,t-1} + IndustryFE \\ & + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where the subscripts *i* and *t* refer to the firm and year, respectively. *Net_Hiring* is the percentage change in the number of employees, *Sales_Growth* is the percentage change in sales revenue, *ROA* is the returns on assets, *⊿ROA* is the change in *ROA*, *Return* is the annual stock return, *Firm_Size_R* is the natural logarithm of market value of equity at the beginning of the year, ranked into percentiles, *Quick* is the quick ratio (the ratio of receivables plus short-term investments and cash to current liabilities), *⊿Quick* is the change in quick ratio, and *Leverage* is the sum of long-term debt and debt in current liabilities, scaled by the assets. *LossBIN* variables are dummy variables that indicate each range of prior-year *ROA* with a length interval of 0.005 from 0 to -0.025 (e.g., *LossBIN1* takes a value of 1 if *ROA* in the previous year is between -0.005 and 0, otherwise *LossBIN1* equals 0; *LossBIN2* equals 1 if *ROA* in the previous year is between -0.01 and -0.005, and otherwise *LossBIN2* is 0; and so on). *AUR* is the ratio of annual sales to assets, *CAPX* is the ratio of capital expenditure to assets, *AQC* is the ratio of acquisition expenditure to assets, *XRD* is the ratio of R&D expenditure to assets, and *lnGDPpc* is the natural logarithm of gross domestic product (GDP) per capita. The model

includes industry fixed effects. My primary inverse measure of efficiency in labor investment is the absolute residuals ($|\varepsilon|$) from Equation (1). A smaller absolute value means that labor investment is more efficient. A summary of variable descriptions is also provided in Appendix A.

3.1.2 Measure of Outside Directors' Equity Compensation

I define outside directors as independent directors on the board (Sengupta and Zhang, 2015). First, I calculate the equity compensation (the sum of option and stock compensation) as a proportion of the total compensation for each outside director of a firm. Then, I calculate my primary measure (*MDIRCOMP*) by taking the average of the proportions for all outside directors in a firm for each year. Sengupta and Zhang (2015) argue that this measure is relatively less scale dependent than those which use dollar compensations. Although I use this as the primary measure of outside directors' equity compensation, I also use alternative measures and report the findings in this thesis.

3.2 Control Variables

Based on the relevant prior research, I discuss the controls that are likely to be related to labor decisions, CEOs' personal characteristics that could affect labor investment efficiency, and corporate governance variables that provide a potential monitoring role. In this section, I discuss the firm-level controls, CEO-level controls, and board-level controls.

3.2.1 Firm-level Control Variables

The control variables at the firm-level are motivated by Pinnuck and Lillis (2007), Biddle et al. (2009), Jung et al. (2014), Ben-Nasr and Alshwer (2016), and Khedmati et al. (2020). As growth opportunities and firm size may affect the growth rates of employment, I use market-to-book value of common stock (*MTB*) to control for growth opportunities and the natural logarithm of equity in market value (*Firm_Size*) to control for the firm size. As liquidity and financial risk may affect employment decisions, I control them using *Quick* and *Leverage*, respectively (as defined in Equation (1)). As executives may not pay dividends when they have to devote funds to investment, I create a dummy (*Dividend*) that equals 1 if a firm pays a dividend, and 0 otherwise, to control for dividend payouts. Cash flow volatility may influence investment decisions and the volatility of sales may affect hiring decisions. Therefore, I control for the volatility of cash flow and the volatility of sales using the standard deviation of cash flow from operations over years t - 5 to t - 1 (*SD_CFO*) and the standard deviation of sales revenue over years t - 5 to t - 1 (*SD_Sales*). The extent of investment in fixed assets may affect employment decisions; thus, I control it using property, plant, and equipment, scaled by assets (*Tangible*). Loss-making firms may have a higher probability of cutting their labor investment than profitable firms; therefore, I control any incidence of loss using a dummy (*Loss*) that equals 1 if ROA is negative, and 0 otherwise. As institutional owners may play a monitoring role concerning labor investment, I control the percentage of shares owned by institutional investors (*Institutional*). Labor investment volatility may affect labor investment decisions, and I control for this using the standard deviation of the percentage change in the number of employees over years t - 5 to t - 1 (*SD_net_hire*). As labor intensity may indicate

whether more or fewer staff should be employed, I control for labor intensity (*Labor_intensity*) using the ratio of employees to assets. Labor protection, such as the bargaining power of a labor union, may affect the flexibility of a firm in adjusting labor; thus, I control for this using the unionization rate (*UNION*). As abnormal net hiring may indirectly stem from other investment decisions, I also control for the inefficiency of non-labor investment (*Abn_other_invest*) using the absolute residual of the following model:

$$Other\_invest_{i,t} = \beta_0 + \beta_1 Sales\_Growth_{i,t-1} + \varepsilon_{i,t} ,$$

where *Sales_Growth* is as defined in Equation (1), and *Other_Invest* is calculated by adding the acquisition expenditures, R&D expenditures, and capital expenditures, minus cash from selling property, plant, and equipment, scaled by assets in the prior year. Finally, as many scholars highlight the role of accounting quality on labor investment, I control for this (*AQ*) using the absolute value of Dechow and Dichev's (2002) measure of abnormal accruals, as modified by Ball and Shivakumar (2005).

3.2.2 CEO-level Control Variables

CEOs are likely to have the greatest influence of all relevant parties on decision-making (e.g., Hambrick and Mason, 1984; Kim and Lu, 2011) and CEOs' personal characteristics and their stock compensation can be related to firms' investment decisions (e.g., Jensen and Murphy, 1990; Jensen, 1993; Holmstrom, 1999; Sualihu et al., 2021). Thus, I include CEO-level control variables in my model.

As the investment decisions of a firm may depend on the gender of the CEO (Faccio, Marchica, and Mura, 2016), I control for this using a dummy (*CEOGender*) that

equals 1 if the firm has a male CEO and 0 if the firm has a female CEO. CEOs have different career concerns and levels of risk aversion when they become older compared with younger CEOs (Holmstrom, 1999). Thus, CEOs' ages can affect corporate investment decisions (Yim, 2013) and corporate policies (Serfling, 2014), such as their labor investment decisions. I control for this using the measure of the natural logarithm of the age of the CEO (*CEOAge*). If the CEO is the board chairperson within a firm (CEO duality), it will be more difficult for the board to perform critical functions such as firing and evaluating the CEO (Jensen, 1993). As CEO duality may influence the monitoring function of the board, I control for it with a dummy (*CEO_dual*) that equals 1 if the CEO is the board chairperson, and 0 otherwise. CEOs' equity compensation can affect the labor investment efficiency (Sualihu et al., 2021) because equity compensation may align the interests of managers and shareholders (Jensen and Murphy, 1990). Thus, I also control for CEO equity compensation, which is calculated as the proportion of equity (option and stock) compensation of the CEO in his/her total pay (*MCEOCOMP*).

3.2.3 Board-level Control Variables

Boards of directors can provide advisory and monitoring roles (Fama and Jensen, 1983) and influence labor investment efficiency. However, the effectiveness of their roles may depend on their attributes. Oversized boards can be ineffective because of poor communications and the overwhelming nature of decision-making (Jensen, 1993; Yermack, 1996). However, a large board may bring greater access to information that is useful to labor investment decisions compared with a smaller board. Thus, I control for board size (*BDSize*) using the number of directors of a board. Board independence can affect monitoring effectiveness

(Fama and Jensen, 1983; Weisbach, 1988) and information access (Pfeffer and Salancik, 1978), and hence affect labor investment efficiency. Thus, I control for board independence (*BDIndependence*) using the proportion of outside directors. Board gender diversity may also affect governance performance, investment policies, and firm decisions (e.g., Chen, Leung, Song, and Goergen, 2019; Chen, Tong, Zhang, and Zhou, 2021). Thus, I control for the potential effect of board gender diversity (*BDGender*) by calculating the proportion of male directors on the board. Similar to CEO age, the age of directors may affect corporate investment. For example, Bo, Li, and Sun (2016) document that boards that have more young directors have a greater chance of making investment decisions closer to their industry peers. Therefore, I use the natural logarithm of the average age of the board to control the age of the board members (*BDAge*).

3.3 Empirical Model

To test the relationship between outside directors' equity compensation and the efficiency of labor investment, I estimate the model shown in Equation (2):

$$
\begin{aligned}
Abnormal\ net\ hiring\ _{i,t} &= \beta_0 + \beta_1 MDIRCOMP_{i,t-1} + \beta_2 MTB_{i,t-1} + \beta_3 Firm\_Size_{i,t-1} \\
&+ \beta_4 Quick_{i,t-1} + \beta_5 Leverage_{i,t-1} + \beta_6 Dividend_{i,t-1} \\
&+ \beta_7 SD\_CFO_{i,t-1} + \beta_8 SD\_Sales_{i,t-1} + \beta_9 Tangible_{i,t-1} \\
&+ \beta_{10} Loss_{i,t-1} + \beta_{11} Institutional_{i,t-1} + \beta_{12} SD\_net\_hire_{i,t-1} \\
&+ \beta_{13} Labor\_intensity_{i,t-1} + \beta_{14} UNION_{i,t-1} \\
&+ \beta_{15} Abn\_other\_invest_{i,t-1} + \beta_{16} AQ_{i,t-1} + \beta_{17} CEOGender_{i,t-1} \\
&+ \beta_{18} CEOAge_{i,t-1} + \beta_{19} CEO\_dual_{i,t-1} \\
&+ \beta_{20} MCEOCOMP_{i,t-1} + \beta_{21} BDSize_{i,t-1} \\
&+ \beta_{22} BDIndependence_{i,t-1} + \beta_{23} BDGender_{i,t-1} \\
&+ \beta_{24} BDAge_{i,t-1} + \varepsilon_{i,t} \qquad (2)
\end{aligned}
$$

where *Abnormal net hiring* is the absolute residual in Equation (1), where a smaller value indicates more efficiency in labor investment, and *MDIRCOMP* is the primary measure of outside directors' equity compensation (as defined previously). All control and independent variables are lagged by a year. I include three levels of controls, which are firm-level (firm characteristics and economic variables), CEO-level, and board-level controls. Variable descriptions and rationales of including those variables are summarized in the previous sections and/or Appendix A. To account for time trends and time-invariant industry heterogeneity, I estimate the model with year and industry fixed effects. In additional tests, I also consider other time-varying and time-invariant effects.

3.4 Data and Sample

For the sample construction of the first-stage regression (shown in Equation (1) above), I collect the number of employees and other corporate fundamental financial and economic information from Compustat. The information on stock returns is from Center for Research in Security Prices (CRSP), and GDP per capita is from the World Bank. Following prior studies (e.g., Jung et al., 2014; Khedmati et al., 2020), my initial sample starts from 1983 with all the available information to estimate the expected net hiring and hence labor investment efficiency, and it consists of 115,648 firm-year observations. To mitigate the effect of outliers, I winsorize all continuous variables at the 1st and 99th percentiles (Jung et al., 2014). Following Ghaly et al. (2020), I exclude utilities and financial firms (denoted by standard industry classification (SIC) codes from 4900 to 4999 or from 6000 to 6999) because these firms are heavily regulated and may relatively have low discretion on future investment decisions.

My primary dependent variable of Equation (2) is the absolute residual in Equation (1), which is an inverse measure of the efficiency in labor investment. I collect directors' compensation data from ExecuComp, which includes the name of individual directors with company identifiers. Other information on boards and directors is from Institutional Shareholder Services Inc. (ISS), which includes the features of individual directors for the sample firms in the S&P 1500, such as name, age, gender, and classification (e.g., inside, linked, or independent outside directors). I match the director compensation by director names and the company identifiers between ExecuComp and ISS to obtain the data on outside (i.e., independent) directors' equity compensation and other directors' information. The labor unionization data are from Hirsch and Macpherson's (2003) updated database of Union Membership and Coverage. In additional tests used for Equation (2), managerial ability data are from Demerjian et al.'s (2012) updated database. I collect other data, such as corporate fundamental economic information, from Compustat.

The number of observations used to measure Equation (2) is smaller than the sample used for Equation (1), as I merge the original data with the other databases to provide the empirical test[7]. My final sample reduces to 9,495 firm-year observations, which include all the information necessary for hypothesis testing.

[7] Khedmati et al. (2020) provide 102,824 firm-year observations from 1983 to 2017 in their first-stage regression model, and their sample size decreases to 8,583 firm-year observations for the period from 1997 to 2017 in their second-stage regression. Similarly, Sualihu et al. (2021) report 92,175 observations for the period from 1983 to 2017 in their first-stage model, and their sample decreases to 19,344 observations for the period from 1992 to 2017 because of data availability.

The period of analysis is from 2006 to 2019 because of the availability of directors' compensation data. I commence from 2006 because it is the first year in which U.S. public companies are required to provide each individual director's compensation in essentially the same way as they had previously reported managerial compensation, and ExecuComp provides detailed director-level compensation data from that year[8].

4. Empirical Results and Discussion

4.1 Estimation of Labor Investment Efficiency

I estimate the expected net hiring based on Equation (1) to form my inverse measure (i.e., *Abnormal net hiring*) for the labor investment efficiency. Panel A of Table 1 shows the summary statistics of the variables. Most descriptive statistics are consistent with the observations in the literature, such as Jung et al. (2014) and Khedmati et al. (2020). For example, the mean (median) of the percentage change in employees (*Net_Hiring*) is 7.90% (2.40%), which is comparable with the 7.90% (2.90%) reported in Khedmati et al. (2020).

I report the regression results of Equation (1)[9] in Panel B of Table 1. Model 1 reports the corresponding estimated coefficients. The results are generally consistent with the predicted signs (Jung et al., 2014; Khedmati et al. 2020). For

[8] In 2006, Rule 33-8732a was adopted.

[9] Models 2 and 3 are alternative versions of equation (1). Model 4 uses an alternative time period (commencing in 2001) for equation (1) to estimate the alternative measures of labor investment efficiency for the robustness tests (discussed in Section 4.6).

instance, the coefficients of *LossBIN1, LossBIN2,* and *LossBIN3* are negative and significant at the 1% level, suggesting that a small loss for a firm is associated with a reduction in the net hiring level (Pinnuck and Lillis, 2007). Apart from *ROA, LossBIN4,* and *LossBIN5*, all other variables in Model 1 are statistically significant, which indicates that Equation (1) provides a reasonable benchmark for the estimation of expected net hiring. The absolute deviation of the residuals (*Abnormal net hiring*) is my primary inverse measure for labor investment efficiency.

Table 1. Estimating the Expected Level of Net Hiring (Equation (1))

This table reports the descriptive statistics and regression results of Equation (1). Panel A reports the descriptive statistics for the variables used in the estimation of expected net hiring. Panel B reports the regression results for the estimation of the expected net hiring. All variables are defined in Appendix A. The t-statistics in parentheses are based on robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Although sample sizes vary, I follow studies such as Jung et al. (2014) and Ghaly et al. (2020) in presenting the data with the maximum number of observations available.

Panel A: Descriptive Statistics for the Variables in Equation (1)

Variable	N	Mean	Std. Dev.	Q1	Median	Q3
Net_Hiring$_{i,\,t}$	115,648	0.079	0.361	-0.057	0.024	0.138
Sales_Growth$_{i,\,t}$	115,648	0.169	0.670	-0.039	0.073	0.217
Sales_Growth$_{i,\,t-1}$	115,648	0.230	0.786	-0.025	0.086	0.247
ΔROA$_{i,\,t}$	115,648	0.002	0.326	-0.051	-0.001	0.038
ΔROA$_{i,\,t-1}$	115,648	0.016	0.401	-0.051	-0.001	0.040
ROA$_{i,\,t}$	115,648	-0.040	0.346	-0.058	0.031	0.083
Return$_{i,\,t}$	115,648	0.130	0.640	-0.268	0.029	0.359
FirmSize_R$_{i,\,t-1}$	115,648	56.007	27.689	33.000	58.000	80.000
Quick$_{i,\,t-1}$	115,648	2.149	2.885	0.794	1.280	2.306
ΔQuick$_{i,\,t-1}$	115,648	0.207	1.374	-0.216	-0.011	0.226
ΔQuick$_{i,\,t}$	115,648	0.145	1.173	-0.223	-0.019	0.202
Leverage $_{i,\,t-1}$	115,648	0.227	0.232	0.029	0.187	0.350
LOSSBIN1 $_{i,\,t-1}$	115,648	0.011	0.106	0.000	0.000	0.000
LOSSBIN2 $_{i,\,t-1}$	115,648	0.012	0.110	0.000	0.000	0.000
LOSSBIN3 $_{i,\,t-1}$	115,648	0.175	0.380	0.000	0.000	0.000
LOSSBIN4 $_{i,\,t-1}$	115,648	0.011	0.106	0.000	0.000	0.000
LOSSBIN5 $_{i,\,t-1}$	115,648	0.010	0.100	0.000	0.000	0.000
AUR $_{i,\,t-1}$	115,648	1.140	0.801	0.580	0.991	1.501
CAPX $_{i,\,t-1}$	115,648	0.060	0.066	0.019	0.039	0.076
AQC $_{i,\,t-1}$	115,648	0.023	0.061	0.000	0.000	0.009
XRD $_{i,\,t-1}$	115,648	0.058	0.239	0.000	0.003	0.062
lnGDPpc $_{i,\,t-1}$	115,648	10.533	0.345	10.264	10.545	10.792

Table 1. (continued)

Panel B: Regression Results of Equation (1)				
	(1)	(2)	(3)	(4)
Sales_Growth i, t	0.191***		0.200***	0.137***
	(40.28)		(43.04)	(24.16)
Sales_Growth i, t-1	0.030***	0.054***	0.032***	0.033***
	(12.55)	(28.00)	(13.79)	(10.37)
ΔROA i, t	-0.107***		-0.119***	-0.055***
	(-14.76)		(-17.02)	(-6.11)
ΔROA i, t-1	-0.024***		-0.029***	-0.019***
	(-5.21)		(-6.27)	(-3.20)
ROA i, t	-0.002		0.025***	-0.048***
	(-0.22)		(3.47)	(-4.26)
Return i, t	0.077***		0.066***	0.068***
	(34.21)		(31.84)	(23.49)
FirmSize_R i, t-1	0.001***		0.001***	0.001***
	(17.31)		(13.88)	(15.28)
Quick i, t-1	0.008***		0.007***	0.007***
	(12.73)		(11.68)	(9.51)
ΔQuick i, t-1	0.017***		0.018***	0.017***
	(12.87)		(13.26)	(9.71)
ΔQuick i, t	-0.006***		-0.007***	-0.007***
	(-3.67)		(-4.27)	(-2.91)
Leverage i, t-1	-0.053***		-0.054***	-0.055***
	(-9.49)		(-10.28)	(-7.89)
LOSSBIN1 i, t-1	-0.027***		-0.034***	-0.013
	(-4.07)		(-5.08)	(-1.52)
LOSSBIN2 i, t-1	-0.023***		-0.031***	-0.020**
	(-3.55)		(-4.78)	(-2.12)
LOSSBIN3 i, t-1	-0.016***		-0.026***	-0.014***
	(-5.61)		(-9.43)	(-3.74)
LOSSBIN4 i, t-1	-0.006		-0.004	-0.005
	(-0.81)		(-0.49)	(-0.57)
LOSSBIN5 i, t-1	-0.010		-0.005	0.000
	(-1.30)		(-0.56)	(0.04)
AUR i, t-1	0.009***			0.008***
	(4.97)			(3.16)
CAPX i, t-1	0.158***			0.203***
	(7.39)			(6.35)
AQC i, t-1	0.072***			0.074***
	(3.80)			(3.25)
XRD i, t-1	-0.057**			-0.213***
	(-2.05)			(-9.94)
lnGDPpc i, t-1	-0.022*			0.040*
	(-1.84)			(1.71)
Constant	0.161	0.010	-0.024	-0.530**
	(1.33)	(0.57)	(-1.52)	(-2.12)
Observations	115,648	166,115	121,681	59,038
R-squared	0.194	0.036	0.187	0.151
Industry fixed effects	Yes	Yes	Yes	Yes
Robust t-statistics in parentheses				
*** p < 0.01, ** p < 0.05, * p < 0.1				

4.2 Descriptive Statistics and Univariate Results

Table 2 presents the descriptive statistics for the variables used in Equation (2). I report the distributional statistics in Panel A. The mean (median) value of my dependent variable, *Abnormal net hiring*, is 0.087 (0.051), which is comparable with the mean (median) of 0.089 (0.064) reported by Khedmati et al. (2020). The mean (median) value of my primary interest of independent variable, *MDIRCOMP*, is 0.500 (0.542), which is comparable with the mean (median) value of 0.500 (0.516) observed by Sengupta and Zhang (2015)[10]. The distributional statistics of my firm-level controls are similar to those of relevant labor investment research (Jung et al., 2014), and those for CEO-level and board-level controls (are comparable to prior research (Dah and Frye, 2017; Lahlou and Navatte, 2017).

Pearson correlation coefficients for *MDIRCOMP, Abnormal net hiring*, and my control variables are presented in Panel B. The coefficients indicated by a * symbol are statistically significant at the 5% level. *MDIRCOMP* is negatively related to *Abnormal net hiring*, providing preliminary evidence that outside directors' equity compensation improves labor investment efficiency. The correlation coefficients of my controls are generally consistent with related research (Jung et al., 2014). Notably, *Abnormal net hiring* is positively related to *Abn_other_invest*, suggesting that labor investment is more inefficient if a firm has a higher abnormal level of non-labor investments. In addition, *Abnormal net hiring* is positively related to *SD_net_hire, SD_Sales*, and *SD_CFO*, indicating that firms with higher volatilities of

[10] The median amount of outside directors' equity compensation and their total pay during the period of 2006–2019 is shown in Table 3. I discuss it in the subsequent part of this section.

labor investment, sales, and cash flows have larger absolute differences between expected and actual net hiring.

In general, I do not find high correlation coefficients between *MDIRCOMP* and other control variables. To mitigate any unobserved potential multicollinearity, I estimate the variance inflation factor (VIF). Panel C reports that all VIFs are less than 3, implying that multicollinearity is not an important concern in my study.

Table 2. Descriptive Statistics for the Variables in Equation (2)

This table presents descriptive statistics for my main analysis, including the inverse measure of labor investment efficiency, outside directors' equity compensation, firm-level control variables, CEO-level control variables, and board-level control variables. Panel A presents the distributional statistics. Panel B reports the Pearson correlation matrix. Panel C shows the variance inflation factors (VIFs). All variables are defined in Appendix A. The symbol * in Panel B denotes statistical significance at the 5% level. Although sample sizes vary, I follow related studies (e.g., Jung et al., 2014) in reporting the data with the maximum number of observations available.

Panel A: Summary Statistics

Variable	N	Mean	Std. Dev.	Q1	Median	Q3
Abnormal net hiring $_{i, t}$	9495	0.087	0.147	0.023	0.051	0.099
MDIRCOMP $_{i, t-1}$	9495	0.500	0.234	0.435	0.542	0.643
MTB $_{i, t-1}$	9495	3.360	6.359	1.621	2.505	3.940
FirmSize $_{i, t-1}$	9495	7.880	1.473	6.796	7.714	8.893
Quick $_{i, t-1}$	9495	1.680	1.626	0.830	1.265	1.955
Leverage $_{i, t-1}$	9495	0.218	0.196	0.065	0.201	0.319
Dividend $_{i, t-1}$	9495	0.563	0.496	0.000	1.000	1.000
SD_CFO $_{i, t-1}$	9495	0.033	0.045	0.012	0.021	0.038
SD_Sales $_{i, t-1}$	9495	0.177	0.531	0.060	0.110	0.189
Tangible $_{i, t-1}$	9495	0.248	0.214	0.087	0.177	0.342
Loss $_{i, t-1}$	9495	0.138	0.345	0.000	0.000	0.000
Institutional $_{i, t-1}$	9495	0.676	0.354	0.616	0.824	0.926
UNION $_{i, t-1}$	9495	0.089	0.048	0.052	0.066	0.125
SD_net_hire $_{i, t-1}$	9495	0.136	0.155	0.053	0.091	0.159
Labor_intensity $_{i, t-1}$	9495	0.005	0.009	0.002	0.003	0.006
Abn_other_invest $_{i, t-1}$	9495	0.091	0.109	0.033	0.065	0.113
AQ $_{i, t-1}$	9495	5.477	2.849	3.000	5.000	8.000
CEOGender $_{i, t-1}$	9495	0.960	0.195	1.000	1.000	1.000
CEOAge $_{i, t-1}$	9495	4.028	0.125	3.951	4.025	4.111
CEO_dual $_{i, t-1}$	9495	0.434	0.496	0.000	0.000	1.000
MCEOCOMP $_{i, t-1}$	9495	0.487	0.237	0.354	0.524	0.660
BDSize $_{i, t-1}$	9495	8.517	2.333	7.000	8.000	10.000
BDIndependence $_{i, t-1}$	9495	0.794	0.108	0.727	0.818	0.889
BDGender $_{i, t-1}$	9495	0.859	0.108	0.800	0.875	0.923
BDAge $_{i, t-1}$	9495	4.143	0.066	4.104	4.145	4.185

Table 2. (continued)

Panel B: Pearson Correlation Matrix

		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
[1]	*Abnormal net hiring i, t*	1.000											
[2]	*MDIRCOMP i, t-1*	-0.0431*	1.000										
[3]	*MTB i, t-1*	-0.008	0.0540*	1.000									
[4]	*FirmSize i, t-1*	-0.0730*	0.2073*	0.1570*	1.000								
[5]	*Quick i, t-1*	0.0967*	0.0422*	-0.011	-0.1723*	1.000							
[6]	*Leverage i, t-1*	0.016	0.0272*	-0.008	0.1713*	-0.2338*	1.000						
[7]	*Dividend i, t-1*	-0.0617*	-0.0553*	0.0366*	0.3043*	-0.2086*	0.0893*	1.000					
[8]	*SD_CFO i, t-1*	0.0844*	-0.0332*	0.0425*	-0.1488*	0.2407*	-0.0298*	-0.1716*	1.000				
[9]	*SD_Sales i, t-1*	0.0637*	-0.0423*	0.006	-0.0397*	0.1326*	0.003	-0.0933*	0.2905*	1.000			
[10]	*Tangible i, t-1*	-0.013	-0.0724*	-0.0638*	0.0574*	-0.2322*	0.1703*	0.1387*	-0.015	0.0240*	1.000		
[11]	*Loss i, t-1*	0.0890*	-0.001	-0.0725*	-0.2323*	0.0366*	0.0253*	-0.1512*	0.1058*	0.0496*	0.0446*	1.000	
[12]	*Institutional i, t-1*	0.007	0.1264*	0.007	-0.0335*	0.0890*	0.0753*	-0.1491*	0.0453*	0.0481*	-0.0383*	0.0325*	1.000
[13]	*UNION i, t-1*	-0.0226*	-0.0592*	-0.006	-0.009	-0.0526*	0.0228*	0.0732*	-0.0478*	-0.018	-0.0204*	-0.0244*	-0.0500*
[14]	*SD_net_hire i, t-1*	0.1044*	-0.0206*	-0.0390*	-0.1244*	0.0470*	0.0610*	-0.2060*	0.1284*	0.2465*	-0.0380*	0.1058*	0.0598*
[15]	*Labor_intensity i, t-1*	-0.016	-0.0822*	0.010	-0.1623*	-0.1401*	-0.0785*	0.0301*	-0.0543*	-0.0668*	0.1162*	-0.0409*	-0.1460*
[16]	*Abn_other_invest i, t-1*	0.3603*	0.013	0.0438*	-0.010	0.1216*	0.004	-0.0751*	0.0839*	0.0358*	-0.1210*	0.0412*	0.0671*
[17]	*AQ i, t-1*	-0.0275*	0.0729*	0.009	0.6216*	-0.2359*	0.2270*	0.2624*	-0.0488*	0.015	0.1714*	-0.014	-0.0484*
[18]	*CEOGender i, t-1*	0.009	0.017	-0.018	0.018	0.0237*	0.0247*	-0.005	-0.007	0.020	-0.012	0.017	0.0392*
[19]	*CEOAge i, t-1*	-0.0443*	-0.017	-0.0375*	0.0538*	-0.0386*	0.0272*	0.1045*	-0.0428*	0.003	0.0615*	-0.0270*	-0.0439*
[20]	*CEO_dual i, t-1*	-0.0456*	-0.013	-0.016	0.1013*	-0.0507*	-0.0253*	0.0834*	-0.0712*	-0.016	0.0756*	-0.0688*	0.008
[21]	*MCEOCOMP i, t-1*	0.009	0.3200*	0.0744*	0.2962*	0.008	0.1125*	-0.0634*	0.0267*	0.001	-0.0357*	0.0536*	0.0897*
[22]	*BDSize i, t-1*	0.007	0.0765*	0.0490*	0.5190*	-0.2464*	0.2054*	0.2957*	-0.1488*	-0.0579*	0.0792*	-0.0464*	-0.0882*
[23]	*BDIndependence i, t-1*	-0.014	0.1482*	0.0398*	0.2083*	-0.0759*	0.0985*	0.1133*	-0.0543*	-0.018	-0.005	-0.011	0.0824*
[24]	*BDGender i, t-1*	0.0411*	-0.0708*	-0.0548*	-0.2955*	0.1799*	-0.1304*	-0.1974*	0.1100*	0.0767*	0.000	0.0715*	0.0973*
[25]	*BDAge i, t-1*	-0.017	-0.0228*	-0.0428*	0.009	0.0614*	-0.0251*	0.0897*	-0.0316*	0.007	0.014	-0.0210*	0.002

* indicates statistical significance at the 5% level.

Table 2 (continued)

Panel B (continued): Pearson Correlation Matrix

		[13]	[14]	[15]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]	[25]
[1]	*Abnormal net hiring i, t*													
[2]	*MDIRCOMP i, t-1*													
[3]	*MTB i, t-1*													
[4]	*FirmSize i, t-1*													
[5]	*Quick i, t-1*													
[6]	*Leverage i, t-1*													
[7]	*Dividend i, t-1*													
[8]	*SD_CFO i, t-1*													
[9]	*SD_Sales i, t-1*													
[10]	*Tangible i, t-1*													
[11]	*Loss i, t-1*													
[12]	*Institutional i, t-1*													
[13]	*UNION i, t-1*	1.000												
[14]	*SD_net_hire i, t-1*	-0.0312*	1.000											
[15]	*Labor_intensity i, t-1*	0.012	-0.0544*	1.000										
[16]	*Abn_other_invest i, t-1*	-0.007	0.0561*	-0.0307*	1.000									
[17]	*AQ i, t-1*	0.014	-0.014	-0.2036*	-0.0500*	1.000								
[18]	*CEOGender i, t-1*	0.0233*	0.0387*	-0.0552*	-0.001	0.004	1.000							
[19]	*CEOAge i, t-1*	-0.0227*	-0.0422*	0.003	-0.011	0.0749*	0.0477*	1.000						
[20]	*CEO_dual i, t-1*	0.0261*	-0.0391*	0.007	-0.0414*	0.0619*	0.0450*	0.2731*	1.000					
[21]	*MCEOCOMP i, t-1*	-0.0772*	0.016	-0.0831*	0.0376*	0.1791*	-0.008	-0.0916*	-0.0764*	1.000				
[22]	*BDSize i, t-1*	0.014	-0.0796*	-0.0488*	-0.0251*	0.4553*	-0.012	-0.002	0.010	0.1793*	1.000			
[23]	*BDIndependence i, t-1*	-0.0294*	-0.0572*	-0.0599*	0.014	0.1730*	-0.011	-0.0215*	0.1096*	0.2503*	0.3355*	1.000		
[24]	*BDGender i, t-1*	-0.0247*	0.1266*	-0.0635*	0.0304*	-0.2307*	0.2495*	-0.0222*	-0.0443*	-0.1049*	-0.3317*	-0.2351*	1.000	
[25]	*BDAge i, t-1*	-0.0235*	-0.016	-0.0460*	0.0291*	0.0353*	0.0243*	0.2302*	0.0456*	-0.0714*	-0.0350*	-0.0777*	0.1560*	1.000

* indicates statistical significance at the 5% level.

Table 2. (continued)

Panel C: Variance Inflation Factor (VIF)	
Variable	VIF
MDIRCOMP i, t-1	1.30
MTB i, t-1	1.07
FirmSize i, t-1	2.92
Quick i, t-1	1.47
Leverage i, t-1	1.35
Dividend i, t-1	1.47
SD_CFO i, t-1	1.24
SD_Sales i, t-1	1.17
Tangible i, t-1	2.32
Loss i, t-1	1.21
Institutional i, t-1	1.28
UNION i, t-1	1.10
SD_net_hire i, t-1	1.17
Labor_intensity i, t-1	1.66
Abn_other_invest i, t-1	1.19
AQ i, t-1	2.52
CEOGender i, t-1	1.15
CEOAge i, t-1	1.21
CEO_dual i, t-1	1.25
MCEOCOMP i, t-1	1.36
BDSize i, t-1	1.76
BDIndependence i, t-1	1.39
BDGender i, t-1	1.59
BDAge i, t-1	1.20

Table 3 reports the median value of directors' compensation during the period of 1998–2019. Panel A shows the data (for 1998–2005) provided by Linck et al. (2009), and Panel B presents the data (for 2006–2019) in my sample. First, the table shows that there is a monotonic increase in outside directors' total compensation. I find that the median total pay for an outside director increases dramatically, rising from $148,506 in 2006 to $193,500 in 2012 (a 30.3% increase) and to $256,874 in 2019 (a 73.0% increase).

Second, I find that outside directors' equity compensation also monotonically increases over time. For instance, there is a 39.4% increase from $71,760 in 2006

to $100,048 in 2012, and the equity compensation approximately doubles (102.1%) from 2006 to 2019 ($145,026).

Third, the substantial increase in outside directors' compensation is particularly evident in terms of equity compensation, which is consistent with Linck et al. (2009). For instance, with the adoption of SOX in 2002, equity compensation and the portion of equity in total pay increased substantially between 2002 and 2003[11]. In the post-SOX period, firms pay more total compensation with a higher proportion of equity than before SOX to attract qualified outside directors and compensate them for the increased workload and risk of sitting on boards post-SOX (Linck et al., 2009). I report an increase in the proportion of equity for an outside director in total compensation, with the median proportion rising from 48.3% in 2006 to 56.5% in 2019. However, the proportion of equity compensation remains roughly the same each year, at approximately 54.8% to 56.5%, from 2014 to 2019. I also observe that the total director compensation is dramatically higher in 2006 than in the previous year, which is consistent with Dah and Frye (2017)[12]. The increase in compensation may reflect both the acceleration in directors' pay over the time period and the change in disclosure requirements in 2006, which

[11] Based on Linck et al., (2009), equity pay for the median director increased by $19,058 (47.1%) from 2002 to 2003 (($59,539 - $40,481)/$40,481 = 47.1%). Total compensation increased by $21,407 ($95,623 - $74,216). Thus, the increase in compensation was mainly derived from the increase in equity ($19,058/$21,407 = 89.0%) in that year.

[12] Dah and Frye (2017) report the mean director total compensation of $100,000–$120,000 in 2005, increasing to $140,000–$160,000 in 2006, representing an increase of approximately $40,000. The findings in Table 3 are comparable with Dah and Frye (2017), as the increase in the median director total compensation is $35,783 (rising from $112,723 to $148,506) during 2005–2006.

results in different measures of director compensation[13] because of the reporting requirement for Securities and Exchange Commission (SEC) filings since 2006 (Dah and Frye, 2017).

Table 3. Median Director Compensation

This table reports median director compensation. Panel A shows the data provided by Linck et al. (2009), and Panel B shows my sample data. The measures of director compensation in these two panels are not identical because of the change in disclosure requirements for director compensation in 2006. Linck et al. (2009) measure director compensation through different sources, such as the Investor Responsibility Research Center, and calculate option compensation using the Black–Scholes (1973) method, with a number of assumptions. I collect the compensation data directly from ExecuComp as there is a change of compensation reporting requirements in SEC filings in 2006, as noted in the main text.

Panel A: Median Director Compensation in Linck et al. (2009)				Panel B: Median Director Compensation in my Sample			
Year	Equity-based Pay ($'000)	Total Pay ($'000)	Ratio of Equity Pay	Year	Equity-based Pay ($'000)	Total Pay ($'000)	Ratio of Equity Pay
1998	25.113	57.514	43.7%	2006	71.760	148.506	48.3%
1999	31.580	63.396	49.8%	2007	77.192	150.921	51.1%
2000	31.927	65.119	49.0%	2008	82.730	160.242	51.6%
2001	41.827	74.488	56.2%	2009	80.055	160.009	50.0%
2002	40.481	74.216	54.5%	2010	91.857	175.565	52.3%
2003	59.539	95.623	62.3%	2011	100.000	185.826	53.8%
2004	70.216	112.745	62.3%	2012	100.048	193.500	51.7%
2005	68.448	112.723	60.7%	2013	110.003	205.005	53.7%
				2014	120.000	218.336	55.0%
				2015	124.493	222.071	56.1%
				2016	125.000	228.123	54.8%
				2017	130.019	236.458	55.0%
				2018	135.057	244.998	55.1%
				2019	145.026	256.874	56.5%

In sum, firms provide both a higher amount and a higher percentage of outside directors' equity compensation over time. It is important to determine whether

[13] For instance, Linck et al. (2009) measure director compensation using different sources, such as the Investor Responsibility Research Center. They estimate option compensation using the Black–Scholes (1973) method with a number of assumptions (e.g., they assume at the money options with a 7-year maturity). With the reporting requirement of directors' compensation since 2006, I collect the data directly from ExecuComp, which provides a comprehensive measure of directors' compensation.

the higher equity compensation enhances the board's performance (Jensen, 1993)—and hence reduces the inefficiency of labor investment and improves corporate performance—or whether it is used by self-serving executives to collude with outside directors in the pursuit of their own private interests, such as empire building and rent seeking.

4.3 Baseline Results

Table 4 presents the ordinary least squares (OLS) findings for the relationship between (*MDIRCOMP)* outside directors' equity compensation and (*Abnormal net hiring*) labor investment efficiency. In both Models 1 and 2, I control for year, and industry fixed effects, and I provide t-statistics based on heteroskedastically robust standard errors.

In Model 1, I evaluate my main empirical findings from Equation (2). The results provide evidence that rejects the null hypothesis of H1a. Consistent with my univariate evidence, the estimate of *MDIRCOMP* is negative (-0.019) and significant at the 1% level (t statistic = -2.88). This indicates that outside directors' equity compensation is negatively related to *Abnormal net hiring* (i.e., the inverse measure of labor investment efficiency). The finding is economically significant. An increase of one standard deviation in outside director's equity compensation is associated with a 5.11% reduction of inefficient labor investment[14]. This finding

[14] The sample average value of *Abnormal net hiring* is 0.087. The standard deviation of *MDIRCOMP* is 0.234 and the estimated coefficient is -0.019. Therefore, an increase of one standard deviation in *MDIRCOMP* is related to a 5.11% reduction in the inefficiency of labor investment (-0.019*0.234/0.087 = -0.0511).

indicates that outside directors' equity compensation aligns the interests of shareholders and outside directors, and incentivizes the outside directors to monitor CEOs who engage in suboptimal labor investment decisions (e.g., empire building). An alternative explanation is that equity compensation motivates the outside directors to share their relevant experience and information, which leads to an increase in efficiency in labor investment.

Firm characteristics appear to affect labor investment efficiency. My findings are largely consistent with the related research (Jung et al., 2014). The coefficients for *Firm_Size*, *Dividend*, *Institutional*, and *Labor_intensity* are negative and significant, which indicates that large firms, firms with dividend payouts, firms with high institutional ownership, and firms with high labor intensity invest labor more efficiently than their counterpart firms. In addition, I report positive and significant relationships between the control variables (*Quick, SD_CFO*, *Loss*, *SD_net_hire*, and *Abn_other_invest*) and labor investment inefficiency, which suggest that firms with higher liquidity, higher cash flow volatility, losses, higher labor investment volatility, and larger abnormal non-labor investments tend to exhibit less efficiency in labor investment than their counterpart firms.

Prior research shows that CEO age affects corporate policies (Prendergast and Stole, 1996), but little attention is paid to the effect of CEO age on labor investment. Younger CEOs may be more risk averse and adopt more conservative investment policies to avoid adverse effects on their careers resulting from poor firm performance (e.g., Scharfstein and Stein, 1990; Holmstrom, 1999). Conversely, younger CEOs may be aggressive in corporate investment to signal their superior ability (e.g., Prendergast and Stole, 1996). By reporting a negative and significant

coefficient for *CEOAge*, I extend the inconclusive studies on the effect of CEO age and show that older CEOs tend to avoid taking the risk of investing labor inefficiently. I find a significant and positive coefficient for *BDSize*, implying that a large board tends to engage in inefficient labor investment activities. This supports the notion that a large board can adversely affect board performance because of problems arising from poor communication (Jensen, 1993; Yermack 1996).

Table 4. The Relation between Outside Directors' Equity Compensation and Labor Investment Efficiency

This table presents the regression results on the impact of outside director's equity compensation on abnormal net hiring (an inverse measure of labor investment efficiency). In Model 1, I regress *Abnormal net hiring* on my variable of primary interest, *MDIRCOMP*, and on firm- CEO-, and board-level controls, which provides my main analysis from Equation (2). In Model 2, I exclude CEO- and board-level controls, a specification used by Jung et al. (2014). All variables are defined in Appendix A. The t-statistics in parentheses are based on robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1)	(2)
MDIRCOMP i, t-1	-0.019***	-0.018***
	(-2.88)	(-2.79)
MTB i, t-1	-0.000	-0.000
	(-0.42)	(-0.33)
FirmSize i, t-1	-0.004**	-0.001
	(-2.28)	(-0.97)
Quick i, t-1	0.008***	0.008***
	(7.84)	(7.61)
Leverage i, t-1	0.013	0.017**
	(1.60)	(2.00)
Dividend i, t-1	-0.007**	-0.007**
	(-2.13)	(-2.18)
SD_CFO i, t-1	0.220***	0.223***
	(6.22)	(6.33)
SD_Sales i, t-1	0.000	0.000
	(0.15)	(0.05)
Tangible i, t-1	-0.007	-0.007
	(-0.67)	(-0.71)
Loss i, t-1	0.016***	0.019***
	(3.67)	(4.22)
Institutional i, t-1	-0.011**	-0.012***
	(-2.42)	(-2.62)
UNION i, t-1	-0.019	-0.017
	(-0.60)	(-0.56)
SD_net_hire i, t-1	0.076***	0.078***
	(7.70)	(7.95)
Labor_intensity i, t-1	-0.541***	-0.532***
	(-2.64)	(-2.60)

Abn_other_invest i, t-1	0.393***	0.394***
	(28.20)	(28.21)
AQ i, t-1	0.001	0.000
	(0.79)	(0.43)
CEOGender i, t-1	0.008	
	(1.05)	
CEOAge i, t-1	-0.039***	
	(-3.17)	
CEO_dual i, t-1	0.000	
	(0.14)	
MCEOCOMP i, t-1	0.004	
	(0.63)	
BDSize i, t-1	0.004***	
	(4.61)	
BDIndependence i, t-1	-0.020	
	(-1.30)	
BDGender i, t-1	0.022	
	(1.33)	
BDAge i, t-1	-0.027	
	(-1.17)	
Constant	0.275***	0.023
	(2.62)	(0.77)
Observations	9,495	9,495
R-squared	0.137	0.133
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
State fixed effects	no	no
Industry-year fixed effects	no	no
State-year fixed effects	no	no

In Model 2 of Table 4, I provide the results from considering the variables used by Jung et al. (2014). My result on *MDIRCOMP* remains qualitatively unchanged in this model. I also include CEO-level and board-level variables in Model 1 to mitigate the potential omitted variable bias. The results show that CEOs' personal characteristics and board characteristics appear to influence labor investment efficiency.

4.4 Specific Forms of Labor Investment Inefficiency

Product demand is likely to be larger (smaller) during periods of economic growth (downturns), which can result in overinvestment (underinvestment) in labor to match demand (Khedmati et al., 2020). I extend the baseline analysis by separately investigating whether outside directors' equity compensation affects

overinvestment in labor and underinvestment in labor[15]. The subsamples of overinvesting (underinvesting) firms are those in which the actual net hiring is greater (less) than the expected one. In line with related research (Jung et al., 2014), I split the overinvestment sample into two parts, where over-hiring (under-firing) firms consist of those in the overinvestment subsample with a positive (negative) expected net hiring. Likewise, I decompose my underinvestment sample such that under-hiring (over-firing) firms are those in the underinvestment subsample with a positive (negative) expected net hiring[16].

4.4.1 Overinvestment, Over-hiring, and Under-firing

Panel A of Table 5 presents the findings on the relationship between overinvestment in labor and outside directors' equity compensation. Model 1 presents the results of the overall overinvestment subsample firms. I find a negative and significant coefficient for *MDIRCOMP* (-0.027), which suggests that outside directors' equity compensation can help mitigate problems causing overinvestment in labor, such as empire building. This result is consistent with my prediction that the null hypothesis of H1b would be rejected. Model 2 provides evidence that over-hiring is mitigated by outside directors' equity compensation. However, the negative but insignificant coefficient of *MDIRCOMP* in Model 3 implies that outside directors' equity compensation may be less effective in mitigating under-firing than in addressing overinvestment.

[15] I use the absolute value for the dependent variables for all of the subsamples in this section. Thus, a negative estimate of *MDIRCOMP* means that outside directors' equity compensation alleviates the relevant inefficiency in labor investment.

[16] The descriptive statistics for the specific forms of labor investment inefficiency are provided in Appendix B.

4.4.2 Underinvestment, Under-hiring, and Over-firing

I present the findings on the underinvestment in labor subsample in Panel B of Table 5. In Model 4, the negative (-0.016) and significant (at the 1% level) coefficient of *MDIRCOMP* implies that equity compensation for outside directors can reduce the absolute difference between expected and actual net hiring for the underinvesting firms. Hence, I reject my null hypothesis of H1c. The estimate (in absolute value) of *MDIRCOMP* for the overinvesting firms is higher than that of underinvesting firms, which implies that outside directors' equity compensation may play a more significant role in reducing overinvestment problems than underinvestment problems. The results in Models 5 and 6 suggest that outside directors' equity compensation can mitigate both types of underinvestment (i.e., over-firing and under-hiring). Interestingly, I observe that the estimate of *MDIRCOMP* in the over-firing firms (-0.039, 1% significance) is approximately three times (in absolute value) the size of the estimate in the subsample of under-hiring firms (-0.011, 10% significance), suggesting that outside directors' equity compensation has a more pronounced impact on over-firing than on under-hiring.

Table 5. The Relation between Outside Directors' Equity Compensation and Specific Forms of Labor Investment Inefficiency

This table provides the regression results on the effect of outside directors' equity compensation on specific forms of labor investment inefficiency. Panel A reports the results on the sample of overinvestment in labor, and Panel B reports the results on the sample of underinvestment of labor. In Model 1, I estimate Equation (2) for the overinvesting firms, in which overinvestment occurs when the actual net hiring is greater than the expected net hiring. I decompose the overinvesting firms into two subsamples, the over-hiring subsample in Model 2 and the under-firing subsample in Model 3, where a firm is classified as over-hiring (under-firing) if it overinvests with a positive (negative) expected net hiring. In Model 4, I estimate Equation (2) for the underinvesting firms, in which underinvestment occurs when the actual net hiring is less than the expected net hiring. I decompose the underinvesting firms into subsamples of under-hiring in Model 5 and over-firing in Model 6, where a firm is classified as under-hiring (over-firing) if it underinvests in labor with positive (negative) expected net hiring. All variables are defined in Appendix A. The t-statistics in parentheses are based on robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: Overinvestment			Panel B: Underinvestment		
VARIABLES	Total	OverHire	UnderFire	Total	UnderHire	OverFire
	(1)	(2)	(3)	(4)	(5)	(6)
MDIRCOMP i, t-1	-0.027**	-0.043**	-0.024	-0.016***	-0.011*	-0.039***
	(-2.04)	(-2.49)	(-0.71)	(-2.68)	(-1.66)	(-2.71)
MTB i, t-1	-0.000	0.000	-0.002***	0.000	0.000	0.000
	(-0.85)	(0.68)	(-3.30)	(0.14)	(0.48)	(0.68)
FirmSize i, t-1	-0.007**	-0.013***	0.001	-0.003**	-0.003	-0.002
	(-2.05)	(-2.90)	(0.13)	(-2.35)	(-1.63)	(-0.72)
Quick i, t-1	0.009***	0.010***	0.003	0.007***	0.007***	0.011***
	(4.33)	(3.72)	(0.81)	(7.51)	(7.04)	(3.50)
Leverage i, t-1	0.017	0.022	-0.005	0.016**	0.004	0.041**
	(1.08)	(0.99)	(-0.26)	(2.03)	(0.48)	(2.45)
Dividend i, t-1	-0.016**	-0.015*	-0.017*	0.005*	0.004	0.009
	(-2.27)	(-1.74)	(-1.82)	(1.76)	(1.23)	(1.32)
SD_CFO i, t-1	-0.010	-0.091	0.248***	0.385***	0.439***	-0.012
	(-0.13)	(-0.98)	(2.63)	(12.57)	(13.47)	(-0.14)
SD_Sales i, t-1	0.009	0.007	0.023**	-0.007***	-0.009***	0.007
	(1.46)	(0.99)	(1.99)	(-2.97)	(-3.46)	(1.14)
Tangible i, t-1	-0.016	-0.040	0.026	-0.009	-0.007	-0.021
	(-0.81)	(-1.51)	(1.06)	(-0.99)	(-0.66)	(-1.13)
Loss i, t-1	0.018*	0.049***	-0.004	0.018***	0.022***	0.003
	(1.92)	(3.45)	(-0.37)	(4.85)	(4.56)	(0.51)
Institutional i, t-1	-0.016*	-0.012	-0.013	-0.005	0.002	-0.030***
	(-1.78)	(-1.04)	(-1.08)	(-1.23)	(0.57)	(-3.40)
UNION i, t-1	-0.061	-0.091	-0.041	0.015	0.043	-0.112*
	(-0.98)	(-1.12)	(-0.52)	(0.55)	(1.47)	(-1.76)
SD_net_hire i, t-1	0.071***	0.127***	-0.031	0.094***	0.119***	-0.014
	(3.59)	(4.73)	(-1.34)	(11.00)	(12.66)	(-0.71)
Labor_intensity i, t-1	-1.512***	-1.291**	-3.985***	0.041	0.089	0.337
	(-3.17)	(-2.27)	(-4.53)	(0.25)	(0.51)	(0.76)
Abn_other_invest i, t-1	0.485***	0.476***	0.235***	0.071***	0.060***	0.206***
	(22.62)	(19.66)	(2.72)	(3.86)	(3.16)	(3.07)
AQ i, t-1	0.002	0.000	0.002	-0.001**	-0.002**	0.001
	(1.29)	(0.12)	(0.57)	(-2.10)	(-2.04)	(0.61)
CEOGender i, t-1	0.021	0.039*	-0.008	-0.002	0.002	-0.014
	(1.28)	(1.66)	(-0.43)	(-0.38)	(0.25)	(-0.95)
CEOAge i, t-1	-0.052**	-0.045	-0.073**	-0.018	-0.015	-0.007
	(-2.08)	(-1.40)	(-2.16)	(-1.64)	(-1.31)	(-0.27)
CEO_dual i, t-1	0.001	0.002	0.000	-0.002	0.001	-0.017***
	(0.18)	(0.26)	(0.05)	(-0.56)	(0.42)	(-2.71)

MCEOCOMP i, t-1	-0.003	-0.008	0.012	0.006	0.003	0.014
	(-0.22)	(-0.42)	(0.68)	(1.03)	(0.49)	(0.94)
BDSize i, t-1	0.006***	0.010***	0.001	0.002**	0.001*	0.001
	(3.95)	(4.45)	(0.41)	(2.47)	(1.86)	(0.91)
BDIndependence i, t-1	-0.040	-0.046	-0.028	-0.006	-0.010	-0.005
	(-1.29)	(-1.16)	(-0.71)	(-0.43)	(-0.72)	(-0.15)
BDGender i, t-1	0.037	0.056	-0.009	-0.001	-0.002	-0.020
	(1.10)	(1.30)	(-0.20)	(-0.09)	(-0.15)	(-0.61)
BDAge i, t-1	-0.004	0.003	0.001	-0.031	-0.024	-0.074
	(-0.10)	(0.05)	(0.02)	(-1.46)	(-1.06)	(-1.43)
Constant	0.245	0.211	0.316	0.247***	0.202**	0.415*
	(1.19)	(0.81)	(1.07)	(2.63)	(1.97)	(1.82)
Observations	4,026	2,844	1,182	5,469	4,356	1,113
R-squared	0.174	0.200	0.145	0.135	0.164	0.179
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	no	no	no	no	no	no
Industry-year fixed effects	no	no	no	no	no	no
State-year fixed effects	no	no	no	no	no	no

4.4.3 Effects of Controls on Specific Forms of Labor Investment Inefficiency

Although I report qualitatively similar results for some controls (e.g., *Quick* and *Abn_other_invest*) between my main test of the overall labor investment inefficiency (Model 1 in Table 4) and the tests for its specific forms (the models in Table 5), the significance and/or magnitudes of the estimates for some variables for specific forms of overinvestment and/or underinvestment are different. This suggests that the effect of the variables on different forms of inefficiency in labor investment will vary.

Effects of Firm-level Controls. Institutional ownership can mitigate abnormal net hiring (Ghaly et al., 2020). Consistently, I find that institutional ownership (*Institutional*) helps mitigate overall abnormal net hiring (Model 1 of Table 4), overinvestment in labor (Model 1 of Table 5), and the subsample of over-firing in underinvesting firms (Model 6 of Table 5).

Accounting quality may lead to an increase in labor investment efficiency (Jung et al., 2014). My findings are qualitatively comparable with Khedmati et al. (2020). I report that better accounting quality (*AQ*) improves labor investment efficiency for underinvestment firms (Model 4 of Table 5) and in particular for the under-hiring subsample (Model 5 of Table 5).

Labor intensity can affect labor investment efficiency. Firms can more flexibly adjust labor when their stock of labor is larger (Jung et al., 2014). Consistent with this, I find that the coefficient of *Labor_intensity* is negative and significant for the entire sample (Model 1 of Table 4), and that the impact of labor intensity is significant only for the overinvesting firms (Models 1 to 3 of Table 5) but that is insignificant for the underinvesting firms (Model 4 to 6 of Table 5).

Dividend payouts can reduce managerial discretion to spend excess free cash flow (Sharma, 2011), and hence reduce the likelihood of a firm overinvesting in non-valuable projects and labor. Consistent with Jung et al. (2014), I report negative and significant coefficients (*Dividend*) for the whole sample (Model 1 of Table 4) and all overinvestment subsamples (Panel A in Table 5). These findings support the view that firms may pay out excess cash flows (e.g., dividends) to reduce potential agency problems (Easterbrook, 1984; Jensen, 1986). Similar to Khedmati et al. (2020), I report marginally significant or insignificant results for *Dividend* in the underinvestment subsamples.

Effects of CEO- and Board-level Controls. The presence of CEO duality can reduce the effectiveness of board performance (Jensen, 1993), but it may also enhance unity of command and help the firm retain essential resource relationships with

stakeholders (Finkelstein and D'Aveni, 1994). Model 6 of Table 5 shows that when the CEO is the board chairperson, there is less inefficiency in terms of over-firing for the firm than in the absence of CEO duality. This result supports the view that CEO duality may improve the unity of command and thus avoid the component of underinvestment problems stemming from information asymmetries.

The estimates of *CEOAge* are all negative in Table 5, but they are significant only for the overinvestment firms (Model 1) and, in particular, for the under-firing subsample (Model 3). These findings may suggest that older CEOs tend to invest in less risky projects than younger CEOs (e.g., Serfling, 2014) and hence that they avoid overinvestment in labor for such risky projects.

Gender may influence the risk-taking decisions of CEOs for their firms (Faccio et al., 2016). For instance, male executives tend to be more overconfident and engage in more projects involving negative net present values compared with female executives (Huang and Kisgen, 2013). My result for the over-hiring subsample (Model 2 of Table 5), which is consistent with other studies, indicates that the coefficient of *CEOGender* is positive and significant.

4.5 Addressing Concerns of Endogeneity

Endogeneity may arise due to factors such as simultaneity, omitted variables, and reverse causality. Although my research is unlikely to suffer from simultaneity (the efficiency of labor investment and outside directors' equity compensation are not jointly determined), it is possible that there is an omitted variable bias or reverse causality. To address the concern of omitted variable bias, I include control

variables at board- and CEO-level in addition to the firm-level control variables used in related studies (Jung et al., 2014). To address the reverse causality issue, all my main specifications in the previous models are lead–lag. Nevertheless, to improve the robustness of my results, I undertake additional measures to mitigate potential endogeneity problems such as omitted variables and reverse causality.

Fixed Effects. Following the literature (e.g., Jung et al., 2014), I include year and industry fixed effects for my main analysis. However, there are other potential sources of heterogeneity. First, it is possible that there are persistent differences of characteristics (e.g., labor laws) across states that may affect the relationship between labor investment efficiency and outside directors' equity compensation. To account for these time-invariant characteristics, I additionally control for state fixed effects in Model 1 of Table 6. The result of *MDIRCOMP* remains qualitatively unchanged, which implies that my baseline findings are not affected by the time-invariant characteristics across states. Second, local economic conditions and geographic location can influence labor investment decisions (Landier et al., 2009). To address concerns of time-varying differences in terms of industries and economic environments, I include industry-year and state-year fixed effects (Ghaly et al., 2020) in Model 2 of Table 6. The estimate of *MDIRCOMP* remains negative and significant.

Change Specification. As an additional robustness test, I employ a change specification by regressing the annual change in abnormal net hiring (*∆Abnormal net hiring*) on the annual change in outside directors' equity compensation (*∆MDIRCOMP*) and the annual change in all control variables. Using the change specification may alleviate the concerns of omitted variables (Naiker et al., 2013;

Sualihu et al., 2021). If the potential unobservable omitted variable is assumed to be constant over time, then the corresponding annual change for the omitted variable would be zero in the change variable (Naiker et al., 2013; Sualihu et al., 2021). However, this approach decreases the sample size to 6,151 firm-year observations. I report the results in Model 3 of Table 6. The impact of outside directors' equity compensation on labor investment efficiency is qualitatively similar to my main findings, suggesting that it is not likely to be confounded by the omitted variable bias.

Table 6. Addressing Concerns of Endogeneity

This table reports the results for endogeneity analyses. Model 1 repeats the main analysis using all the variables and the year and industry fixed effects of Equation (2). In addition, it includes state fixed effects to account for time-invariant characteristics across states. Model 2 includes all the variables in Equation (2) but instead of controlling for year, industry, and state fixed effects, it incorporates industry-year and state-year fixed effects to address concerns of time-varying differences across industries and in economic environments. Model 3 reports the result of the change specification by regressing the annual change in abnormal net hiring (*Abnormal net hiring*) on the annual change in outside directors' equity compensation (*MDIRCOMP*) and the annual change in all control variables in Equation (2). Models 4 and 5 present the results of the two-stage least squares (2SLS) regression on the impact of outside directors' equity compensation on labor investment efficiency. Model 4 is the first stage of the 2SLS; I regress *MDIRCOMP* on the instrumental variable (*IndustryDEQR*) and other control variables in Equation (2). The predicted level of *MDIRCOMP* in the first stage is used to show the impact of outside directors' equity compensation on labor investment efficiency in the second stage. All variables are defined in Appendix A. The t-statistics in parentheses are based on robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

				1st stage 2SLS	2nd stage 2SLS
VARIABLES	(1)	(2)	(3)	(4)	(5)
MDIRCOMP i, t-1	-0.020**	-0.020**	-0.042**		-0.051***
	(-2.38)	(-2.26)	(-2.02)		(-3.37)
IndustryDEQR i, t-1				0.921***	
				(49.38)	
MTB i, t-1	-0.000	-0.000	-0.000	0.000*	-0.000
	(-0.35)	(-0.31)	(-0.61)	(1.94)	(-0.18)
FirmSize i, t-1	-0.004***	-0.004**	-0.004	0.026***	-0.003*
	(-2.59)	(-2.48)	(-0.58)	(12.26)	(-1.67)
Quick i, t-1	0.008***	0.008***	0.016***	0.005***	0.008***
	(5.53)	(5.50)	(3.06)	(3.73)	(6.03)
Leverage i, t-1	0.016*	0.013	0.085***	0.014	0.013
	(1.72)	(1.32)	(2.72)	(1.50)	(1.34)
Dividend i, t-1	-0.006	-0.007*	0.003	-0.039***	-0.008**
	(-1.54)	(-1.82)	(0.76)	(-9.03)	(-2.22)
SD_CFO i, t-1	0.214**	0.206**	-0.051	0.073	0.215**
	(1.99)	(2.24)	(-0.56)	(1.62)	(2.03)
SD_Sales i, t-1	0.001	0.001	-0.007	-0.009	-0.000
	(0.24)	(0.13)	(-0.87)	(-1.62)	(-0.05)
Tangible i, t-1	-0.006	-0.005	-0.045	-0.037***	-0.007
	(-0.53)	(-0.47)	(-0.65)	(-3.01)	(-0.73)

Loss i, t-1	0.016***	0.019***	-0.005	0.002	0.017***
	(3.03)	(3.17)	(-0.94)	(0.33)	(3.10)
Institutional i, t-1	-0.011**	-0.012**	-0.027	0.013**	-0.009
	(-1.96)	(-2.26)	(-1.08)	(2.34)	(-1.58)
UNION i, t-1	0.065	-4.842***	0.189	-0.025	-0.019
	(0.43)	(-3.08)	(0.74)	(-0.65)	(-0.61)
SD_net_hire i, t-1	0.071***	0.081***	-0.613***	0.002	0.076***
	(5.43)	(6.08)	(-24.59)	(0.15)	(5.98)
Labor_intensity i, t-1	-0.508**	-0.474**	-11.676***	-1.197***	-0.577***
	(-2.57)	(-2.54)	(-6.17)	(-4.91)	(-2.76)
Abn_other_invest i, t-1	0.396***	0.386***	0.306***	-0.017	0.392***
	(9.25)	(9.82)	(19.14)	(-0.90)	(9.19)
AQ i, t-1	0.001	0.001	0.003	0.006***	0.001
	(0.80)	(1.19)	(1.25)	(5.64)	(0.87)
CEOGender i, t-1	0.010*	0.010*	0.006	0.017*	0.009*
	(1.82)	(1.66)	(0.27)	(1.75)	(1.70)
CEOAge i, t-1	-0.043***	-0.046***	-0.019	-0.030*	-0.039***
	(-3.03)	(-3.09)	(-0.52)	(-1.84)	(-2.90)
CEO_dual i, t-1	0.001	0.002	-0.002	0.001	0.000
	(0.37)	(0.68)	(-0.29)	(0.19)	(0.15)
MCEOCOMP i, t-1	0.005	0.005	0.011	0.170***	0.010
	(0.60)	(0.59)	(1.03)	(17.01)	(1.33)
BDSize i, t-1	0.004***	0.004***	0.003*	-0.002	0.004***
	(3.41)	(3.47)	(1.78)	(-1.59)	(3.34)
BDIndependence	-0.021	-0.019	0.016	0.129***	-0.016
	(-1.31)	(-1.15)	(0.40)	(6.32)	(-1.09)
BDGender i, t-1	0.017	0.011	-0.027	0.054***	0.022
	(1.03)	(0.63)	(-0.62)	(2.63)	(1.39)
BDAge i, t-1	-0.030	-0.028	0.025	-0.197***	-0.029
	(-1.19)	(-1.07)	(0.45)	(-4.89)	(-1.19)
Constant	0.279***	1.339***	-0.010	0.871***	0.279***
	(2.60)	(3.46)	(-0.26)	(5.07)	(2.77)
Observations	9,495	9,495	6,151	9,495	9,495
R-squared	0.142	0.228	0.173	0.502	0.138
Year fixed effects	Yes	No	Yes	Yes	Yes
Industry fixed effects	Yes	No	Yes	Yes	Yes
State fixed effects	Yes	No	No	No	No
Industry-year fixed effects	No	Yes	No	No	No
State-year fixed effects	No	Yes	No	No	No

Two-Stage Least Squares (2SLS). To further rule out endogeneity issues (e.g., reverse causality), I use the 2SLS estimation procedure to reexamine my main findings. The 2SLS approach allows me to disentangle the impact of outside directors' equity compensation on labor investment efficiency. Larcker and Rusticus (2010) discuss the requirements for an appropriate instrumental variable, including that it is uncorrelated with the residual of the regression in the second stage, but it is related to the endogenous regressor. Firms behave like their peers (Scharfstein and Stein, 1990). For example, firms are likely to follow industry

benchmarks when they decide on CEO pay (Sualihu et al., 2021). As a result, I expect that the outside directors' equity compensation at the firm level will be strongly correlated with that at the industry level. Following Lahlou and Navatte (2017), my first-stage instrumental variable (*IndustryDEQR)* is the industry median equity-based compensation (%) of outside directors lagged by 1 year, which is unlikely to influence labor investment efficiency at the firm level directly other than through its correlation with the firm-level outside directors' equity compensation.

In stage one, I regress *MDIRCOMP* on the instrumental variable and all my controls in Equation (2). I expect the instrumental variable to be positively related to *MDIRCOMP*. Model 4 of Table 6 shows the findings of the first-stage regression. As expected, the estimate of my instrumental variable (*IndustryDEQR)* is positive and significant. The results suggest that the industry median of outside directors' equity compensation is a significant determinant of outside directors' equity compensation at the firm level. The partial F-statistic for *IndustryDEQR* is 2,781.25, suggesting that it is not a weak instrument. My test variable in the second stage is the predicted *MDIRCOMP* from the first stage. Model 5 of Table 6 presents the findings of the second stage. The relationship between the predicted outside directors' equity compensation and abnormal net hiring is negative and significant, implying that my main findings remain unchanged and robust after I control for endogeneity.

4.6 Robustness Tests

4.6.1 Alternative Proxies for Labor Investment Efficiency

A key issue in the design of my empirical research is the measurement of expected labor investment for a firm and hence the efficiency of labor investment. I replicate my analysis by considering four alternative measures of my dependent variable for robustness checking. Panel A of Table 7 presents the findings.

Prior research (e.g., Buddle et al., 2009) shows that sales growth is a strong measure of growth opportunities. Firms that exhibit stronger growth in sales are more likely to employ labor (Sualihu et al., 2021). In line with Buddle et al. (2009), I use lagged sales growth as the sole independent variable in Equation (1) (i.e., Model 2 of Panel B in Table 1) to estimate expected net hiring, and the absolute value of the residuals as an alternative inverse measure for labor investment efficiency. As shown in Model 1 of Table 7, using this measure, I find a similar result for *MDIRCOMP* to that of my main analysis, suggesting that outside directors' equity compensation can mitigate labor investment inefficiency.

When managers make investment decisions, their behavior often closely follows that of their peers in the same industry (Sualihu et al., 2021). Following Jung et al. (2014), I use the median labor investment in the firm's industry[17] as an alternative measure of expected net hiring. Thus, a larger absolute difference between the net hiring of a firm and the net hiring of the industry peers implies greater inefficiency

[17] I use the Fama–French 48-industry classification.

in labor investment. Model 2 of Table 7 presents the findings using this alternative measure and shows that the estimate of *MDIRCOMP* remains negative and significant.

Furthermore, I strip Equation (1) by excluding the ratio of annual sales to assets (*AUR*), capital expenditure to assets (*CAPX*), acquisition expenditure to assets (*ACQ*), R&D expenditure to assets (*XRD*), and the natural logarithm of GDP per capita (*lnGDPpc)*[18]. This specification is used in Jung et al. (2014) for the estimation of expected net hiring, and Model 3 of Panel B in Table 1 reports the results of this version. Model 3 of Table 7 reports the corresponding findings of Equation (2). It shows that the result is robust, and the estimate of *MDIRCOMP* remains negative and significant.

For my initial sample, I follow studies such as Jung et al. (2014) and Khedmati et al. (2020) in commencing the analysis from 1983 using all available information to estimate the expected net hiring. In addition, I estimate the expected net hiring for an alternative time period starting in 2001 to avoid the possibility of "stale information" influencing the results[19]. Model 4 of Panel B in Table 1 provides the result of Equation (1) for this alternative time period. Model 4 of Table 7 indicates

[18] I initially include *AUR* because it indicates how efficiently managers use the firm's assets (Khedmati et al., 2020), and *CAPX*, *ACQ*, and *XRD* because a firm is more likely to increase labor investment when these expenditures are higher (Ben-Nasr and Alshwer, 2016). Finally, I initially include *lnGDPpc* because firms may change their production level to meet different product demands under different economic conditions (Sualihu et al., 2021).

[19] Recall that some variables require information from years t - 5 to t, and that the comprehensive data for director compensation begin in 2006. Thus, I do not set a start year later than 2001 to avoid an unnecessary reduction of the compensation data.

that I find a similar result for the alternative time period as that for the initial time period, with a negative and significant coefficient for *MDIRCOMP*.

Collectively, these tests imply that my finding that outside directors' equity compensation improves the efficiency of labor investment is robust to different labor investment measurements.

4.6.2 Alternative Proxies for Outside Directors' Equity Compensation

To further check the robustness of my results, I use five alternative measures for outside directors' equity compensation. Panel B of Table 7 reports the results. First, option compensation and stock compensation can provide different motivations for outside directors in their corporate risk and investment decisions because the directors may perceive stock as current wealth, but options as potential future gains (e.g., Deutsch et al., 2007). Stock options are rights but not obligations to purchase the stock at the exercise price, which have little downside risk (e.g., the option simply expires without value if the share price is less than the exercise price) compared with stock. For instance, Sualihu et al. (2021) document that stock options for CEOs exacerbate inefficient labor investments, whereas stock compensation granted to CEOs can mitigate such inefficiency. Similar to some studies (e.g., Sualihu et al., 2021), I separate the effects of stock and stock options for outside directors into *MDIRCOMPS* (an averaged ratio of stock to total pay) and *MDIRCOMPO* (an averaged ratio of stock options to total pay), respectively, in Model 5 of Table 7. Although both *MDIRCOMPS* and *MDIRCOMPO* are negative, the results show that stock compensation (*MDIRCOMPS*) has a greater magnitude and greater statistical significance than option compensation (*MDIRCOMPO*).

Second, following Kim et al. (2019), I consider the median proportion of outside directors' equity compensation to total pay (*DEQR*). This modification can avoid the effect of a potential extreme value (i.e., an outlier) for equity compensation (stock and option) earned by a particular outside director. The estimate of *DEQR* in Model 6 of Table 7 remains negative and significant, which indicates that the impact of outside directors' equity compensation on labor investment efficiency remains qualitatively unchanged from the main results.

For the third measure, I consider the maximum proportion of outside directors' equity compensation to total pay (*MaxDIRCOMP*). I find that the estimate of *MaxDIRCOMP* is negative and statistically significant (in Model 7), and that the magnitude is slightly larger than that of the median ratio (*DEQR*).

For the fourth and the fifth measures, I examine whether the size rather than the mixture of equity compensation is what matters. If a larger amount of equity compensation is used to pay the outside directors who help mitigate the inefficiency of labor investment, my results in the previous models may include effects relating to the amount of equity compensation. To examine the effect of the amount of equity compensation (rather than its proportion in total compensation), I use the median (natural logarithm) value of outside directors' equity compensation (*MedStock_Opt*) in Model 8 of Table 7, and the mean (natural logarithm) value of outside directors' equity compensation (*MeanStock_Opt*) in Model 9 of Table 7. By considering the size instead of the mix of compensation, I continue to find qualitatively similar results to my main results.

Table 7. Alternative Proxies for Labor Investment Efficiency and Outside Directors' Equity Compensation

This table provides the findings of the robustness tests. I replicate my main analysis using alternative proxies for expected net hiring and hence for the inverse measure of labor investment efficiency in Panel A (Models 1 to 4), and using alternative measures for outside directors' equity compensation in Panel B (Models 5 to 9). In Panel C (Models 10 to 13), I consider alternative proxies for expected net hiring and outside directors' equity compensation with different fixed effects. In Model 1, I estimate the expected net hiring by using lagged sales growth as the sole independent variable in Equation (1). In Model 2, the measure of expected net hiring is the median net hiring in the firm's industry. In Model 3, I strip Equation (1) and measure expected net hiring using all the controls in Jung et al. (2014) only. In Model 4, I start Equation (1) from 2001 rather than 1983. In each model shown in Panel A, the absolute difference between net hiring and expected net hiring is an alternative proxy for the inverse measure of labor investment efficiency. In Model 5, I decompose the proportion of outside directors' equity-based compensation into two parts, which are the average proportion of stock compensation and the average proportion of stock option compensation for outside directors. In Model 6, I use the median (instead of the average) ratio of outside directors' equity compensation to total compensation. In Model 7, I use the maximum ratio of outside directors' equity compensation to total compensation. In Models 8 and 9, I measure outside directors' equity compensation using the natural logarithm value of the median and mean amounts, respectively, of outside directors' equity compensation. In Models 10 to 13, I use the alternative measure of expected net hiring in Model 2 and the alternative measure of outside directors' equity compensation in Model 9 to further examine different fixed effects. Model 10 considers year and industry fixed effects, Model 11 adds the state fixed effect on top of the year and industry fixed effects, Model 12 examines year and firm fixed effects, and Model 13 considers industry-year and state-year fixed effects. I include all control variables in Equation (2) for all models in this table. For brevity, the coefficients of the control variables are not reported. All variables are defined in Appendix A. The t-statistics in parentheses are based on robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	Panel A: Alternative Proxies for Labor Investment Efficiency				Panel B: Alternative Proxies for Outside Directors' Equity Compensation				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	Expected net hiring depends only on lagged sales growth	Expected net hiring = Industry median net hiring	Strip Equation (1) with controls used in Jung et al. (2014)	Equation (1) starts in 2001					
MDIRCOMP i, t-1	-0.019***	-0.018***	-0.020***	-0.019***					
	(-3.22)	(-2.83)	(-2.87)	(-2.86)					
MDIRCOMPS i, t-1					-0.022***				
					(-2.92)				
MDIRCOMPO i, t-1					-0.017*				
					(-1.94)				
DEQR i, t-1						-0.018**			
						(-2.24)			
MaxDIRCOMP i, t-1							-0.019***		
							(-2.72)		

MedStock_Opt $_{i, t-1}$								-0.004***	
								(-3.17)	
MeanStock_Opt $_{i, t-1}$									-0.004***
									(-3.20)
Constant	0.359***	0.416***	0.313***	0.280***	0.249**	0.250***	0.276***	0.237**	0.237**
	(4.71)	(5.17)	(3.68)	(2.67)	(2.41)	(2.58)	(2.75)	(2.43)	(2.44)
Observations	9,495	9,495	9,495	9,495	9,495	9,495	9,495	9,495	9,495
R-squared	0.208	0.197	0.175	0.137	0.137	0.136	0.137	0.137	0.137
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-level controls in Equation (2)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CEO-level controls in Equation (2)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Board-level controls in Equation (2)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 7 (continued)

Panel C: Alternative Proxies with Different Fixed Effects				
VARIABLES	(10)	(11)	(12)	(13)
MeanStock_Opt $_{i, t-1}$	-0.004***	-0.004***	-0.002**	-0.004***
	(-3.87)	(-3.80)	(-2.17)	(-3.52)
Constant	0.429***	0.422***	0.287*	0.807***
	(5.20)	(4.53)	(1.72)	(3.46)
Observations	9,495	9,495	9,495	9,495
R-squared	0.198	0.204	0.394	0.288
Year fixed effects	Yes	Yes	Yes	No
Industry fixed effects	Yes	Yes	No	No
State fixed effects	No	Yes	No	No
Firm fixed effects	No	No	Yes	No
Industry-year fixed effects	No	No	No	Yes
State-year fixed effects	No	No	No	Yes
Firm-level controls in Equation (2)	Yes	Yes	Yes	Yes
CEO-level controls in Equation (2)	Yes	Yes	Yes	Yes
Board-level controls in Equation (2)	Yes	Yes	Yes	Yes

4.6.3 Alternative Proxies with Different Fixed Effects

In Panel C of Table 7, I further examine the relationship between outside directors' equity compensation and labor investment efficiency by using alternative proxies with different fixed effects. I use the median labor investment in the firm's industry and the firm's mean (natural logarithm) of outside directors' equity compensation as alternative proxies of expected net hiring and outside directors' equity compensation, respectively. In Model 10, I control the same fixed effects (i.e., year and industry fixed effects) as in my main analysis. The significant and negative relationship implies that the finding is robust when I use alternative proxies for both variables. In addition to year and industry fixed effects, I include state fixed effects in Model 11 to account for the potential persistent differences of characteristics across states, and the results are qualitatively similar to my main findings. In Model 12, I run the regression model with firm and year fixed effects (but excluding industry fixed effects) to control for the possibility that a firm may have its own distinct features (i.e., time-invariant firm characteristics) that may affect equity compensation for outside directors. I find that the relationship between outside directors' equity compensation and abnormal net hiring remains negative and significant, suggesting that my results are not affected by time-invariant firm characteristics. In Model 13, I consider industry-year and state-year fixed effects to address the concern of time-varying differences relating to industries and economic environments. I report that the relationship remains qualitatively unchanged from my main results.

4.6.4 Sensitivity of Employment to Investment Opportunity and Cash Flow

McLean and Zhao (2014) show that both investment opportunity (Tobin's Q) and internal resources (cash flows) are positively related to corporate employment, but that the sensitivity of employment to investment opportunities and cash flows depend on the cost of external finance. McLean and Zhao (2014) find that firms with low (vs. high) cash flows tend to have a greater need for external finance, and if a factor (e.g., during economic expansion) lowers the cost of external finance, then the employment sensitivity to cash flow will decline. As equity compensation can provide incentives for outside directors to fulfill their roles in advising and monitoring (e.g., Jensen, 1993), and have positive impacts on firms, such as lowering their cost of capital (e.g., Sengupta and Zhang, 2015), the study of McLean and Zhao (2014) motivates me to examine how outside directors' equity compensation may affect the sensitivity of employment to investment opportunities and cash flows. I use the following model presented in Equation (3) with year and firm fixed effects:

$$\Delta EMP_{i,t} = \beta_0 + \beta_1 Q_{i,t-1} + \beta_2 CF_{i,t} + \beta_3 MDIRCOMP_{i,t} + \beta_4 MDIRCOMP_{i,t} * Q_{i,t-1} + \beta_5 MDIRCOMP_{i,t} * CF_{i,t} + \beta_6 Controls_{i,t} + \varepsilon_{i,t} \quad (3)$$

where ΔEMP captures employee growth and is measured as the change in the log number of employees; *Q* represents Tobin's Q and is measured as (the natural log of) the sum of the book value of total assets and the market value of equity minus the book value of equity over the lagged total assets; *CF* represents cash flow and is measured as net income plus depreciation over lagged total assets; *MDIRCOMP*

is as previously defined in Equation (2), and *Controls* are the same as the control variables in Equation (2).

Table 8. Sensitivity of Employment to Investment Opportunity and Cash Flow

This table presents the results for the sensitivity of employment to investment opportunity and cash flow. The dependent variable is employment growth (*ΔEMP*). In Model 1, I examine the effect of investment opportunity (*Q*) and cash flow (*CF*) on employment growth. In Model 2, I examine how outside directors' equity compensation (*MDIRCOMP*) affects the sensitivity of employment to investment opportunity and cash flow by the interaction term between *MDIRCOMP* and *Q* (i.e., *MDIRCOMP*Q*) and the interaction term between *MDIRCOMP* and *CF* (i.e., *MDIRCOMP*CF*) respectively. I include all controls of Equation (2) for Model 2. For brevity, the coefficients of the controls are not reported. All variables are defined in Appendix A. The t-statistics in parentheses are based on robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1)	(2)
$Q_{i, t-1}$	0.013***	0.009
	(5.01)	(1.39)
$CF_{i, t}$	0.368***	0.682***
	(7.15)	(5.45)
$MDIRCOMP_{i, t}$		0.124***
		(3.77)
$MDIRCOMP_{i, t}*Q_{i, t-1}$		-0.010
		(-1.14)
$MDIRCOMP_{i, t}*CF_{i, t}$		-0.573***
		(-3.08)
Constant	-0.098***	-0.400
	(-2.77)	(-1.35)
Observations	8,113	7,080
R-squared	0.271	0.371
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Firm-level controls in Equation (2)	no	Yes
CEO-level controls in Equation (2)	no	Yes
Board-level controls in Equation (2)	no	Yes

Model 1 of Table 8 reports that the coefficients of both *Q* and *CF* are positive and significant, which is consistent with the results of McLean and Zhao (2014), and suggests that firms with more investment opportunities and higher cash flows are more likely to increase their employee numbers than their counterpart firms. In Model 2, the estimate of *MDIRCOMP*Q* is insignificant, and thus it does not

confirm that director compensation mitigates the inefficiency of labor investment. However, the estimate of *MDIRCOMP*CF* is negative and statistically significant at the 1% level, indicating that outside directors' equity compensation can reduce the sensitivity of employment to cash flows. This result implies that outside directors' equity compensation ameliorates the financial constraints for labor investments, which is likely to be due to increased transparency and thus a reduced cost of capital.

4.6.5 Additional Controls for Alternative Explanations

I provide additional tests to rule out alternative explanations that may influence my findings, including financial crisis (e.g., Khedmati et al., 2020), financial constraints (e.g., Ben-Nasr and Alshwer, 2016), analyst coverage (e.g., Lee and Mo, 2020), and managerial ability (e.g., Jung et al., 2014). These factors may confound outside directors' equity compensation or affect labor investment efficiency by interacting with the variable of interest. To address these concerns, I include these variables and their interactions with *MDIRCOMP* in the equations separately.

Financial Crisis. A financial crisis can affect firm performance (Lins et al., 2017), leading firms to reduce their investments in the face of limited resources (Almeida et al., 2012). Thus, a financial crisis, which leads to an economic downturn, may influence labor decisions (Khedmati et al., 2020). To examine the potential effect of a major financial crisis, I use a dummy (*Crisis*) that equals 1 for the fiscal years of 2008 and 2009, and 0 otherwise. Conversely, better governance can mitigate the adverse effect of financial crises on corporate financing and investing activities (Nguyen, Nguyen, and Yin, 2015), which implies that the potential monitoring

effect of outside directors' equity compensation might be more pronounced during the 2008–2009 financial crisis compared with non-crisis periods to alleviate the potential suboptimal labor investment. To test this possibility, I incorporate an additional interaction term, *MDIRCOMP*Crisis*, into Equation (2). Models 1 and 2 in Table 9 report the results. Consistent with Khedmati et al. (2020), I find that there is no significant relationship between the financial crisis and labor investment efficiency. The coefficients of *MDIRCOMP* remain negative and significant, suggesting that outside directors' equity compensation mitigates the inefficiency regardless of whether the economy is in financial crisis.

Financial Constraints. It is possible that firms facing more financial constraints than others have a reduced ability to make labor investment decisions efficiently (Benmelech et al., 2011). To test this, I use two proxies for financial constraints. First, following prior studies (Lamont et al. 2001; Farre-Mensa and Ljungqvist, 2016), I construct a Kaplan–Zingales (KZ) index[20]. Firms are relatively constrained when the KZ index is high and the firms in the top tercile are particularly financially constrained (Farre-Mensa and Ljungqvist, 2016). I use a dummy *(KZ_Top*) that equals 1 when the KZ index of a firm is in the top tercile (i.e., constrained), and 0 otherwise. I use an interaction term *MDIRCOMP*KZ_Top* to test whether the effect of my primary variable of interest (*MDIRCOMP*) is larger for the financially constrained firms than for other firms.

Second, following studies such as Almeida et al. (2004), I classify a firm as financially constrained when it does not have a credit rating. I use a dummy

[20] The equation for the KZ index is provided in Appendix A.

variable, *NoRated*, which equals 1 if the firm does not have credit rating, and 0 otherwise. One of the merits of using this measure is that the process of being granted a credit rating may mitigate asymmetric information between investors and the firms because the rated firms are relatively transparent (Whited, 1992). Similar to the first measure, I use the interaction term of *MDIRCOMP*NoRated* to test the potential moderating effect.

Models 3 to 6 of Table 9 present the results for the effect of outside directors' equity compensation on the efficiency of labor investment when additional controls for financial constraints are introduced. The estimates of *MDIRCOMP* in all models remain negative and significant, but the findings show insignificant coefficients for *KZ_Top, MDIRCOMP*KZ_Top, NoRated,* and *MDIRCOMP*NoRated*.

The insignificant effects found for these four measures on labor investment efficiency does not necessarily imply that there is no impact of financial constraints on abnormal net hiring. Indeed, there are many different measures (e.g., Almeida et al., 2004) to indicate whether a firm is constrained. For instance, a firm can be regarded as financially constrained if it is not a dividend payer (Farre-Mensa and Ljungqvist, 2016). Indeed, my discussion of the negative and significant coefficient for *Dividend* (e.g., Model 1 of Table 4) in Section 4.4.3 implies that a less financially constrained firm (as indicated by its paying dividends) is associated with more efficient labor investment, and vice versa. This evidence implies that outside directors' equity compensation remains effective in mitigating labor investment inefficiency, regardless of whether a firm is financially constrained.

Table 9. Further Robustness Tests with Additional Controls

This table presents the regression results on the impact of outside director's equity compensation on abnormal net hiring (an inverse measure of labor investment efficiency) with additional variables to rule out alternative explanations. Models 1 and 2 control for the financial crisis using a dummy variable (*Crisis*), which equals one for the fiscal years of 2008 and 2009, and 0 otherwise. Models 3 and 4 control for corporate financial constraints using a dummy variable (*KZ_Top*) that equals 1 if the Kaplan–Zingales index (KZ index) of a firm is in the top tercile (i.e., the firm is financially constrained), and 0 otherwise, where the KZ index loads positively on leverage and the market-to-book ratio, and negatively on cash, dividends, and cash flows. The KZ index is constructed as {-1.001909[(*ib* +*dp*)/lagged *ppent*] + 0.2826389[(*at* + *prcc_ f*×*csho* - *ceq* - *txdb*)/*at*] + 3.139193[(*dltt* + *dlc*)/(*dltt* +*dlc* + *seq*)] - 39.3678[(*dvc* + *dvp*)/lagged *ppent*] - 1.314759[*che*/lagged *ppent*]}, where the variables are the data items in Compustat. Models 5 and 6 provide another control for corporate financial constraints using a dummy variable, *NoRated*, which equals one if a firm does not have a credit rating, and 0 otherwise. Models 7 and 8 control for analyst coverage using a dummy variable, *Analyst_coverage*, which equals 1 if the number of analysts that follow a particular firm is greater than the median, and 0 otherwise. Models 9 and 10 control for managerial ability using a dummy variable *HighAbility*, which equals 1 if the industry-year decile rank of Demerjian et al.'s (2012) updated managerial ability scores are between 0.6 and 1.0; and 0 otherwise (i.e., for a score of 0.5 or below). Models 2, 4, 6, 8, and 10 each include controls for an additional variable and its interaction with *MDIRCOMP* in my equation. Model 11 includes all additional variables except interaction terms, and Model 12 includes all additional controls and interaction terms. I include all control variables in Equation (2) for all models in this table. For brevity, the coefficients of the controls in Equation (2) are not reported. All variables are defined in Appendix A. The t-statistics in parentheses are based on robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
MDIRCOMPi, t-1	-0.019***	-0.017**	-0.018**	-0.019**	-0.020**	-0.025**	-0.020***	-0.027***	-0.019***	-0.015*	-0.018**	-0.029*
	(-2.88)	(-2.10)	(-2.11)	(-2.05)	(-2.35)	(-2.57)	(-2.91)	(-2.96)	(-2.74)	(-1.68)	(-2.56)	(-1.76)
Crisis i, t-1	-0.040	-0.037									-0.040	-0.038
	(-1.64)	(-1.49)									(-1.61)	(-1.50)
*MDIRCOMP i, t-1*Crisis i, t-1*		-0.007										-0.005
		(-0.53)										(-0.35)
KZ_Top i, t-1			-0.006	-0.011							-0.006	-0.010
			(-1.49)	(-1.27)							(-1.38)	(-0.98)
*MDIRCOMP i, t-1*KZ_Top i, t-1*				0.009								0.007
				(0.60)								(0.43)
NoRatedi, t-1					0.003	-0.001					0.003	-0.003
					(0.61)	(-0.10)					(0.65)	(-0.40)
*MDIRCOMPi, t-1*NoRatedi, t-1*						0.008						0.011
						(0.55)						(0.83)
Analyst_coverage i, t-1							-0.004	-0.012			-0.005	-0.013*
							(-1.10)	(-1.60)			(-1.17)	(-1.74)
MDIRCOMPi,t-1 Analyst_coverage i, t-1*								0.015				0.017
								(1.19)				(1.34)
HighAbilityi, t-1									0.003	0.005	0.002	0.004
									(0.90)	(1.06)	(0.67)	(0.88)
*MDIRCOMPi, t-1*HighAbility i, t-1*										-0.005		-0.006
										(-0.62)		(-0.64)
Constant	0.316***	0.314***	0.269***	0.267***	0.271***	0.273***	0.275***	0.278***	0.269**	0.239**	0.300***	0.302***
	(2.91)	(2.89)	(2.68)	(2.66)	(2.68)	(2.69)	(2.62)	(2.65)	(2.55)	(2.31)	(2.75)	(2.75)

Observations	9,495	9,495	9,495	9,495	9,495	9,495	9,495	9,495	9,495	9,495	9,495	9,495
R-squared	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137	0.137
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-level controls in Eq. (2)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CEO-level controls in Eq. (2)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Board-level controls in Eq. (2)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Analyst Coverage. Analysts track financial statements regularly and they are important in firm governance, for instance, by mitigating excess CEO compensation (Chen et al., 2015). Conversely, however, analysts may pressure executives to meet short-term earnings target (Irani and Oesch, 2016). As a result, it is possible that analysts can affect governance and labor investment efficiency (Lee and Mo, 2020). To control for analyst coverage, I use a dummy (*Analyst_coverage*) that equals 1 if the number of analysts that follow a firm is larger than the median, and 0 otherwise. To further control for the potential interdependent effect of alternative governance mechanisms (e.g., Rediker and Seth, 1995), I use the interaction term *MDIRCOMP*Analyst_coverage*. Models 7 and 8 of Table 9 report the results. Although I find insignificant coefficients for the additional control variables, the impact of my main variable of interest, *MDIRCOMP*, remains negative and significant.

Managerial Ability. More able managers can manage their employees more efficiently and they tend to participate less in value-destroying activities than less able managers (Sualihu et al., 2021). Therefore, firms are less likely to deviate from the predicted level of net hiring if they have greater managerial ability (Jung et al., 2014). I use the industry-year decile rank of Demerjian et al.'s (2012) updated managerial ability scores as my proxy for managerial ability. I introduce a dummy, *HighAbility*, which equals 1 for a managerial score between 0.6 and 1.0, and equals 0 otherwise (i.e., for score of 0.5 or below). If more able managers invest in labor more efficiently, it is easier for outside directors to provide their advisory and monitoring services, and the impact of outside directors' equity compensation will be weaker. To test this view, I use the interaction term *MDIRCOMP*HighAbility*.

Models 9 and 10 of Table 9 show that the effect of outside directors' equity compensation on labor investment efficiency remains qualitatively unchanged. Although higher managerial abilities may increase labor investment efficiency (Jung et al., 2014), my result is consistent with the baseline model in Khedmati et al. (2020), in which managerial ability does not influence labor investment efficiency.

In Models 11 and 12 of Table 9, I find that my main findings for the variable of primary interest (*MDIRCOMP*) remain qualitatively unchanged when I include all additional controls (with or without interaction terms, respectively) together. The estimate of *MDIRCOMP* is negative and significant in each model. Collectively, these results confirm the robustness of my result concerning the negative impact of outside directors' equity compensation on labor investment inefficiency.

4.7 Weighted Average Measure of Outside Directors' Equity Compensation

Equity compensation can incentivize outside directors to provide proper monitoring and advisory services, but its effectiveness may depend on the individual characteristics of the directors. Prior studies (e.g., Byrd et al., 2010; Coles et al., 2014; Masulis et al., 2018) document that the incentives, capabilities, and effectiveness of outside directors on monitoring and advising can vary with the directors' characteristics and positions. Although I follow Sengupta and Zhang (2015) in defining my main proxy for outside directors' equity compensation as the mean ratio of equity compensation to total compensation of outside directors, I

adopt the weighted average of outside directors' equity compensation[21] in this section to address the potential differences owing to directors' characteristics. I report the regression results of the weighted measures on abnormal net hiring (my primary inverse measure of labor investment efficiency) in Table 10.

Monitoring Role

Directors tend to have greater monitoring capacity if they are female, they are not co-opted[22], or they hold a position on monitoring committee(s). Although equity compensation can enhance monitoring, I allocate additional weight to an outside director if he/she tends to have stronger monitoring capacity due to these characteristics.

As female directors can reduce the adoption of aggressive investment policies by a firm (Chen et al., 2019), I allocate a weight of 2 (1) to female (male) directors to calculate the weighted average outside director compensation (*WDIRCOMP_Gender*). As co-opted outside directors behave as though they are not independent (Cole et al., 2014), I give a weight of 2 (1) if an outside director is not (is) co-opted for the alternative measure (*WDIRCOMP_Co_opted*). Although the three principal monitoring committees are the audit, compensation, and nominating committees (Faleye et al., 2011), I create another measure (*WDIRCOMP_Committee*) with a weight of 1 if an outside director does not hold a

[21] I first multiply the weight for each outside director by the proportion of equity compensation in total compensation for that director of a firm. Next, the total sum obtained in the first step is divided by the total weights for all outside directors in the firm, which provides the weighted average measure of outside directors' equity compensation.

[22] A co-opted director is defined as a director who joins the board after the CEO assumes office (Cole et al., 2014).

position on any of these three monitoring committees, and a weight of 2 (3) if an outside director is a member (chairperson) of any of the monitoring committees.

Models 1 to 3 in Table 10 show the findings. The estimates of *WDIRCOMP_Gender*, *WDIRCOMP_Co_opted*, and *WDIRCOMP_Committee* are negative and significant, suggesting that equity compensation for outside directors can mitigate the inefficient labor investment when directors' characteristics that can affect monitoring incentives and capabilities are incorporated.

Advisory Role

Directors accumulate valuable experience with tenure (Sharma, 2011), age (Fedaseyeu et al., 2018), and their number of directorships (Bugeja et al., 2009). These factors appear to support the advisory role of outside directors (e.g., Field et al., 2013; Kim et al., 2014) because firms pay high compensation, with a high proportion of equity, to attract outside directors (Linck et al., 2009) and grant more to directors who are more experienced, such as those who are older, have longer tenure, and have larger networks (Goh and Gupta, 2016).

As longer tenure improves advisory performance (Kim et al., 2014), I use a measure of the weighted average of outside directors' equity compensation (*WDIRCOMP_Tenure*), in which I allocate a weight of 2 to outside directors if their tenure is more than the median tenure in the firm; otherwise, a weight of 1 is given. Similarly, as older directors are more experienced than younger directors (Fedaseyeu et al., 2018), I use an alternative measure (*WDIRCOMP_Age*), allocating a weight of 2 (1) to an outside director if he/she is older (younger) than the median age in the firm. The number of directorships held by an outside

director can be a measure of reputation and/or networks (Fich and Shivdasani 2007), and a high number of directorships can enhance a director's advisory role (Field et al., 2013). I create another weighted measure (*WDIRCOMP_Directorship*) in which I allocate weights of 1, 2, and 3 to an outside director if he/she does not hold any other outside directorship, holds one or two other outside directorships, and holds at least three other directorships, respectively.

Models 4 to 6 in Table 10 present the results. I find that the coefficients of *WDIRCOMP_Tenure*, *WDIRCOMP_Age*, and *WDIRCOMP_Directorship* are negative and significant, which provides additional evidence that outside directors' equity compensation can improve labor investment efficiency when directors' characteristics that can affect advisory roles are incorporated into the analysis.

Table 10. The Relation between the Weighted Average of Outside Directors' Equity Compensation and Labor Investment Efficiency

This table provides the regression results for the impact of the weighted average outside director's equity compensation on abnormal net hiring (an inverse measure of labor investment efficiency). For each model, I first calculate the weight for each outside director times the proportion of equity compensation in total compensation for that director. Then, the total sum obtained in the first step is divided by the total weights for all outside directors in the firm, which provides the measure of the weighted average outside directors' equity compensation. In Model 1, a weight of 2 (1) is given to a female (male) outside director. In Model 2, a director is regarded as co-opted if he/she joins the board after the CEO assumes office, and a weight of 1 (2) is allocated to a co-opted (non-co-opted) outside director. In Model 3, a weight of 1 is given for an outside director who does not hold a position in any of the three monitoring committees (audit, compensation, and nominating committee), whereas he/she receives a weight of 2 if the outside director is a non-chair member in any of the committees, and a weight of 3 if he/she is a chairperson in any of the committees. In Model 4, a weight of 2 is allocated to outside directors if their tenure exceeds the median tenure in the firm; otherwise, a weight of 1 is given. In Model 5, a weight of 2 (1) is allocated to an outside director if he/she is older (younger) than the median age in the firm. In Model 6, a weight of 1 is allocated to an outside director if he/she does not hold any other outside directorships, whereas an outside director receives a weight of 2 (3) if he/she holds one or two other outside directorships (at least three other directorships). I include all control variables in Equation (2) for all models in this table. For brevity, the coefficients of the controls are not reported. The t-statistics in parentheses are based on robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Female	Co-opted director	Monitoring committee	Tenure	Age	No. of directorships
WDIRCOMP_Gender i, t-1	-0.019**					
	(-2.21)					
WDIRCOMP_Co_opted i, t-1		-0.016**				
		(-2.10)				
WDIRCOMP_Committee i, t-1			-0.018**			
			(-2.06)			
WDIRCOMP_Tenure i, t-1				-0.019**		
				(-2.25)		
WDIRCOMP_Age i, t-1					-0.020**	
					(-2.37)	
WDIRCOMP_Directorship i, t-1						-0.018**
						(-2.10)
Observations	9,495	9,495	9,495	9,495	9,495	9,495
R-squared	0.137	0.136	0.137	0.137	0.137	0.137
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm-level controls in Equation (2)	Yes	Yes	Yes	Yes	Yes	Yes
CEO-level controls in Equation (2)	Yes	Yes	Yes	Yes	Yes	Yes
Board-level controls in Equation (2)	Yes	Yes	Yes	Yes	Yes	Yes

4.8 Cross-Sectional Tests

4.8.1 The Role of Institutional Ownership

Both outside directors' equity compensation and institutional investors are important in monitoring corporate decisions (e.g., Shleifer and Vishny, 1986; Jensen 1993), and equity compensation can incentivize outside directors to perform their proper duties (e.g., Jensen 1993). For instance, institutional investors can reduce free-riding problems (Shleifer and Vishny, 1986), affect management decision-making such as decisions on R&D (Graves, 1988), improve corporate financial performance (Cornett et al., 2007), and mitigate the inefficiency of labor investment (Ghaly et al., 2020). Consistent with this notion, I report negative and significant coefficients for *MDIRCOMP* and *Institutional* in Table 4, suggesting that both outside directors' equity compensation and institutional ownership can mitigate abnormal net hiring. However, the impacts of outside directors' equity compensation and institutional ownership on corporate decisions may also have an interdependent effect (Cordeiro et al., 2007; Hope et al., 2019). Although equity compensation aligns the interests of shareholders and directors, institutional ownerships can reduce the incremental benefits provided by the outside directors' equity compensation (Cordeiro et al., 2007). Thus, I hypothesize that institutional ownership and outside directors' equity compensation have an interdependent effect on the efficiency of labor investment.

To test the moderating effect, I examine the interaction term between *MDIRCOMP* and *Institutional* (i.e., *MDIRCOMP*Institutional*). Model 1 of Table 11 shows the results. The estimates of *MDIRCOMP* and *Institutional* remain negative and

significant, indicating that both outside directors' equity compensation and institutional ownership can enhance labor investment efficiency. Consistent with my hypothesis H2a and the substitution hypothesis (e.g., Cordeiro et al., 2007), the estimate of *MDIRCOMP*Institutional* is positive and significant, implying that the effectiveness of outside directors' equity compensation in improving labor investment efficiency is lower for a firm with a higher percentage of institutional ownership.

Table 11. The Moderating Role of Institutional Ownership, CEO Ownership, Human Capital Intensity, Firm Complexity, and Female Directors

This table presents the results for the moderating effects of institutional ownership, CEO ownership, human capital intensity, firm complexity, and female directors on the relationship between outside directors' equity compensation and abnormal net hiring (the inverse measure of labor investment efficiency). In Model 1, I examine the effect of institutional ownership, in which *Institutional* is one of the original control variables in Equation (2). In Model 2, I investigate the effect of CEO ownership using a dummy variable (*HighCEOOwn*) that equals 1 if CEO ownership is above-the median, and 0 otherwise. In Model 3, I study the impact of firms operating in human-capital-intensive industries, where a dummy variable (*High_Human_Cap*) equals 1 if a firm belongs to such an industry (applies to industries with two- and three-digit SIC codes of 36, 48, 80, 283, 357, and 384), and 0 otherwise. In Model 4, I examine the effect of complex firms using a dummy variable (*Complex_Firm*) that equals 1 if a firm has more than two business segments, and 0 otherwise. In Model 5, I investigate the impact of female directors with the variable *LogFemale*, which is the log value of the number of female directors on the board plus one. In each model, the interaction term between the mentioned variable and the variable of outside directors' equity compensation (i.e., *MDIRCOMP*Institutional, MDIRCOMP*HighCEOOwn, MDIRCOMP*High_Human_Cap, MDIRCOMP*Complex_Firm,* and *MDIRCOMP* LogFemale*) is used to show the potential moderating effect. I include all controls in Equation (2) for all models. For brevity, the coefficients of the controls are not reported. All variables are defined in Appendix A. The t-statistics in parentheses are based on robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Institutional Ownership	CEO Ownership	Human Capital Intensity	Firm Complexity	Female Directors
MDIRCOMP i, t-1	-0.056***	-0.027***	-0.013*	-0.013*	-0.019*
	(-3.04)	(-2.72)	(-1.91)	(-1.68)	(-1.85)
Institutional i, t-1	-0.039***				
	(-2.90)				
*MDIRCOMP i, t-1*Institutional i, t-1*	0.059***				
	(2.62)				
HighCEOOwn i, t-1		-0.015**			
		(-2.07)			
*MDIRCOMP i, t-1*HighCEOOwn i, t-1*		0.026*			
		(1.92)			
High_Human_Cap i, t-1			0.024**		
			(2.15)		
*MDIRCOMP i,t-1*High_Human_Cap i, t-1*			-0.027**		
			(-2.14)		

Complex_Firm i, t-1				0.013**	
				(2.14)	
*MDIRCOMPi, t-1*Complex_Firm i, t-1*				-0.020*	
				(-1.76)	
LogFemale i, t-1					-0.012
					(-0.91)
*MDIRCOMPi, t-1*LogFemale i, t-1*					-0.000
					(-0.03)
Constant	0.291***	0.258**	0.315***	0.322***	0.317***
	(2.85)	(2.57)	(3.35)	(3.44)	(2.82)
Observations	9,495	9,495	9,495	9,495	9,495
R-squared	0.138	0.137	0.138	0.137	0.137
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
Firm-level controls in Equation (2)	Yes	Yes	Yes	Yes	Yes
CEO-level controls in Equation (2)	Yes	Yes	Yes	Yes	Yes
Board-level controls in Equation (2)	Yes	Yes	Yes	Yes	Yes

4.8.2 The Role of CEO Ownership

CEOs may have the most influence on decision-making within a firm compared with other relevant parties (e.g., Hambrick and Mason, 1984; Kim and Lu, 2011). A large CEO stock ownership can reduce the demand for monitoring (Jensen and Meckling, 1976) because decisions made by the CEO directly affect his/her own wealth, and there is a strong alignment between the CEO's and the shareholders' interests when the CEO has high ownership stakes (Dah and Frye, 2017). However, CEO ownership and other governance mechanisms can be substitutes for mitigating agency problems (Kim and Lu, 2011). Thus, a larger CEO stock ownership may reduce the incremental benefit of outside directors' equity compensation on improving labor investment efficiency. Nevertheless, CEOs may become overly risk averse if their stock ownership is high, and they may not optimally invest in profitable but risky projects (Bryan et al., 2000), and hence may aggravate the inefficiency of labor investment. Based on this argument, more monitoring by outsider directors may be required when the level of CEO stock ownership is higher.

To test the potential moderating effect, I focus on CEO ownership because CEOs are highly influential in firm decision-making (Kim and Lu, 2011). First, I measure CEO ownership as the value of options and stock of the CEO, and classify firms as high (low) managerial ownership firms if this value is above (below) the median (Ghaly et al. 2020). Then, I use a dummy (*HighCEOOwn*), which equals 1 (0) if a firm is classified as having high (low) managerial ownership. Finally, an interaction term (*MDIRCOMP*HighCEOOwn*) between outside directors' equity compensation (*MDIRCOMP*) and the dummy variable (*HighCEOOwn*) is used to provide the empirical test of the potential moderating effect of the CEO ownership.

Model 2 of Table 11 reports the findings related to CEO ownership. Consistent with the alignment effect, the estimate of *HighCEOOwn* is negative and significant. This implies that a large CEO ownership can reduce inefficiency in labor investment, such as caused by CEOs' empire building. The coefficient of *MDIRCOMP*HighCEOOwn* is positive and significant at the 10% level. This finding supports my hypothesis H2b in the sense that when the CEO has greater ownership, the negative effect of outside directors' equity compensation on abnormal net hiring is weaker. Thus, the incentive provided by outside directors' equity compensation is less important when CEOs have large stock ownership, which also supports the substitution hypothesis.

4.8.3 The Role of Human Capital Intensity and Labor Adjustment Costs

Human-capital-intensive firms possess highly skilled laborers and face keen labor competition. These firms face higher labor adjustment costs than less human-capital-intensive firms, and hence it is not easy for them to adjust the efficiency of

their labor investments (Cao and Rees, 2020). Therefore, I hypothesize that the effect of outside directors' equity compensation on labor investment efficiency is greater for firms with higher human-capital intensity.

To proxy the intensity of human capital, I partition my sample into two subsamples according to whether a firm belongs to a human-capital-intensive industry. Following Cao and Rees (2020), I regard firms as human-capital-intensive if they belong to the healthcare, high-tech, or telecommunications industries, for which the two- and three-digit SIC codes are 36, 48, 80, 283, 357, and 384. Then, I use a dummy (*High_Human_Cap*), which equals 1 (0) if a firm belongs (does not belong) to a human-capital-intensive industry. Finally, I use an interaction term (*MDIRCOMP* High_Human_Cap*) to examine the moderating role of human capital intensity.

Model 3 of Table 11 reports the findings. The estimate of *High_Human_Cap* is significant and positive (0.024), which suggests that firms with high human capital intensity may face keen competition in labor and/or a high labor adjustment cost, and thus they are reluctant to adjust their labor investment even when this may be required (i.e., this results in inefficiency in labor investment). Similar to previous models, I continue to find a negative association between outside directors' equity compensation and labor investment inefficiency. In addition, I find a negative (-0.027) and significant association (at the 5% level) between the interaction term (*MDIRCOMP*High_Human_Cap*) and abnormal net hiring. This result supports my hypothesis H2c, suggesting that the effectiveness (monitoring and/or advisory) of outside directors' equity compensation on labor investment efficiency is stronger when human capital is more important to a firm.

4.8.4 The Role of Firm Complexity

Firm complexity may affect the relationship between labor investment efficiency and outside directors' equity compensation. Complex firms may make suboptimal investment decisions and face greater agency conflicts because they face larger information asymmetries than less complex firms do (Jensen, 1986; Hoechle et al., 2012). Therefore, more complex firms may need more monitoring.

To test the potential moderating effect of firm complexity, I first follow previous research (e.g., Ghaly et al., 2020) by classifying a firm as complex when it has more than two business segments. Then, I use a dummy (*Complex_Firm*), which equals 1 if the firm is complex (i.e., has more than two business segments), and otherwise equals 0. Finally, I use the coefficient of the interaction (*MDIRCOMP*Complex_Firm*) to determine whether the association between labor investment efficiency and outside directors' equity compensation depends on firm complexity.

Model 4 of Table 11 reports the findings. The positive and significant estimate for *Complex_Firm* suggests that complex firms are more inefficient in their labor investments than firms that are not complex. The estimate of *MDIRCOMP* remains negative and significant. As expected, based on hypothesis H2d, the interaction term (*MDIRCOMP*Complex_Firm*) is also negative and significant. The results imply that the negative impact of outside directors' equity compensation on labor investment inefficiency is larger for complex firms, which require more monitoring and advice, than for less complex firms.

4.8.5 The Role of Female Directors

Female directors (board gender diversity) are effective monitors, and a larger proportion of female directors is associated with a larger proportion of equity-based compensation for directors (e.g., Adam and Ferreira, 2009). For instance, female directors can reduce the overconfidence of male CEOs and their tendency to adopt aggressive investment policies (Chen et al., 2019). Furthermore, a high representation of female directors can enhance labor investment efficiency for firms with poor governance quality (Sun and Zhang, 2021). If female directors can provide additional monitoring, then the effectiveness of equity compensation for outside directors on labor investment efficiency may be less pronounced than in firms that lack or have fewer female directors.

As a proxy for female directors, I follow Sun and Zhang (2021) and use the log value of the number of female directors on the board plus one (*LogFemale*). I use the interaction term (*MDIRCOMP* LogFemale*) to show the potential moderating role of female directors on the association between outside directors' equity compensation and labor investment efficiency.

Model 5 of Table 11 reports the results. Similar to the previous models, I find a negative association between outside directors' equity compensation and labor investment inefficiency. However, the coefficients of both *LogFemale* and *MDIRCOMP*LogFemale* are insignificant, suggesting that a strong representation of female directors does not moderate the impact of outside directors' equity

compensation on labor investment efficiency[23]. The negative but insignificant coefficient of *LogFemale* may support the notion that female directors do not significantly affect labor investment efficiency when the firm is strongly monitored (Sun and Zhang, 2021).

In sum, outside directors' equity compensation helps mitigate labor investment inefficiency, but the magnitude depends on other factors, including institutional ownership, CEO ownership, human intensive capacity, and firm complexity.

4.9 The Impact of Outside Directors' Equity Compensation on Labor Cost Stickiness and Employment Level Stickiness

Rather than focusing on abnormal hiring and firing decisions, I now draw on the cost stickiness literature and discuss the impact of outside directors' equity compensation on the stickiness of labor costs and the employment level. Previous research (e.g., Hall, 2016) shows that labor costs do not behave symmetrically; for example, firms may spend more resources to lay off a current staff member when sales decrease than they do to employ a new staff member when sales rise, which indicates a large stickiness of labor costs. Managers' incentives, such as empire-building incentives, can affect the behavior of labor cost (Dierynck et al., 2012). For instance, Prabowo et al. (2018) document that the self-interest of managers who

[23] Following Sun and Zhang (2021), I also use a dummy variable as an alternative proxy; it takes a value of 1 if a firm has female directors, and 0 otherwise. I use an interaction term between the dummy variable and *MDIRCOMP* to examine the potential moderating effect. The findings are similar to the main proxy. I do not report them in the table for brevity, but note that the coefficient of *MDIRCOMP* remains significant and negative, and the coefficients for the dummy and the interaction term are insignificant.

engage in empire building may restrain them from firing labor when sales decrease, and that firms with weak corporate governance have stickier labor costs than those with strong governance. As equity compensation can incentivize outside directors to perform their proper duties—for example, by providing better monitoring and mitigating empire-building activities—I expect the stickiness of labor costs to decrease with outside directors' equity compensation. To test my expectation, I follow Ben-Nasr and Alshwer (2016), Prabowo et al. (2018), and Khedmati et al. (2020) by using the regression model in Equation (4) below with year and industry fixed effects:

$$\log\left(\frac{LabCost_{i,t}}{LabCost_{i,t-1}}\right) = \beta_0 + \beta_1 \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) + \beta_2 Decr_{i,t} * \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right)$$

$$+\beta_3 Decr_{i,t} * \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) * MDIRCOMP_{i,t} + \beta_4 Decr_{i,t} * \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) * Controls_{i,t}$$

$$+\beta_5 MDIRCOMP_{i,t} + \beta_6 Controls_{i,t} + \varepsilon_{i,t} \quad (4)$$

where *LabCost* denotes staff expenses, sourced from Compustat, which represent salary, wages, and other benefits paid to employees and officers; *Rev* is the total revenue; *Decr* is a dummy that equals 1 if total revenue is less than the previous year, and 0 otherwise; and *MDIRCOMP* is the measure of my main proxy for the outside directors' equity compensation, as defined previously. The controls include asset intensity (*AI*), which is the ratio of assets over revenue; *Suc_Decr*, which is a dummy variable that equals 1 if revenue decreases during the current and previous year, and 0 otherwise; *Loss*, which is a dummy variable that equals 1 if the ROA of the firm is negative in the previous year, and 0 otherwise; and *Institutional* and *UNION* are as previously defined in Equation (2).

Model 1 of Table 12 presents the findings. The sample size decreases dramatically mainly because of the limited availability of data on labor costs[24]. Similar to other studies (e.g., Ben-Nasr and Alshwer, 2016), my estimate of β_1 in Equation (4) is positive and significant and my estimate of β_2 is negative and significant, which suggests that labor cost is sticky. In line with my expectation, the coefficient of $Decr_{i,t} * \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) * MDIRCOMP_{i,t}$ is positive and significant, implying that outside directors' equity compensation mitigates empire-building activities and alleviates the stickiness of labor costs.

Table 12. The Impact of Outside Directors' Equity Compensation on Labor Cost Stickiness and Employment Level Stickiness

This table reports the regression results for the impact of outside directors' equity compensation on labor cost stickiness and employment level stickiness. All variables are defined in Appendix A. The t-statistics in parentheses are based on robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

VARIABLES	(1) $\log\left(\frac{LabCost_{i,t}}{LabCost_{i,t-1}}\right)$	(2) $log\left(\frac{Employee_{i,t}}{Employee_{i,t-1}}\right)$
$\log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right)$	0.756***	0.509***
	(22.90)	(34.94)
$Decr_{i,t} * \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right)$	-0.322*	-0.220***
	(-1.69)	(-3.34)
$Decr_{i,t} * \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) * MDIRCOMP_{i,t}$	0.562***	0.138*
	(3.99)	(1.86)
$Decr_{i,t} * \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) * AI_{i,t}$	0.053	-0.008**
	(1.32)	(-2.39)
$Decr_{i,t} * \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) * Suc\_Decr_{i,t}$	0.356***	0.192***
	(4.45)	(6.05)

[24] Labor costs are voluntarily disclosed (Sualihu et al., 2021). In interpreting the findings of this model, a caveat is that it reduces my sample size dramatically; the sample size of Model 1 is approximately 7% (i.e., 673/8117*100%) of the sample size in Model 2. This reduction is comparable with the sample size reduction of 94% in Sualihu et al. (2021) when labor cost is used.

$Decr_{i,t} * \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) * Loss_{i,t-1}$	0.011	-0.326***
	(0.14)	(-10.72)
$Decr_{i,t} * \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) * Institutional_{i,t}$	-0.441**	-0.107**
	(-2.42)	(-2.26)
$Decr_{i,t} * \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) * UNION_{i,t}$	-0.002	-1.097***
	(-0.00)	(-3.61)
MDIRCOMP i, t	0.025*	0.013
	(1.78)	(1.34)
AI i, t	-0.001	0.007***
	(-0.32)	(3.69)
Suc_Decr i, t	0.014	-0.001
	(1.20)	(-0.20)
Loss i, t-1	-0.016	-0.026***
	(-1.53)	(-4.71)
Institutional i, t	0.014	0.000
	(1.44)	(0.08)
UNION i, t	0.010	-0.040
	(0.16)	(-1.17)
Constant	-0.049	-0.042
	(-1.61)	(-1.53)
Observations	673	8,117
R-squared	0.701	0.350
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
State fixed effects	no	no
Industry-year fixed effects	no	no
State-year fixed effects	no	no

Labor cost stickiness can occur owing to sticky adjustments of the number of employees and/or a sticky average wage rate (Gu, et al., 2020). Firms may face nominal wage rigidity (i.e., sticky wages) because of constant contract periods (Taylor, 1980). If labor cost stickiness is (almost) purely caused by a sticky average wage rate (i.e., low/no sticky employment level), firms may still invest in an efficient number of employees, and the sticky wage rate may not provide evidence that managers engage in empire-building activities. Thus, it is important to examine the impact of outside directors' equity compensation on the employment level stickiness.

Following Gu et al. (2020), I examine the stickiness of the employment level by replacing the dependent variable in Equation (4) with $\log\left(\frac{Employee_{i,t}}{Employee_{i,t-1}}\right)$, where *Employee* is the number of employees in a firm. Model 2 of Table 12 shows the findings. Similar to Model 1 of Table 12, I report a positive coefficient for $\log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right)$ and negative coefficient for $Decr_{i,t} * \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right)$, which implies a sticky employment level. The coefficient of interest, $Decr_{i,t} * \log\left(\frac{Rev_{i,t}}{Rev_{i,t-1}}\right) * MDIRCOMP_{i,t}$, is positive and significant at the 10% level, implying that outside directors' equity compensation can mitigate labor cost stickiness through the adjustment of the employment level. Using this method can enlarge the sample size by more than 10 times[25], which can enhance the robustness of our analysis on the influence of outside directors' equity compensation on the labor cost stickiness.

Collectively, the results show that equity compensation incentivizes outside directors to provide timely advice to firms to decrease the number of employees when employee layoffs are necessary, as well as timely advice to cut labor costs in response to an economic downturn.

5 Conclusion

5.1. Overviews

This study investigates the relationship between outside directors' equity compensation and labor investment efficiency. I argue that there are two

[25] Although the sample size in Model 1 of Table 12 is 673, that for Model 2 of Table 12 is 8,117.

alternative impacts of equity compensation for outside directors. One school of thought believes that equity compensation provides a proper and sufficient motivation for outside directors to fulfill their duties in monitoring and advising firms and, hence, we can expect that outside directors' equity compensation will improve labor investment efficiency. However, another school of thought argues that outside directors are agents, and that equity compensation may incentivize them to engage in self-interested behavior, such as empire-building activities by self-serving executives, and thus we may expect that outside directors' equity compensation may exacerbate the inefficiency of labor investment.

Using a sample of U.S. firms for the period from 2006 to 2019, I demonstrate that outside directors' equity compensation mitigates the absolute deviation of labor investment from the predicted level (that is, it improves labor investment efficiency), which supports the school believing in the positive impact of outside directors' equity compensation (e.g., Jensen 1993).

My results are robust to considering alternative proxies for labor investment efficiency and outside directors' equity compensation, when I additionally control for other potential variables that can affect labor decisions (e.g., managerial ability), and when I address endogeneity concerns, such as by performing 2SLS regressions.

I provide consistent evidence that outside directors' equity compensation can alleviate labor investment inefficiency when I partition my sample into subsamples of firms overinvesting and underinvesting in labor. I also find that equity compensation for outside directors can improve labor investment efficiency when

directors' characteristics that can affect monitoring and advisory functions are incorporated in the weighted measures. In addition, I report evidence that the impact of outside directors' equity compensation is smaller when the firms have other strong disciplinary mechanisms, particularly high institutional and CEO ownership. Furthermore, I show that outside directors' equity compensation plays a more important role in improving labor investment efficiency for higher human-capital-intensive firms and complex firms than for low human-capital-intensive and simpler firms. This result indicates that equity compensation can incentivize outside directors to play a stronger monitoring and advisory role in labor investment decisions when human capital is important for company success, and also when firms require different labor skills for different business segments.

Finally, I find that outside directors' equity compensation can also reduce labor cost stickiness and corporate employment level stickiness. Although self-interested managers who engage in empire building may not reduce labor costs or lay off their workers when there is a decrease in sales revenue with a weak corporate governance (Prabowo et al., 2018), I report evidence that equity compensation incentivizes outside directors to provide timely cuts in labor costs and the number of employees in response to an economic downturn (i.e., reducing labor cost stickiness and employment level stickiness).

5.2. Contributions and Implications

My paper contributes to the literature in the following ways. First, it contributes to the director compensation literature. Prior studies provide results on the relationship between outside directors' equity compensation and monitoring

performance, such as the effects of higher firm value, lower cost of capital, better corporate disclosure and monitoring of CEO turnover, and higher-quality corporate strategic alliance decisions (e.g., Perry 2000; Fich and Shivdasani, 2005; Sengupta and Zhang, 2015; Burns et al., 2021; Chan et al., 2023). However, some studies show negative results. For example, outside directors' equity compensation restrains firm's propensity to pay dividends (Sharma, 2011). In other words, the potential impact of outside directors' equity compensation on firm decisions remains debatable. My research extends to a new area and enriches the literature by providing novel evidence on the impact of director compensation on a firm's labor investment decision. Directors' incentives and capabilities to monitor and advise can vary with their own characteristics and positions (e.g., Coles et al., 2014; Masulis et al., 2018). However, scholars pay little attention to the directors' characteristics and positions when they analyze the effectiveness of director compensation. To the best of my knowledge, no studies use weighted average measures of director compensation. As directors' characteristics and positions (e.g., board tenure and gender) are important factors that can affect their monitoring and advisory services (e.g., Byrd et al., 2010; Chen et al., 2019), future studies can incorporate such individual features by using my new measures to analyze and test the corresponding effects of director compensation.

Second, this research adds to the literature on labor investment efficiency. The investigation of efficiency in labor investment is largely overlooked (Jung et al., 2014), with the relatively scant literature (Sualihu et al., 2021). Most studies highlight the role of financial reporting quality in affecting efficiency of labor investment (e.g., Jung et al., 2014; Ghaly et al., 2020; Khedmati et al., 2020; and Sualihu et al., 2021). In addition, prior studies examine how alternative external

governance mechanisms (e.g., Ghaly et al., 2020; Lee and Mo, 2020) and internal governance mechanisms (e.g., Khedmati et al., 2020; Sualihu et al., 2021) affect labor investment efficiency. My paper is closely related to Sualihu et al. (2021), who investigate the impact of CEO equity compensation on labor investment efficiency. However, risk aversion and concerns differ between CEOs and outside directors (e.g., Lim and McCann, 2014), and the effects of equity grants for CEOs are potentially different from those for outside directors (e.g., Ertugrul and Hegde, 2008). As CEO compensation and outside directors' compensation operate differently with different channels (e.g., Kim et al., 2019), there is a need to investigate director compensation and CEO compensation separately (e.g., Burns et al., 2021). Directors play important roles in corporate governance and the firm policy formulation process (Fama and Jensen, 1983), outside directors matter for employee-related decisions (e.g., Perry and Shivdasani, 2005; Yawson, 2006; Vafeas and Vlittis, 2018), and equity compensation provides the incentives for outside directors (e.g., Yermack, 2004). Nevertheless, prior studies pay little attention to the effect of director compensation on labor investment. My study advances the current literature by investigating the effect of outside directors' equity compensation on labor investment efficiency.

Third, this research enriches the sticky costs literature, particularly in relation to labor cost stickiness. A few recent studies, such as Ben-Nasr and Alshwer (2016) and Khedmati et al. (2020), examine the relationship between the determinants of labor investment efficiency and labor cost stickiness based on staff expenses. I enrich this stream of work by showing that outside directors' equity compensation can mitigate both labor cost and employment level stickiness. Perry and Shivdasani (2005) show that outside-dominated boards are more likely to initiate employee

layoffs for firms experiencing declining performance than firms with fewer outside directors. My research complements this study by showing through my investigation of labor cost stickiness that outside directors' equity compensation increases the layoff sensitivity to firm performance.

Last but not least, this study provides practical implications for regulators, shareholders, and directors. Equity compensation for outside directors substantially increased after the adoption of SOX (Linck et al., 2009), and I find that equity-based pay approximately doubled from 2006 to 2019. It is important to determine whether the high compensation is designed to attract qualified experts to perform additional board functions or whether it is provided to the outside directors to achieve their loyalty to the executives. The study provides robust evidence that there is a negative association between labor investment inefficiency and outside directors' equity compensation, which supports the calls for the provision of equity to incentivize outside directors to perform their proper duties (e.g., Jensen 1993). In addition, this study shows that equity compensation can incentivize outside directors in providing timely cuts to labor costs and the number of employees, and also to mitigate labor underinvestment and overinvestment. Hence, outside directors' equity compensation improves corporate governance and reduces executive misbehavior, such as empire-building activities.

5.3 Limitations of the Study and Potential Future Research

Following the literature (e.g., Jung et al., 2014), my primary measure of labor investment efficiency is the absolute difference between the expected and actual

percentage change in employees. Although I use different proxies to enhance the robustness of my results, these measures may nevertheless contain noise. Other measures, particularly labor cost, may be desirable. However, the use of labor costs is largely hindered by the lack of availability of the relevant data. Most firms do not separately disclose their labor costs because labor-related expenses are voluntarily disclosed (Sualihu et al., 2021). Sualihu et al. (2021) find that their sample size decreases by 94% when they examine labor cost rather than the number of employees. Similarly, the sample size for my analysis on employment level stickiness is more than 10 times the sample size when I examine labor cost stickiness. As a result, the use of labor cost may not be feasible to estimate labor investment efficiency because the sample sizes are too small at present. When sufficient data become available, future research can investigate the influence of outside directors' equity compensation on labor investment efficiency using the measure of labor costs.

My research provides insights for practitioners into the effectiveness of outside directors' equity compensation at the firm level. However, there is substantial variation in outside director compensation across firms and within the same firm (Fedaseyeu et al., 2018). Directors at the same firm can have different knowledge and expertise in monitoring labor investment and they may provide different advice on employment policies within a firm. Furthermore, the outcomes of outside director compensation may depend on the diversity of directors' compensation within a firm rather than the averaged directors' equity compensation of the firm. In the future, scholars could enhance understanding of outside directors' equity compensation by investigating its potential effect on labor investment efficiency at the director level.

A potential limitation of this study is that the use of U.S. firms in my sample may limit the generalizability of the results to other economies. In other words, caution should be adopted in applying my findings to other economies that have different institutional and cultural environments to the U.S. economy. Institutional and cultural environments can significantly influence the effects of various corporate governance mechanisms (such as outside directors' equity compensation) on corporate outcomes (Cumming, Filatotchev, Knill, Reeb, and Senbet, 2017). For instance, the institutional environment can play an important role in shaping laborism, and firms in stronger laborism countries are under pressure (e.g., from institutional forces such as left-leaning governments) to retain their existing employees and thus make less efficient labor investment decisions than they would otherwise (Jung, Kang, Lee, and Zhou, 2022). Therefore, the difference in institutional environments across countries may affect the impact of the outside directors' equity compensation on corporate labor investment decisions. Further studies could examine my empirical question in economies with different institutional and cultural environments to further investigate how the relations between outside directors' equity compensation and labor investment efficiency vary with different environments.

Appendix A: Variable Description

Variable	Description
Equation (1) Variables	
Net_Hiring	The dependent variable in Equation (1), which is the percentage change in the number of employees
AQC	The ratio of acquisition expenditure to total assets
AUR	The ratio of annual sales to total assets
CAPX	The ratio of capital expenditure to total assets
Firm_Size_R	The natural logarithm of the market value of equity, ranked into percentiles
lnGDPpc	The natural logarithm of GDP per capita
Leverage	The sum of debt in current liabilities and long-term debt, scaled by the total assets
LossBIN	Dummy variables that indicate each interval of prior-year ROA with a length interval of 0.005 from 0 to -0.025. For example, LossBIN1 equals 1 if prior-year ROA is between -0.005 and 0, otherwise LossBIN1 equals 0; LossBIN2 equals 1 if the prior-year ROA is between -0.01 and -0.005; otherwise LossBIN2 equals 0; and so on
Quick	Quick ratio (the ratio of cash and short-term investments plus receivables to current liabilities)
⊿Quick	The change in the quick ratio
Return	The annual stock return
ROA	The return on assets
⊿ROA	The change in ROA
Sales_Growth	Percentage change in sales revenue
XRD	The ratio of R&D expenditure to total assets

Equation (2) Variables

Dependent Variable: *Abnormal net hiring*	The dependent variable in Equation (2). It is the absolute value of the residual in Equation (1). It is an inverse measure of labor investment efficiency, where a smaller value means that labor investment is more efficient
Independent Variable: *MDIRCOMP*	The mean ratio of equity-based (i.e., stock and option) compensation to total compensation of outside (i.e., independent) directors
Board-Level Control Variables:	
BDAge	The natural logarithm of the average age of the directors
BDGender	The percentage of male directors on the board
BDIndependence	The percentage of independent directors on the board
BDSize	The total number of directors on the board
CEO-Level Control Variables	
CEOAge	The natural logarithm of the age of the CEO
CEO_dual	A dummy variable that equals 1 if the CEO holds the position of the board chairperson, and 0 otherwise
CEOGender	A dummy variable that equals 1 (0) if the CEO is male (female)
MCEOCOMP	The sum of stock and option compensation of the CEO divided by the total compensation of the CEO

Firm-Level Control Variables:

Abn_other_invest	Abnormal other (non-labor) investments, defined as the absolute value of the residual from the model of: $Other\_invest_{it}=\beta_0+\beta_1 Sales\_Growth_{it-1}+\varepsilon_{it}$, where *Sales_Growth* is as previously defined in Equation (1). *Other_Invest* is the sum of capital expenditures, acquisition expenditures, and R&D expenditures, less cash receipts from the sale of property, plant, and equipment, scaled by lagged total assets.
AQ	The absolute value of Dechow and Dichev's (2002) measure of abnormal accruals, as modified by Ball and Shivakumar (2005)
Dividend	A dummy variable that equals 1 if the firm pays dividends, and 0 otherwise
Firm_Size	The natural logarithm of the firm's market value
Institutional	The proportion of outstanding shares held by institutional investors
Labor_intensity	The ratio of employees to total assets
Leverage	The variable is descripted in Equation (1)
Loss	A dummy variable that equals 1 if the ROA is negative, and 0 otherwise
MTB	The market-to-book value of common stock
Quick	The variable is descripted in Equation (1)
SD_CFO	The standard deviation of cash flows from operations over years t – 5 to t – 1
SD_net_hire	The standard deviation of the percentage change in employees over years t – 5 to t – 1
SD_Sales	The standard deviation of sales revenue over years t – 5 to t – 1
Tangible	The ratio of property, plant, and equipment to total assets

UNION	Labor unionization rate. It is an estimate of state-level union membership and coverage. The data are from Hirsch and Macpherson's (2003) updated database of Union Membership and Coverage
Instrumental Variable: *IndustryDEQR*	The industry median equity compensation (%) of outside directors. It is an instrumental variable in the first stage to predict *MDIRCOMP* for the two-stage least squares (2SLS) regression
Moderators & Related Variables:	
Institutional	Defined in Firm-Level Control Variables of Equation (2)
*MDIRCOMP*Institutional*	An interaction term between outside directors' equity compensation and institutional ownership, which is calculated by *MDIRCOMP* times *Institutional*
HighCEOOwn	A dummy variable that equals 1 if the CEO ownership is above the median, and 0 otherwise
*MDIRCOMP*HighCEOOwn*	An interaction term between outside directors' equity compensation and high CEO ownership, which is calculated by the variable of *MDIRCOMP* times the variable *HighCEOOwn*
High_Human_Cap	A dummy variable that equals 1 if a firm belongs to a human-capital-intensive industry (the relevant two- and three-digit SIC codes are 36, 48, 80, 283, 357, and 384), and 0 otherwise
*MDIRCOMP*High_Human_Cap*	An interaction term between outside directors' equity compensation and firms operating in human-capital-intensive industries, which is calculated by the variable of *MDIRCOMP* times the variable *High_Human_Cap*

Complex_Firm	A dummy variable that equals 1 if a firm has more than two business segments, and 0 otherwise
*MDIRCOMP*Complex_Firm*	An interaction term between outside directors' equity compensation and a complex firm, which is calculated by the variable of *MDIRCOMP* times the variable *Complex_Firm*
LogFemale	It is the log value of the number of female directors on the board plus one
MDIRCOMP LogFemale*	An interaction term, which is calculated by the variable of *MDIRCOMP* times *LogFemale*
Alternative Proxies for Outside Directors' Equity Compensation	
MDIRCOMPS	The mean ratio of stock compensation to total compensation of outside directors
MDIRCOMPO	The mean ratio of option compensation to total compensation of outside directors
DEQR	The median proportion of outside directors' equity-based (i.e., stock and option) compensation to total compensation
MaxDIRCOMP	The maximum proportion of outside directors' equity-based (i.e., stock and option) compensation to total compensation
MedStock_Opt	The median (natural logarithm) value of outside directors' equity-based (i.e., stock and option) compensation
MeanStock_Opt	The mean (natural logarithm) value of outside directors' equity-based (i.e., stock and option) compensation

Additional Control Variables for Robustness Tests:

Analyst_coverage	A dummy variable that equals 1 if the number of analysts that follow a particular firm is greater than the median, and ; 0 otherwise
Crisis	A dummy variable that is equal to 1 for the fiscal years of 2008 and 2009; and 0 for other years
HighAbility	A dummy variable that equals 1 if the industry-year decile rank of Demerjian et al.'s (2012) updated managerial ability score is between 0.6 and 1.0; and 0 otherwise (i.e., score of 0.5 or below)
KZ_Top	A dummy variable that equals 1 if the KZ index[26] of a firm is in the top tercile, and 0 otherwise
NoRated	A dummy variable that equals 1 if a firm does not have a credit rating, and 0 otherwise
*MDIRCOMP*Analyst_coverage*	An interaction term calculated by the variable of *MDIRCOMP* times *Analyst_coverage*
*MDIRCOMP*Crisis*	An interaction term calculated by the variable of *MDIRCOMP* times the variable *Crisis*
*MDIRCOMP*HighAbility*	An interaction term calculated by the variable of *MDIRCOMP* times *HighAbility*
*MDIRCOMP*KZ_Top*	An interaction term calculated by the variable of *MDIRCOMP* times *KZ_Top*
*MDIRCOMP*NoRated*	An interaction term calculated by the variable of *MDIRCOMP* times *NoRated*

[26] The *KZ index* is constructed as –1.001909[(*ib* +*dp*)/lagged *ppent*] + 0.2826389[(*at* + *prcc_ f*×*csho* - *ceq* - *txdb*)/*at*] + 3.139193[(*dltt* + *dlc*)/(*dltt* +*dlc* + *seq*)] – 39.3678[(*dvc* + *dvp*)/lagged *ppent*] – 1.314759[*che*/lagged *ppent*], where the variables are the data items in Compustat.

Equation (3) Variables

Δ EMP	*Δ EMP* captures employee growth. It is measured as the change in the log number of employees
Q	*Q* represents Tobin's Q, and it is measured as (the natural log of) the sum of the book value of total assets and the market value of equity minus the book value of equity over the lagged total assets
CF	*CF* represents cash flows, and it is measured as net income plus depreciation over lagged total assets
MDIRCOMP	As defined for Equation (2)
*MDIRCOMP*Q*	An interaction term calculated by the variable of *MDIRCOMP* times *Q*
*MDIRCOMP*CF*	An interaction term calculated by the variable of *MDIRCOMP* times *CF*

Equation (4) Variables

LabCost	Staff expenses, which represents salary, wages, and other benefits paid to employees and officers
Employee	The number of employees in a firm
AI	The ratio of total assets over total revenue
Decr	A dummy variable that equals 1 if total revenue decreased from the previous year, and 0 otherwise
Institutional	Defined in Equation (2)
Loss	Defined in Equation (2)
MDIRCOMP	Defined in Equation (2)
Rev	The total revenue of a firm
Suc_Decr	A dummy variable that equals 1 if total revenue decreased during the current and the previous year, and 0 otherwise
UNION	Defined in Equation (2)

Appendix B: Descriptive Statistics for the Specific Forms of Labor Investment Inefficiency

This Appendix presents descriptive statistics for the specific forms of labor investment inefficiency. For reference, Column (1) shows the data for the whole sample, in which *Abnormal net hiring* is the inverse measure of labor investment efficiency. The whole sample is decomposed into two parts, overinvestment and underinvestment (in Columns (2) and (5), respectively). Overinvestment (underinvestment) is defined as actual net hiring being greater (less) than expected net hiring. Next, I further decompose the overinvesting firms into over-hiring and under-firing subsamples (in Columns (3) and (4), respectively). I classify a firm as over-hiring (under-firing) if its expected net hiring is positive (negative) and its actual net hiring is greater than its expected net hiring. Similarly, I decompose the underinvesting firms into under-hiring and over-firing subsamples (in Columns (6) and (7), respectively), where a firm is classified as under-hiring (over-firing) if its expected net hiring is positive (negative) and its actual net hiring is less than its expected net hiring.

	Abnormal net hiring	Overinvestment in labor			Underinvestment in labor		
	(1)	Total (2)	OverHire (3)	UnderFire (4)	Total (5)	UnderHire (6)	OverFire (7)
N	9,495	4,026	2,844	1,182	5,469	4,356	1,113
Mean	0.087	0.102	0.114	0.073	0.076	0.074	0.088
Std. Dev.	0.147	0.196	0.217	0.126	0.096	0.095	0.096
Q1	0.023	0.021	0.020	0.022	0.025	0.025	0.024
Median	0.051	0.049	0.052	0.046	0.052	0.050	0.057
Q3	0.099	0.107	0.116	0.091	0.096	0.092	0.112

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CURRICULUM VITAE

Academic qualifications of the thesis author, Mr. CHOI Ka Sing:

- Received the degree of Bachelor of Economics and Finance from The University of Hong Kong, August 2004

- Received the degree of Master of Economics from The University of Hong Kong, August 2007

- Received the certificate of Postgraduate Diploma in Education from The University of Hong Kong, August 2017

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