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Does directors' and officers' liability insurance induce empire building? Evidence from corporate labor investment☆

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ABSTRACT

This study examines whether directors' and officers' (D&O) insurance affects corporate employment decision-making. Using a 2006–2018 sample of Chinese public firms, we find that firms purchasing D&O insurance exhibit lower labor investment efficiency, reflected mainly in over-hiring. The findings are strengthened by a set of additional robustness tests to mitigate endogeneity concerns and selection bias. The negative relation between D&O insurance and labor investment efficiency is more pronounced in firms with weak corporate governance, a low proportion of female executives, high labor intensity and low legal risks. Further analysis suggests that inefficient labor investment leads to worse future firm performance. This study provides the first empirical evidence that D&O insurance increases managerial empire building tendencies via over-investment in labor, which, in turn, is detrimental to shareholder value.

1. Introduction

Directors' and officers' liability insurance (D&O insurance) protects a firm's directors and officers from personal liability arising from litigation brought by investors or other stakeholders. Although purchasing D&O insurance is a well-established corporate risk management practice for North American and European firms, it is relatively new in emerging markets. Further, despite its prevalence in developed markets, there is ongoing debate about the governance role of D&O insurance and its potential impact on corporate decisions. On the one hand, the monitoring hypothesis suggests that the external monitoring by the D&O insurer not only motivates insured managers to be more diligent and avoid short-sighted behavior (Core,1997; Yuan et al., 2016), but also helps companies to recruit and retain managers and outside directors (Priest,1987; O'Sullivan, 1997; Boyer and Stern, 2014). On the other hand, the opportunism hypothesis argues that D&O insurance provides "excessive protection" for managers, which reduces their self-interest costs and induces opportunistic behavior such as empire building (e.g., Lin et al., 2011, 2013, 2019; Boyer and Tennyson, 2015; Jia and Tang, 2018).

We are motivated by the two competing arguments to examine how D&O insurance affects firms' investment in labor. As a critical

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input into production and services, labor investment represents roughly two-thirds of economy-wide value-added and is economically significant (Hamermesh, 1995; Bernanke, 2004). Compared with capital investment, labor investment is typically paid out of current revenues, frequently adjusted, and continuously impacts a firm's operating costs, earnings and cash flows (Jung et al., 2014; Merz and Yashiv, 2007; Khedmati et al., 2020). Inefficient labor investment, including both over- and under-investment,[1] can be detrimental to firm growth and shareholder value (Jung et al., 2014).

Previous studies indicate that corporate governance quality is crucial in labor allocation efficiency (Khedmati et al., 2020; Ghaly et al., 2020; Sualihu et al., 2021a, 2021b; Lai et al., 2021), and this is likely for several reasons. First, directors and officers can directly participate in strategic hiring decisions, and second, through their monitoring role, they can mitigate managers' inappropriate appointments for personal benefit. If D&O insurance plays a positive governance role by allowing insurance companies and competent professionals to serve as effective monitors (Core, 1997; O'Sullivan, 1997; Boyer and Stern, 2014), it should reduce managers' short-sighted behavior and improve firm's labor investment efficiency. However, as D&O insurance shields directors and officers from litigation risks and personal liability (Jia and Tang, 2018), it may undermine corporate governance by reducing directors' monitoring effects and inducing managers' risk-taking behavior (e.g., Lin et al., 2011, 2013). If this is the case, insured managers might have greater incentives to build their corporate empires,[2] by increasing wages and salaries to attract more employees or encourage existing employees to stay (Prabowo et al., 2018). These actions can lead to less inefficient labor investment.

China provides an interesting setting for our study. On the one hand, D&O insurance is common in listed firms under common-law jurisdictions (Zou et al., 2008). China is a civil-law socialist country with relatively weak investor protection, and the government has been vigorously developing D&O insurance. Compared to the dispersed ownership structure in mature markets, the concentrated ownership in China may heighten conflicts between controlling and minority shareholders and thus strong managerial entrenchment and opportunistic behavior (Jia and Tang, 2018). On the other hand, China's D&O insurers might have greater incentives to monitor their insured companies given the weak internal and external governance for Chinese firms (Yuan et al., 2016). Therefore, it is interesting to investigate which effect of D&O insurance dominates under the labor investment setting. In addition, the data availability of D&O insurance allows us to overcome data problems and provides us rigorous empirical evidence about the causal impact of D&O insurance on corporate decisions.[3]

Using a sample of 13,574 Chinese firm-year observations during the period of 2006–2018, we find that firms with D&O insurance are associated with lower labor investment efficiency. This negative association is statistically and economically significant, and remains robust under different model specifications (including firm fixed effects). In addition, we find that firms with D&O insurance coverage are more likely to exhibit severe over-investment problems (particularly in terms of over-hiring), consistent with the managerial opportunism hypothesis of D&O insurance. However, the association between D&O insurance and inefficient labor investment may not be casual because the former might be correlated with omitted variables that might bias our findings. We address the potential endogeneity concerns using an instrumental variable (IV) approach, propensity score matching (PSM), and a Heckman estimation with additional selection variables. Our main results remain robust to endogeneity concerns.

We then run a path analysis to formally investigate the economic mechanisms through which D&O insurance affects labor investment efficiency. Consistent with the indirect impact conjecture, path analysis shows that D&O insurance is positively related to a firm's risk-taking, and greater risk-taking leads to worse labor investment efficiency. In addition, we find that D&O insurance is negatively associated with conservative financial reporting whereas aggressive financial reporting leads to lower labor investment efficiency. Meanwhile, we find evidence of significantly lower labor investment efficiency for firms with D&O insurance coverage, even after holding a firm's risk-taking and financial reporting quality constant.

Prior studies document that the opportunistic effect of D&O insurance might be worse when there is severe information asymmetry and weak corporate governance (Lin et al., 2013; Jia and Tang, 2018; Yuan et al., 2016). Consistent with this notion, we find that the negative effect of D&O insurance on labor investment efficiency is more prominent for firms with weak corporate governance, concentrated ownership structure, and a low proportion of female executives. In addition, we also notice that the effect of D&O insurance is much stronger for labor-intensive firms, firms with lower legal risk, as well as less institutional holdings.

We further show that labor investment inefficiency is positively related to the length of time the D&O insurance is held by a firm, suggesting that an insured firm's managerial empire building behavior intensifies over time. In addition, firms that change their insurance coverage but with no changes in CEOs or chairmen are more likely to experience lower labor investment efficiency, suggesting that the negative impact of buying D&O insurance is more severe for incumbent CEOs and chairmen. We also provide evidence that the first successful D&O insurance claim in China alleviates the positive association between D&O insurance and labor investment inefficiency. This implies that the insurance claim event leads to more intensive monitoring of insured firms by the insurance companies,

[1] Over-investment occurs when firms over-hire and/or retain employees working on negative NPV projects, whereas under-investment occurs when firms under-hire and/or over-fire staff on positive NPV projects (Ghaly et al., 2020; Jung et al., 2014).

[2] The empire-building activities of corporate managers increase their firm growth beyond optimal size so that they can have more resources under control (e.g., Hope and Thomas, 2008; Gul et al., 2020). Insured managers might achieve this growth by carrying out excessive investment (Jensen, 1986; Li and Liao, 2014). Sualihu et al. (2021a) argue that it is easier to increase the size of labor force than it is to invest in fixed assets. As a way to build corporate empires and gain more power and influence, over-investment in labor is likely to occur if insured managers increase the number of employees beyond their optimal levels (Stein, 2003). These actions can lead to lower labor investment efficiency.

[3] To promote D&O insurance, the government issued "Opinions on the Reform and Development of the Insurance Industry" and "Opinions on Accelerating the Development of Modern Insurance Service Industry". Despite that, approximately 8% Chinese firms carry D&O insurance coverage compared to 97% in U.S., 86% in Canada, and approximately 70% in Hongkong (Yuan et al., 2016).

which in turn improves labor investment efficiency. Lastly, we provide evidence that labor investment inefficiency leads to worse future firm performance as measured by changes in ROA and Tobin's Q one-, two-, and three-year ahead.

Our study contributes to the literature in several ways. First, we contribute to the growing literature on D&O insurance, and to the best of our knowledge, this study is the first to examine the impact of D&O insurance on firms' labor investment efficiency. Previous studies have focused on the impact of D&O insurance on the cost of debt and equity (Chen et al., 2016; Lin et al., 2013), capital investment efficiency (Li and Liao, 2014), auditing fees (Chung and Wynn, 2014), tax avoidance (Zeng, 2014), stock price crash risk (Yuan et al., 2016), dissenting behavior of independent directors (Jia and Tang, 2018), and corporate innovation (Wang et al., 2020). Our study enriches the literature by exploring a new economic effect of D&O insurance.

Second, we contribute to the understanding of the governance role of D&O insurance in a civil-law socialist country with relatively weak investor protection and concentrated ownership. While previous studies examining D&O insurance have mainly concentrated on developed markets, such research in emerging economies is under-explored. Most written D&O insurance policies in emerging markets are directly translated from insurance products in developed markets, with the translation often vague and the liability boundary blurred. Our findings are consistent with Jia and Tang (2018) that D&O insurance de-incentivizes directors to behave responsibly and diligently, which in turn increases managers' empire building tendencies. Our results suggest that the D&O insurance policies need to be more carefully designed and written for emerging markets.

Third, our study contributes to the growing literature between corporate governance and labor investment efficiency. Prior studies have explored the determinants of labor investment efficiency, including CEO-director ties (Khedmati et al., 2020), institutional investors' horizon (Ghaly et al., 2020), compensation structure (Sualihu et al., 2021a), as well as CEO overconfidence (Lai et al., 2021). However, until this study, no prior studies have systematically examined the impact of firms' corporate risk management practices such as D&O insurance, on labor investment decisions.

2. Institutional background, literature review, and hypothesis

2.1. Institutional background

D&O insurance is commonly used by companies in developed markets to cover their directors and managers for the legal liability arising from their decisions and actions on behalf of the company. For example, 97% of U.S. firms and 86% of Canadian firms carry D&O insurance (Yuan et al., 2016). D&O insurance was introduced relatively late in China. In 2002, the Supreme People's Court issued the *Notice on Accepting Issues Concerning Civil Tort Disputes Caused by False Statements in the Securities Market*, making civil litigations possible in China. Subsequently, several major insurance companies in China launched D&O insurance. At the end of 2002, Vanke Group, a well-known company engaged in real estate development and property management, became the first buyer of D&O insurance. In 2014, the State Council issued *the Opinions on Accelerating Modern Insurance Service Industry* to further promote the development of D&O insurance in China. While the purchase of D&O insurance by Chinese listed firms is low compared to developed markets, the proportion of firms with coverage steadily increased over time to around 10%.

As a new product in China, D&O insurance has encountered many problems in its practice. The majority of the D&O insurance policies are directly translated from overseas products, and the translation can be vague and astringent, with the insurance liability boundary unclear. For example, the exclusion liability scope of insurance companies such as PICC and Ping An Property Insurance is too large, which makes it difficult for the insured companies to receive compensation leading to low levels of monitoring from insurance companies (Jia and Tang, 2018; Wang et al., 2020). In 2006, the AIG Shanghai branch launched the first liability for directors, supervisors, and senior managers for listed companies in China. This product extended the guaranteed target to the subsidiary's management, including the management of relevant personnel, labor and employment negligence, and non-intentional defamation.

A notable example is that the Ministry of Finance in Hunan Province inspected the financial statements of GAC Changfeng Motor Co., Ltd. ("GAC" hereafter; stock code: 600991) in 2008, and found that GAC had illegal acts in its accounting and implementation of national fiscal and taxation policies. Accordingly, the Government imposed administrative penalties on the company and required supplementary tax payments. In 2011, 17 shareholders filed a civil compensation lawsuit with GAC due to its false financial statements. After court mediation between the two parties, GAC incurred litigation costs of RMB 980,000, whereas AIG paid RMB 800,000 to the company in 2012. GAC had already had false representations of bad deeds, whereas these did not prevent GAC from being covered by the D&O insurance. Under the protection of D&O insurance, the management of GAC neglected its responsibilities, which caused a negative impact on the firm. This first successful D&O insurance claim in China highlighted the need for insurers to be vigilant when assessing and monitoring governance risks of their insured firms.

2.2. Literature review

2.2.1. D&O insurance

Previous literature suggests two competing hypotheses about D&O insurance. First, the monitoring hypothesis argues that D&O insurance is an active and effective external governance mechanism, allowing managers to fully display their skills and improve corporate governance. By transferring the occupational risks to the insurance company, Priest (1987) shows that D&O insurance is attractive to, and therefore helps firms hire outstanding talents such as senior managers and independent directors. Holderness (1990) and O'Sullivan (1997) believe that D&O insurance provides monitoring on directors and managers and forces them to engage in responsible conduct and deter wrongdoings. Further, Yuan et al. (2016) find that the effective external monitoring mechanism of insurance companies is important in countries with weak governance and that D&O insurance reduces stock price crash risk in China.

Core (1997) argues that D&O insurance alleviates potential agency problems such as risk aversion, and consistent with this, Wang et al. (2020) show that when managers are freed of litigation risks, they have greater risk-tolerance and invest more in innovation.

The opportunism hypothesis, however, posits that D&O insurance induces severe moral hazard and managerial opportunism, which negatively impacts firm value. For example, D&O insurance is associated with less conservative earnings (Chung and Wynn, 2008; Kim, 2015), higher capital costs (Lin et al., 2013; Chen et al., 2016), lower investment efficiency (Li and Liao, 2014), higher probability of getting a lawsuit (Gillan and Panasian, 2015), greater tax avoidance (Zeng, 2014), less optimistic forecasts by analysts (Boubakri and Bouslimi, 2016), higher auditing fees (O'Sullivan, 2009; Chung and Wynn, 2014), worse IPO performance (Chalmers et al., 2002; Boyer and Stern, 2014), lower announcement-period abnormal stock returns of acquirers (Lin et al., 2011), and a lower bid premium. Collectively, these findings support the negative governance effects of D&O insurance.

There is no consensus in the literature on whether D&O insurance alleviates agency problems or encourages the opportunistic behavior of decision-makers. Although researchers have studied the governance roles of D&O insurance from different perspectives, there is a lack of attention on the impact of D&O insurance on firms' labor investment decisions.

2.2.2. *Labor investment efficiency*

Labor investment is one of the most important corporate investments because it determines its competitive success (Becker, 1962). Efficient labor investment enhances productivity and revenue generation, which ultimately increases firm value (Merz and Yashiv, 2007). Since Pinnuck and Lillis (2007) introduced a model to measure labor investment efficiency, an increasing number of studies have investigated the determinants of efficient labor investment. One branch of studies focuses on the role of information quality in promoting efficient labor investment. For example, High-quality financial reporting (Jung et al., 2014), informed trading (Ben-Nasr and Alshwer, 2016), greater accounting comparability (Zhang et al., 2020), more accurate and less dispersed analyst forecasts (Lee and Mo, 2020; Sualihu et al., 2021b), and higher stock liquidity contribute to more efficient labor investment.

Another branch of studies on labor investment efficiency emphasizes the role of corporate governance quality in promoting efficient labor investment. Ghaly et al. (2020) find that long-term institutional investors can reduce agency conflicts in firms' labor investment decisions and lead to higher labor investment efficiency. Khedmati et al. (2020) find that CEOs who have strong ties with independent board members results in ineffective monitoring, which aggravates the inefficient labor investment problem. Lai et al. (2021) find that firms with overconfident CEOs are more likely to have inefficient labor allocation, typically through over-investing in labor.

Recent studies argue that input misallocation in human capital might be an important reason for the low productivity level in emerging markets (Hsieh and Klenow, 2009; Restuccia and Rogerson, 2013). Apart from information and corporate governance quality, factors such as political uncertainty and promotion incentives also adversely affect labor investment efficiency (Kong et al., 2018; Luo et al., 2020). Our study aims to further advance the literature by examining the impact of D&O insurance on labor allocation decisions.

2.3. *Hypothesis*

Based on the above discussion, there could be two opposite effects of D&O insurance on labor investment efficiency. On the one hand, the purchase of D&O insurance results in additional external monitoring by the insurer. The insurer assesses a firm's corporate governance and risk and then controls management behavior through the D&O insurance contract clauses and pricing (Baker and Griffith, 2007). In addition, insurers' independent assessments provide new information to the market about a firm's corporate governance quality, creating an effective monitoring mechanism (Yuan et al., 2016). The continued monitoring by insurers once a policy is in place reduces principal-agent conflicts, and management over-opportunism (Core, 2000). Further, in a weak internal and external governance setting such as China, D&O insurers have an even greater incentive to monitor their insured firms to minimize future litigation costs (Yuan et al., 2016). Therefore, the branch of studies emphasizing the role of corporate governance quality in labor investment efficiency would predict a positive association between D&O insurance coverage and labor investment efficiency. We call this positive association the "monitoring hypothesis".

On the other hand, D&O insurance might increase a manager's propensity to engage in self-serving actions, which can adversely affect labor investment efficiency. First, D&O insurance reduces the personal legal liability of managers, which might encourage opportunistic risk-taking behaviors. For example, Li and Liao (2014) find that insured managers are more likely to over-invest in fixed assets, highlighting the possibility that these managers engage in empire building activities. Similarly, over-investment in labor can occur if self-interested managers increase the size of labor force beyond its optimal level, so as to engage in empire building and gain more security, power and influence (Stein, 2003; Prabowo et al., 2018; Hall, 2016). Second, insurance companies might find it hard to monitor or directly influence the decision-making of the general operations of insured firms (Lai and Tai, 2019). Particularly, Chinese companies operate in an environment with weak investor protection and inefficient external governance mechanisms. With low litigation risks and weak corporate governance, insured managers are more likely to behave opportunistically by over investing in labor, which ultimately lowers labor investment efficiency. We call this negative association the "opportunism hypothesis".

The above discussions imply that whether D&O insurance affects labor investment efficiency is an empirical question.

H1a. D&O insurance leads to a higher level of labor investment efficiency.

H1b. D&O insurance leads to a lower level of labor investment efficiency.

3. Data and methodology

3.1. Sample construction

Our sample consists of all Chinese A-share firms. The sample period begins in 2006 and ends in 2018. We drop financial firms because firms in the financial industry are highly regulated in China. Then we remove firms with missing financial observations and special treatment (ST*) firms. To construct our final sample of labor investment efficiency, we follow Jung et al. (2014) by excluding firms with less than 30 employees and observations without employee background details. In addition, we remove firm-year observations with missing information for the control variables. Firms' D&O insurance coverage is obtained from the *Chinese Research Data Services* (CNRDS), with the financial information from the *China Stock Market & Accounting Research* (CSMAR) database. The final sample includes 13,574 firm-year observations of 2306 unique firms.

Panel A of Table 1 reports the total number of firms that have purchased D&O insurance in each year during our sample period of 2006–2018. While there is an increasing trend of firms purchasing D&O insurance, the proportion is still relatively low compared to developed markets. Over the whole sample period, 8.4% of companies buy D&O insurance. Panel B of Table 1 shows firms purchasing D&O insurance are distributed unevenly across industries. For example, 47.3% of D&O insurance are purchased by companies in the manufacturing industry, followed by the wholesale and retail industry, which accounts for 11.6% of total purchase.

3.2. Methodology

Following prior literature (e.g., Pinnuck and Lillis, 2007; Jung et al., 2014; Ben-Nasr and Alshwer, 2016), we define abnormal net hiring, namely labor investment inefficiency, as the difference between the actual change in firm's labor investment level and the expected change based on underlying economic fundamentals. Our primary estimate of expected net hiring is based on the Pinnuck and Lillis (2007) model where the percentage change of employees is regressed on several fundamental economic factors:

$$\begin{aligned} NET\_HIRE_{it} = {} & \beta_0 + \beta_1 SALES\_GROWTH_{it} + \beta_2 SALES\_GROWTH_{it-1} + \beta_3 ROA_{it} + \beta_4 \Delta ROA_{it} + \beta_5 \Delta ROA_{it-1} + \beta_6 RETURN_{it} \\ & + \beta_7 SIZE_{it} + \beta_8 QUICK_{it-1} + \beta_9 \Delta QUICK_{it} + \beta_{10} \Delta QUICK_{it-1} + \beta_{11} LEV_{it-1} + \beta_{12} LOSSBIN1_{it-1} + \beta_{13} LOSSBIN2_{it-1} \\ & + \beta_{14} LOSSBIN3_{it-1} + \beta_{15} LOSSBIN4_{it-1} + \beta_{16} LOSSBIN5_{it-1} + Industry + \varepsilon_{it} \end{aligned} \quad (1)$$

where NET_HIRE_{it} is the percentage change in the number of employees from *t-1* to *t*. We control for current and past sales growth ($SALES\_GROWTH_{it}$ and $SALES\_GROWTH_{it-1}$), a firm's profitability and change in profitability (ROA_{it}, ΔROA_{it} and ΔROA_{it-1}), stock returns ($RETURN_{i,t}$), firm size ($SIZE_{it-1}$), liquidity ($QUICK_{it-1}$, $\Delta QUICK_{it}$ and $\Delta QUICK_{it-1}$), financial leverage (LEV_{it-1}), and indicator variables ($LOSSBIN1_{it-1}$, $LOSSBIN2_{it-1}$, $LOSSBIN3_{it-1}$, $LOSSBIN4_{it-1}$, and $LOSSBIN5_{it-1}$) for interval of loss in the magnitude of *ROA* at *t-1*. All the variables are defined in Appendix A. As suggested in previous literature, we also include industry fixed effects in Eq. (1).

After estimating Eq. (1), we apply the estimated coefficients to each firm-year to determine the expected level of net hiring. Our primary measure of abnormal net hiring, *ABRESID,* is the absolute difference between actual net hiring and the expected level, which captures the deviation of labor investment from the economic fundamentals (Jung et al., 2014; Ben-Nasr and Alshwer, 2016). A higher value of *ABRESID* indicates less efficient labor investment. We base *ABRESID* on the Pinnuck and Lillis model due to its conceptual appeal and frequent use in the literature; however, we also consider alternative proxies for expected net hiring detailed in Section 4.7.

After constructing the proxy for the labor investment efficiency, we then examine the impact of D&O insurance on *ABRESID* using Eq. (2):

$$\begin{aligned} ABRESID_{it} = {} & \beta_0 + \beta_1 INSURANCE_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 QUICK_{it} + \beta_5 MB_{it} + \beta_6 PPE_{it} + \beta_7 STD\_SALES_{it} + \beta_8 STD\_CFO_{it} \\ & + \beta 9_9 TOP_{it} + \beta_{10} STD\_NET\_HIRE_{it} + \beta_{11} ABINVEST\_OTHER_{it} + \beta_{12} ROA_{it} + \beta_{13} SOE_{it} + \beta_{14} LABOR\_INTENSITY_{it} \\ & + Industry + Year + \varepsilon_{it} \end{aligned} \quad (2)$$

For the set of control variables, we follow Jung et al. (2014) and include firm size ($SIZE_{it}$), investment opportunity (MB_{it}),liquidity ($QUICK_{it}$), tangibility ($TANGIBLE_{it}$) financial leverage (LEV_{it}), dividend ($DIVNUM_{it}$), loss ($LOSS_{it}$) as well as volatilities of cash flows (STD_CFO_{it}), sales (STD_SALE_{it}), and hiring ($STD\_NET\_HIRE_{it}$), labor intensity ($LABOR\_INTNESITY_{it}$) and other investment ($AB\_INVEST\_OTHER_{it}$). In addition, we control for state owned enterprises (SOE_{it}). These variables are defined in Appendix A. Year and industry fixed effects are controlled for in Eq. (2).

Table 2 presents the sample descriptive statistics. The average value of D&O insurance coverage is 8.4% of companies who have purchased this type of insurance in our sample. Moreover, we find the average of $ABRESID_{it}$ is 0.204 and a standard deviation is 0.357, indicating significant variation of labor investment efficiency in our sample. Overall, our summary statistics are comparable to Kong et al. (2018).

Table 1
Summary statistics.

Panel A: Companies' D&O Insurance purchasing by year.

Year	Number of Firms purchasing D&O	Full Sample	Proportion of firms purchasing D&O (%)
2006	33	584	5.65%
2007	38	674	5.64%
2008	53	713	7.43%
2009	52	795	6.54%
2010	68	886	7.67%
2011	67	941	7.12%
2012	78	961	8.12%
2013	90	1027	8.76%
2014	99	1103	8.98%
2015	103	1101	9.36%
2016	126	1306	9.65%
2017	154	1606	9.59%
2018	176	1877	9.38%
Total	1137	13,574	8.38%

Panel B: Distribution of sample of firms purchasing D&O insurance by industry.

Industry	Number of D&O	D&O (%)
A Agriculture, forestry, livestock, fishery	12	1.06%
B Mining	57	5.01%
C Manufacturing	538	47.32%
D Utilities	68	5.98%
E Construction	26	2.29%
F Wholesale and retail	132	11.61%
G Transportation	131	11.52%
H Hotel and catering industry	0	0.00%
I Information transmission, software, and IT	16	1.41%
K Real estate	94	8.27%
L Leasing and commerce service	17	1.50%
M Scientific research and technology service	1	0.09%
N Environment and public facilities	19	1.67%
Q Health and social work	1	0.09%
R Culture, sports, and entertainment	13	1.14%
S Comprehensive	12	1.06%
Total	1137	100%

This table presents distribution of D&O insurance for A-share firms from 2006 to 2018. Firms in the financial industry are excluded. Panel A presents the distribution of firms with D&O insurance by calendar year and Panel B by industry.

Table 2
Summary statistics.

Variables	N	Mean	P50	Std	P25	P75
$ABRESID_{it}$	13,574	0.204	0.109	0.357	0.052	0.198
$INSURANCE_{it}$	13,574	0.084	0	0.277	0	0
$SIZE_{it}$	13,574	22.42	22.28	1.276	21.56	23.18
LEV_{it}	13,574	0.492	0.502	0.193	0.349	0.640
$QUICK_{it}$	13,574	1.251	0.888	1.229	0.567	1.423
MB_{it}	13,574	1.924	1.531	1.186	1.183	2.191
PPE_{it}	13,574	0.418	0.411	0.184	0.280	0.556
STD_SALES_{it}	13,574	0.238	0.046	1.425	0.019	0.129
STD_CFO_{it}	13,574	0.053	0.015	0.179	0.007	0.039
TOP_{it}	13,574	35.22	33.07	15.17	23.13	46.04
$STD\_NET\_HIRE_{it}$	13,574	0.270	0.130	0.349	0.065	0.286
$ABINV\_OTHER_{it}$	13,574	0.044	0.034	0.047	0.018	0.048
ROA_{it}	13,574	0.052	0.036	0.058	0.016	0.070
SOE_{it}	13,574	0.612	1	0.487	0	1
$LABOR\_INTENSITY_{it}$	13,574	0.079	0.058	0.074	0.028	0.104

This table presents descriptive statistics of variables in our sample. Variable definitions are provided in Appendix A. All continuous variables are winsorized at the 1st and 99th percentiles.

Table 3
D&O insurance and labor investment efficiency - main regressions.

	OLS	Firm Fixed	PW	Difference	$ABRESID_{it+1}$	$ABRESID_{it+2}$
	(1)	(2)	(3)	(4)	(5)	(6)
$INSURANCE_{it}$	0.023**	0.041**	0.024**	0.079**	0.022*	0.024*
	(2.21)	(2.00)	(2.17)	(2.01)	(1.87)	(1.73)
$SIZE_{it}$	−0.018***	−0.045***	−0.018***	0.145***	−0.012***	−0.006
	(−5.06)	(−3.86)	(−4.97)	(6.33)	(−2.60)	(−1.20)
LEV_{it}	0.086***	0.166***	0.088***	0.334***	0.035	−0.020
	(3.80)	(3.93)	(3.81)	(4.60)	(1.16)	(−0.66)
$QUICK_{it}$	−0.002	−0.006	−0.002	0.006	−0.004	−0.007
	(−0.84)	(−1.21)	(−0.78)	(0.87)	(−1.04)	(−1.63)
MB_{it}	−0.015***	−0.020***	−0.016***	−0.010**	0.015***	0.008**
	(−4.64)	(−4.02)	(−4.66)	(−2.22)	(3.44)	(1.98)
PPE_{it}	−0.007	0.106***	−0.006	0.036	−0.056**	−0.061***
	(−0.41)	(2.70)	(−0.32)	(0.60)	(−2.57)	(−2.63)
STD_SALES_{it}	0.004	0.000	0.004	−0.008	0.002	0.001
	(1.39)	(0.39)	(1.34)	(−0.81)	(0.84)	(0.30)
STD_CFO_{it}	−0.017	−0.000	−0.017	−0.034	−0.020	0.004
	(−0.88)	(−0.57)	(−0.86)	(−0.60)	(−1.03)	(0.19)
TOP_{it}	0.000	−0.003***	0.000	0.001	0.000	0.000
	(0.12)	(−4.66)	(0.12)	(1.05)	(1.38)	(0.19)
$STD\_NET\_HIRE_{it}$	0.413***	0.396***	0.418***	0.716***	0.026***	0.004
	(22.16)	(25.61)	(21.62)	(16.51)	(2.79)	(0.38)
$ABINV\_OTHER_{it}$	0.616***	0.736***	0.622***	0.669***	0.199**	0.180**
	(7.12)	(6.35)	(7.13)	(5.54)	(2.38)	(2.14)
ROA_{it}	1.032***	1.504***	1.053***	1.679***	0.064	−0.015
	(12.58)	(13.94)	(12.67)	(12.84)	(0.84)	(−0.23)
SOE_{it}	−0.008	0.009	−0.007	0.007	−0.029***	−0.037***
	(−1.21)	(0.52)	(−1.14)	(0.30)	(−3.80)	(−4.45)
$LABOR\_INTENSITY_{it}$	−0.161***	−0.133***	−0.149***	3.087***	−0.533***	−0.406***
	(−3.25)	(−9.24)	(−2.89)	(9.05)	(−9.25)	(−7.41)
CONSTANT	0.491***	1.210***	0.488***	0.015	0.568***	0.459***
	(6.05)	(4.88)	(5.87)	(0.41)	(5.57)	(4.15)
Year	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES
N	13,574	13,574	13,574	10,734	10,734	8601
Adj_R^2	0.229	0.185	0.227	0.235	0.036	0.029

This table presents regression results of the impact of D&O insurance on labor investment efficiency with three alternative models. We present the basic OLS regression results in Column (1), fixed firm regressions in Column (2), the Paris-Winsten regressions in Column (3), and the difference regression in Column (4). Further, the level of $ABRESID_{it}$ in year t + 1 and t + 2 are used as the dependent variable in columns (5) and (6) respectively. All the variables are defined in Appendix A. T-statistics are presented in parentheses, with standard errors clustered at the firm level. ***, **, * indicates significance at 1%, 5%, and 10%, respectively.

4. Results

4.1. Empirical results

The results on the association between D&O insurance and labor investment efficiency are presented in Table 3. Column (1) shows that $INSURANCE_{it}$ is positive and significant at the 5% level, suggesting that firms with D&O coverage are more likely to have less efficient labor investment. A one standard deviation increase in D&O insurance would lead to a 1.78%[4] increase in $ABRESID_{it}$. For the control variables,[5] we find that $SIZE_{it}$, MB_{it}, and $LABOR\_INTENSITY_{it}$ are significantly negatively related to the labor investment efficiency proxy. These results show that larger firms, firms with more investment opportunities, and labor-intensive firms invest in labor more efficiently. On the other hand, leverage, hiring volatility, other investment, and ROA_{it} are significantly positive indicators of the labor investment proxy at the 1% or 5% levels, meaning that these types of firms have poorer labor investment efficiency. The results for the control variables are also similar to those in Jung et al. (2014). Overall, these findings support *H1b* that D&O insurance leads to a lower level of labor investment efficiency.

The rest of Table 3 reports the results of estimating regression Eq. (2) with different approaches to ensure the robustness of our findings. One potential concern is that D&O insurance and labor investment efficiency may be jointly determined by unobservable factors. We further address this concern using the firm-fixed effects approach in Column (2). Moreover, in Column (3), we use the Prais-Winsten (PW) procedures to account for serial correlation in the error term. To capture the change of labor investment efficiency in

[4] 0.0178 = 0.023*0.277/0.357

[5] Following Kong et al. (2018), we control for firm characteristics and economic variables at year t. In unreported tables, we re-run Eq. (2) by using control variables at year t-1 and find similar results. We thank the referee for pointing this out.

subsequent years, we employ a differential model and report the empirical findings in Column (4). Further, we also replace *ABRESID* in year *t*, with *ABRESID* in $t+1$ and $t+2$ and report the results in Columns (5) and (6). Overall, our results suggest that the coefficients for $INSURANCE_{it}$ remain positive and significant, corroborating our baseline result. Taken together, the results suggest that our baseline finding that D&O insurance lowers labor investment efficiency is not confounded by unobservable firm characters or potential cross-sectional correlation of the regression residuals. Moreover, such an effect lasts at least two years.

4.2. Over-investment or under-investment?

Next, we analyze whether the positive association between D&O insurance and labor investment inefficiency is due to over- or under-investment decisions in labor. Following Jung et al. (2014), we further divide the full sample into overinvestment and underinvestment subsamples. Overinvestment (underinvestment) is defined as firms with a positive (negative) sign on the residuals from Eq. (1). Overall, about 69% of the firms underinvest in labor and 31% overinvest. The empirical findings are reported in Columns (1) and (2) of Table 4. The coefficient of $INSURANCE_{it}$ continues to be positive and significant at the 1% level in the overinvestment subsample. However, we cannot conclude the same results for the underinvestment subsample. We further decompose the over- and under- investment into four groups: over-hiring, under-firing, under-hiring, and over-firing. In Columns (3) to (6) of Table 4, the coefficient of $INSURANCE_{it}$ is positive and significant at a 5% level only in the over-hiring sample. Overall, our results suggest that the D&O insurance induces executives to overinvest in labor, particularly through over-hiring, which in turn lowers the labor investment efficiency. These findings support our prediction that insured managers are likely to empire build through increasing the size of their firm's labor force.

4.3. Endogeneity concerns

As a firm's decision to purchase D&O insurance may not be random, we next address the potential endogeneity problem between D&O insurance and corporate labor investment decisions. Specifically, we employ techniques such as IV, PSM and Heckman two-stage regressions.

First, following Lin et al. (2011), we use the industry average D&O insurance incidence as the instrument variable of $INSURANCE_{it}$. To compete for talents with other companies, a company's compensation incentive plan for managers may be influenced by their peers. Meanwhile, companies in the same industry are often faced with similar litigation risks. Therefore, the purchase of directors and officer's liability insurance of other companies in the same industry may affect the purchase decision of a company. In addition, local companies in cities with a larger expansion of degree of openness to foreign companies, are more likely to be influenced by other countries' culture and foreign firms' behavior. We use the *National Development and Reform Commission of China* measure of the relative openness of a region. Generally, the higher the degree of openness to foreign companies of a region, the greater the influence of foreign countries, and the stronger the tendency to buy directors' liability insurance. However, these two variables are not likely to be correlated with a firm's labor investment efficiency.

The results from the 2SLS analysis are reported in Columns (1) and (2) of Table 5. In the first stage, we estimate D&O insurance as a function of our instrumental variables ($MEAN\_INSURANCE_{it}$, $OPENNESS\_INDEX_{it}$), and other control variables in Eq. (2). The results from the first-stage analysis in Column (1) indicate that, as expected, the two IVs are significantly positively correlated with $INSURANCE_{it}$ and the F-test (*Cragg-Donald F-test Statistics* = *120.61*) indicates that the two variables are not weak instruments (*Sargan-Statistics* = 2.32). As we can see from the results for the second-stage regression reported in Column (2), the coefficients of $INSURANCE_{it}$ remain significantly positive. These results reinforce our main findings that D&O insurance exacerbates inefficient labor investment.

Second, we adopt a propensity score matching (PSM) approach to mitigate potential selection bias, since firms with D&O insurance might be systematically different from firms without insurance. Specifically, we estimate a Probit model to predict the effect of D&O insurance on labor investment efficiency by including firm-specific control variables in our baseline regression. Then we perform a 1:2 matching[6] on propensity scores. We obtain a final sample of 2949 observations, and there is no significant difference between the treated sample and the matched sample.[7] Therefore, endogeneity is less of a concern in the matched sample. Column (3) of Table 5 presents the OLS regression results using the matched sample. The coefficients for $INSURANCE_{it}$ remain positive and statistically significant, suggesting that our main results hold after controlling for potential self-selection bias.

Finally, we adopt a Heckman two-stage method to control the potential interference of endogeneity. Following Yuan et al. (2016), we add five additional variables[8] that may affect the purchase of D&O insurance. Results are reported in Columns (5) and (6) of Table 5. The first-stage regression results are consistent with Yuan et al. (2016). We calculate the Inverse Mills Ratio (IMR) of D&O insurance purchased by each company and add it into the second-stage regression. Column (6) confirms our main results as $INSURANCE_{it}$ remains significantly negative, suggesting that our results are robust to selection bias.

[6] We also adopt other matching techniques (i.e., 1:3 and 1:4 matching) and the matching without replacement as alternatives and the results remain qualitatively unchanged.

[7] Appendix C presents the results of univariate analysis of the propensity score-matched sample. By comparing the mean of all independent variables in the matched sample, we find all control variables are not significantly different.

[8] These variables are proportion of independent directors (*INDEP*), whether firm *i* is cross-listed (*CROSS-LIST*), balance of large shareholders' rights (*BALANCE*), industry average purchasing of D&O insurance ($MEAN\_INSURANCE_{)}$ and firms' growth value (*TOBINQ*) in year *t*.

Table 4
D&O insurance and labor investment efficiency - subsample analysis.

	Over investment	Under investment	Over hiring	Under firing	Under hiring	Over firing
	(1)	(2)	(3)	(4)	(5)	(6)
$INSURANCE_{it}$	0.074***	0.001	0.083**	0.014	0.003	−0.013
	(2.76)	(0.12)	(2.34)	(0.54)	(0.49)	(−0.81)
$SIZE_{it}$	−0.000	−0.011***	−0.006	0.001	−0.014***	0.008
	(−0.04)	(−4.21)	(−0.54)	(0.04)	(−5.01)	(1.19)
LEV_{it}	−0.065	0.060***	−0.053	−0.072	0.065***	0.034
	(−1.31)	(3.45)	(−0.75)	(−1.20)	(3.25)	(1.16)
$QUICK_{it}$	−0.006	−0.003	−0.020**	0.008	−0.003	−0.003
	(−1.05)	(−1.46)	(−2.51)	(1.13)	(−1.22)	(−0.90)
MB_{it}	−0.021***	−0.001	−0.025***	−0.003	−0.003	0.015***
	(−3.09)	(−0.27)	(−2.77)	(−0.32)	(−0.94)	(3.35)
PPE_{it}	0.011	−0.028**	0.040	−0.056	−0.026*	−0.074**
	(0.25)	(−2.22)	(0.68)	(−1.00)	(−1.86)	(−2.46)
STD_SALES_{it}	0.017*	0.002	0.018	0.007	0.002	0.010
	(1.86)	(1.48)	(1.52)	(0.93)	(1.41)	(0.49)
STD_CFO_{it}	−0.201**	−0.004	−0.216**	−0.122	−0.000	−0.074
	(−2.30)	(−0.36)	(−2.09)	(−0.38)	(−0.02)	(−0.71)
TOP_{it}	−0.000	0.000	−0.000	−0.001	0.000	0.000
	(−0.51)	(1.54)	(−0.43)	(−1.03)	(1.58)	(0.38)
$STD\_NET\_HIRE_{it}$	0.944***	0.066***	1.033***	0.561***	0.064***	0.085***
	(24.16)	(10.66)	(23.44)	(6.86)	(9.86)	(4.50)
$ABINV\_OTHER_{it}$	0.498***	0.195***	0.357**	0.373	0.197***	0.192
	(3.33)	(3.37)	(2.16)	(1.01)	(3.27)	(1.09)
ROA_{it}	1.016***	0.484***	1.101***	0.143	0.509***	0.224**
	(7.02)	(7.69)	(6.22)	(0.69)	(7.18)	(2.15)
SOE_{it}	0.012	−0.017***	0.009	−0.001	−0.017***	−0.012
	(0.80)	(−4.30)	(0.51)	(−0.03)	(−4.02)	(−1.36)
$LABOR\_INTENSITY_{it}$	0.127	−0.434***	0.087	0.145	−0.443***	−0.365***
	(1.22)	(−13.56)	(0.63)	(1.09)	(−12.31)	(−6.54)
CONSTANT	0.082	0.418***	0.177	0.230	0.491***	0.048
	(0.40)	(8.06)	(0.68)	(0.56)	(8.53)	(0.33)
Year	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES
N	4207	9367	2943	1264	8356	1011
Adj_R^2	0.466	0.112	0.499	0.253	0.112	0.123

This table extends of main analysis and separately examine the relationship between D&O insurance and labor overinvestment and underinvestment (hirings and firings). Then in Columns (3) to (6) we divide the over- (under-) investment groups into over-hiring and under-firing (under-hiring and over-firing) subgroups before re-estimating the impact of D&O insurance on each subsample. All variables are defined in Appendix A. Year and industry effects are controlled. T-statistics are presented in parentheses, with standard errors clustered at the firm level. ***, **, * indicates significance at 1%, 5%, and 10%, respectively.

4.4. Path analysis of effects of D&O insurance on labor investment efficiency

Next, we examine economic mechanisms through which D&O insurance affects the labor investment efficiency of a firm using path analysis. Path analysis allows us to test whether the negative association between D&O insurance and labor investment efficiency is directly due to D&O insurance inducing overinvestment, or indirectly due to D&O insurance increasing a company's risks or opportunistic financial reporting,[9] which subsequently leads to less efficient labor investment. The mediating variables in the indirect channel are therefore a firm's risk level ($RISK_{it}$) and financial information quality ($INFO\_QLTY_{it}$).

Following Pevzner et al. (2015), we estimate a structural equation model (SEM) including regression of labor investment inefficiency ($ABRESID_{it}$) on D&O insurance ($INSURANCE_{it}$) and the mediating variables ($RISK_{it}$ and $INFO\_QLTY_{it}$), and a regression of the mediating variables on D&O insurance, with control variables in both regressions. The *SEM* is specified as follows:

$$ABRESID_{it} = \alpha_0 + \alpha_1\ INSURANCE_{it} + \alpha_2\ RISK/INFO\_QLTY_{it} + \Sigma\alpha_j\ Controls_{it} + \varepsilon_{it} \quad (3)$$

$$RISK/INFO\_QLTY_{it} = \beta_0 + \beta_1\ INSURANCE_{it} + \Sigma\beta_j\ Controls_{it} + \varepsilon_{it} \quad (4)$$

[9] Previous studies suggest that the decision to purchase D&O insurance might increase a company's risk-taking level which triggers unexpected moral hazards and induces managerial opportunistic behavior. For example, Chung and Wynn (2008) and Lin et al. (2013) suggest that D&O insurance protects managers from shareholder lawsuits, which in turn weakens the supervisory punishment effect and aggravates managerial opportunistic behavior. In addition, D&O insurance worsens the quality of the company's financial reports and reduces information disclosure. While the greater the coverage of D&O insurance, the lower the company's expected litigation risk and the less stable of company's earnings.

Table 5
D&O insurance and labor investment efficiency - endogeneity concerns.

	IV		PSM	HECKMAN	
	First Stage	Second Stage	Matched Sample	First Stage	Second Stage
	(1)	(2)	(3)	(4)	(5)
$INSURANCE_{it}$		0.184**	0.029**		0.018*
		(2.19)	(2.23)		(1.70)
$SIZE_{it}$	0.036***	−0.014***	−0.013**	0.158***	−0.024***
	(12.67)	(12.67)	(−2.05)	(7.77)	(−5.65)
LEV_{it}	0.072***	0.071***	0.117**	0.642***	0.074***
	(3.94)	(2.96)	(2.49)	(4.71)	(3.22)
$QUICK_{it}$	0.006**	−0.002	0.004	0.058***	−0.003
	(2.29)	(−0.64)	(0.62)	(2.80)	(−1.28)
MB_{it}	0.008***	−0.012***	−0.023***	0.004	−0.016***
	(2.95)	(−3.49)	(−3.43)	(0.12)	(−4.80)
PPE_{it}	−0.018	−0.007	0.048	−0.167	−0.000
	(−1.17)	(−0.37)	(1.32)	(−1.52)	(−0.00)
STD_SALES_{it}	0.004	0.003	0.005	0.008	0.003
	(1.61)	(1.14)	(1.55)	(0.67)	(1.28)
STD_CFO_{it}	0.132***	−0.011	−0.047*	0.210**	−0.024
	(6.81)	(−0.57)	(−1.77)	(2.05)	(−1.23)
TOP_{it}	−0.001***	0.000	0.000	−0.001	0.000
	(−5.05)	(0.03)	(0.30)	(−0.66)	(0.50)
$STD\_NET\_HIRE_{it}$	−0.015**	0.337***	0.384***	−0.061	0.412***
	(−2.18)	(8.84)	(10.37)	(−1.24)	(21.96)
$ABINV\_OTHER_{it}$	0.051	0.502***	0.646***	0.497	0.608***
	(0.99)	(5.00)	(3.31)	(1.35)	(6.97)
ROA_{it}	−0.068	0.841***	1.155***	−0.288	1.032***
	(−1.51)	(7.03)	(6.35)	(−0.82)	(12.44)
SOE_{it}	0.037***	−0.006	−0.010	0.235***	−0.015**
	(7.08)	(−0.88)	(−0.70)	(5.72)	(−2.23)
$LABOR\_INTENSITY_{it}$	0 0.153***	−0.129**	−0.217*	0.740***	−0.182**
	(4.13)	(−2.54)	(−1.78)	(2.65)	(−3.51)
$OPENNESS\_INDEX_{it}$	0.022***				
	(12.18)				
$MEAN\_INSURANCE_{it}$	0.927***			5.678***	
	(9.58)			(8.17)	
$CROSS\_LIST_{it}$				0.838***	
				(17.64)	
$SHARE\_BALANCE_{it}$				0.001**	
				(2.53)	
$INDEP_{it}$				0 0.907***	
				(2.96)	
$TOBINQ_{it}$				0.025	
				(1.38)	
IMR					−0.033***
					(−2.61)
$CONSTANT$	−0.8311***	0.386***	0.460***	−6.270***	0.700***
	(−13.01)	(4.27)	(2.76)	(−13.14)	(6.14)
Year	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES
N	13,571	13,571	2949	13,415	13,415
Adj_R^2	0.0844	0.229	0.214	0.153	0.228

This table presents Columns (1) and (2) present the 2SLS regression results on the association between D&O insurance and labor investment efficiency. Our sample consists of 13,571 firm-year observations. The first instrumental variable $MEAN\_INSURANCE_{it}$ is the average number of D&O insurance purchasing firms within the same industry, except for the firm itself. The second instrumental variable $OPENNESS\_INDEX_{it}$ is the level of the openness for each city according to the *OPNNESS_INDEX*$_{it}$ issued by *National Development and Reform Commission* (NDRC). Columns (3) and (4) present the association between D&O insurance and labor investment efficiency using propensity score matching and PSM-DID regression. Columns (5) and (6) present the association between D&O insurance and labor investment efficiency using a Heckman two-stage selection model. All variables are defined in Appendix A. Year and industry effects are controlled. T-statistics are presented in parentheses, with standard errors clustered at the firm level. ***, **, * indicates significance at 1%, 5%, and 10%, respectively.

where all the control variables are defined in Eq. (2). We follow Faccio et al. (2011) and John et al. (2008) by using: (1) the volatility of a company's return on total assets adjusted by industry and annual average ($RISK1_{it}$); and (2) the difference between the maximum and minimum return on assets (ROA_{it}) adjusted by the industry and annual average ($RISK2_{it}$) as proxies for firm-level risks ($RISK_{it}$). For financial information quality ($INFO\_QLTY_{it}$), we follow Jones (1991) and Lin et al. (2013) by constructing (1) the discretionary accruals estimated by the Jones model (EM_{it})[10]; and (2) the likelihood of financial restatement ($RESTATE_{it}$).

The direct path of D&O insurance on labor investment inefficiency is measured by β_1 in Eq. (3), which is expected to be significantly positive to support *H1b*. The indirect path of D&O insurance on labor investment inefficiency is measured by the product of β_1 and α_2, which is expected to be positive and significant if D&O insurance indirectly impacts labor investment decisions through increasing firms' risk-taking and opportunistic financial reporting.

The results are presented in Table 6, with Panel A showing the path analysis results using firm risk-taking level as the mediating variable. The results suggest that regardless of which risk-taking proxy ($RISK1_{it}$ or $RISK2_{it}$) is used, the coefficient of D&O insurance remains positive at a 10% significance level. The direct coefficient α_1 of D&O insurance on $ABRESID_{it}$ is 0.021($RISK1_{it}$) and 0.020 (*RISK2*), respectively, with t-values above 1.9. The results support the direct channel that D&O insurance leads to less efficient labor investment decisions. The coefficients of $INSURANCE_{it}$ and $RISK1_{it}$ or $RISK2_{it}$ (β_1) are 0.007 and 0.012 with both *t*-values above 3.5, supporting our predictions that D&O insurance increases firm-level risks. The coefficients of $RISK1_{it}$ or $RISK2_{it}$ (α_2) on $ABRESID_{it}$ are 0.465 and 0.252 with *t*-values above 7.7, suggesting that risky firms have lower labor investment efficiency. The indirect effect of D&O insurance on labor investment inefficiency through the mediating variables is 0.003 ($\alpha_{2*}\beta_1$), and statistically significant at 1% level. The economic magnitude is on average 13% (0.003/0.023) of the direct effect. Similarly, Panel B of Table 6 reports the impact of the possible path of financial information quality ($INFO\_QLYT_{it}$) on labor investment inefficiency. Same as $RISK_{it}$, our results indicate that D&O insurance lowers labor investment efficiency by encouraging opportunistic financial reporting, and the economic magnitude is on average 8.7% (0.002/0.023) of the direct effect.

The above results indicate a relatively weak indirect path explanation that D&O insurance aggravates labor investment inefficiency through increasing firm-level risks or lowering financial reporting quality. Overall, our results suggest that the negative impact of D&O insurance on labor investment efficiency is predominantly due to the direct path that D&O insurance encourages managerss over-hiring decisions, which ultimately lowers the labor investment efficiency. Our findings further support the managerial empire building behavior of insured firms.

4.5. Cross-sectional analysis

4.5.1. The role of internal governance quality

In this subsection, we examine whether the effect of D&O insurance is larger for firms with poorer corporate governance. Lack of effective monitoring by directors and others, enables managers to empire build and thus lowers labor investment efficiency. Specifically, we use the following three metrics to proxy for internal corporate governance quality. The first metric follows Jiang and Yuan (2018) in using nine variables to construct a corporate governance index (*CGI*) for each firm-year observation.[11]e The second metric is the internal control index (*ICQ*) as computed by Chen et al. (2020). It is a process for assuring timely feedback on the achievement of operational or strategic goals, reliable financial reporting, and compliance with laws and regulations. A higher *ICQ* indicates better corporate governance. The third metric is the ratio of female executives. Female managers are usually more risk-averse and more conservative. For example, Faccio et al. (2016) note that the gender of executives is an important factor affecting corporate risk-taking, and compared with males, females are more prudent and conservative. Therefore, we believe the effect of D&O insurance on management practice is likely to be more obvious among males than among females.

We divide our sample into low- and high- corporate governance subsamples based on the median value of *CGI*, *ICQ*, and proportion of female executives. The results are presented in Panel A, Table 7. The relation between D&O insurance and $ABRESID_{it}$ is significantly positive only in the subsamples of firms with poorer corporate governance, as presented in Columns (1), (3), and (5). In addition, the magnitude of the coefficients of $INSURANCE_{it}$ is larger for the low-quality groups, suggesting that the impact of D&O insurance on labor investment efficiency is more pronounced for firms with poorer corporate governance.

[10] To compute modified Jones EM, we first estimate Eq.(5) cross-sectionally by year and industry:

$$ACCRUAL_{it} = \alpha_0 + \alpha_1\left(\frac{1}{ASSETS_{it-1}}\right) + \alpha_2(\Delta \mathrm{SALES_{it}} - \Delta \mathrm{AR_{it}}) + \alpha_3 \mathrm{PPE_{it}} + \varepsilon_{it} \quad (5)$$

where *ACCRUAL* is total accruals scares by lagged total assets. $\Delta SALES_{it}$ is change in sales scared by lagged total assets. $\Delta AR_{it}$is change in account receivable scaled by lagged total assets. *PPE* is net property, plant, and equipment scaled by lagged total assets. Then we compute EM using Eq. (6):

$$EM = ACCRUAL_{it} - \widehat{\alpha_0} - \widehat{\alpha_1}\left(\frac{1}{ASSETS_{it-1}}\right) - \widehat{\alpha_2}(\Delta \mathrm{SALES_{it}} - \Delta \mathrm{AR_{it}}) - \widehat{\alpha_3} \mathrm{PPE_{it}} \quad (6)$$

where $\widehat{\alpha_0}, \widehat{\alpha_1}, \widehat{\alpha_2}$,and $\widehat{\alpha_3}$ are estimates of α_0, α_1, α_2, *and*$\alpha_3$from Eq. (5).

[11] The nine variables are proportion of shares held by the largest shareholder (*LARGEST*), managerial holdings (*MHOLD*), institutional holdings *(INSTITUTION*), analyst coverage (*ANALYST*), ratio of independent directors (*INDEP*), sum of the square of ownership from the 2nd to 10th largest shareholders (*SHARE2_10*), cross listing (*BHSHARE*), audited by one of the top four accounting firms (*BIG4*), and SOE. For each year, we sort the firms based on each of the first eight variables in descending order, while SOE is sorted in ascending order. Then the ranking of all firms is generated accordingly for each variable. We next divide the ranking by the total number of observations in that year and multiply the resulting measure by 100 to obtain a normalized value from 0 to 100. The firm's CGI is constructed as the equally weighted average of all the nine rankings for the nine variables of each firm. A higher value of CGI suggests better corporate governance for the firm.

Table 6
Path analysis of effects of D&O insurance on labor investment efficiency.

Panel A: Risk-taking proxies as the mediating variables.

	PATH = $RISK1_{it}$	PATH = $RISK2_{it}$
	(1)	(2)
Direct Path		
α_1:P ($INSURANCE_{it}$, $ABRESID_{it}$)	0.021*	0.020*
	(1.94)	(1.92)
Mediated Path		
β_1:P ($INSURANCE_{it}$, $RISK_{it}$)	0.007***	0.012***
	(3.46)	(3.47)
$SIZE_{it}$	−0.012***	−0.022***
	(−16.48)	(−16.55)
LEV_{it}	0.050***	0.091***
	(8.51)	(8.54)
$QUICK_{it}$	0.000	0.001
	(0.62)	(0.72)
MB_{it}	0.001	0.002
	(0.89)	(1.08)
PPE_{it}	−0.001	−0.000
	(−0.16)	(−0.02)
STD_SALES_{it}	−0.000	−0.000
	(−0.18)	(−0.32)
STD_CFO_{it}	0.009***	0.016***
	(3.58)	(3.68)
TOP_{it}	−0.000**	−0.000**
	(−2.18)	(−2.30)
$STD\_NET\_HIRE_{it}$	0.012***	0.022***
	(6.35)	(6.48)
$ABINV\_OTHER_{it}$	0.115***	0.211***
	(7.27)	(7.37)
ROA_{it}	0.265***	0.487***
	(13.80)	(13.97)
SOE_{it}	−0.011***	−0.021***
	(−8.79)	(−9.02)
$LABOR\_INTENSITY_{it}$	−0.023**	−0.041**
	(−2.09)	(−2.11)
CONSTANT	0.280***	0.280***
	(17.20)	(17.20)
Year	YES	YES
Industry	YES	YES
Adj_R^2	0.129	0.131
α_2:P ($RISK_{it}$, $ABRESID_{it}$)	0.465***	0.252***
	(7.69)	(7.67)
$\alpha_2\beta_1$: P ($INSURANCE_{it}$, $RISK_{it}$)*	0.003***	0.003***
P ($RISK_{it}$, $ABRESID_{it}$)	(3.20)	(3.22)
N	13,524	13,574

Panel B: Financial reporting proxies as the mediating variables.

	Path = EM_{it}	Path = $RESTATE_{it}$
	(1)	(2)
Direct Path		
α_1:P($INSURANCE_{it}$, $ABRESID_{it}$)	0.022**	0.023**
	(2.05)	(2.16)
Mediated Path		
β_1:P($INSURANCE_{it}$, $INFO\_QLTY_{it}$)	0.004**	0.020*
	(2.13)	(1.76)
$SIZE_{it}$	−0.010***	−0.017***
	(j14.96)	(−4.66)
LEV_{it}	0.075***	0.119***
	(18.16)	(4.71)
$QUICK_{it}$	0.003***	u−0.003
	(5.17)	(st0.91)
MB_{it}	−0.000	0.003
	(−0.79)	(0.93)
PPE_{it}	0.008**	−0.032
	(2.56)	(−1.61)

(*continued on next page*)

Table 6 (*continued*)

Panel B: Financial reporting proxies as the mediating variables.

	Path = EM_{it}	Path = $RESTATE_{it}$
	(1)	(2)
STD_SALES_{it}	−0.002***	−0.001
	(−3.73)	(−0.47)
STD_CFO_{it}	0.041***	−0.039***
	(5.99)	(−2.65)
TOP_{it}	0.000***	−0.001***
	(2.83)	(h3.54)
$STD\_NET\_HIRE_{it}$	0.004***	0.023**
	(3.01)	(2.52)
$ABINV\_OTHER_{it}$	0.057***	0.034
	(4.46)	(0.52)
ROA_{it}	0.334***	−0.102
	(26.85)	(a−1.54)
SOE_{it}	n0.003***	−0.011
	(−3.00)	(−1.55)
$LABOR\_INTENSITY_{it}$	−0.037***	−0.093*
	(−4.67)	(−1.86)
CONSTANT	0.219***	0.618***
	(15.03)	(7.20)
Year	YES	YES
Industry	YES	YES
Adj_R^2	0.181	0.022
α_2:*P (Path,* $ABRESID_{it}$*)*	0.441***	0.028***
	(6.94)	(3.53)
$\alpha_2\beta_1$: *P (*$INSURANCE_{it}$*,* $INFO\_QLTY_{it}$*)* *	0.002**	0.001*
P ($INFO\_QLTY_{it}$*,* $ABRESID_{it}$*)*	(2.71)	(1.71)
N	13,565	13,574

This table reports path analysis estimates of the relation between D&O insurance and labor investment efficiency. The mediating variables in Panel A are firmsg' risk-taking proxies ($RISK1_{it}$ and $RISK2_{it}$). The mediating variables in Panel B are firm financial reporting quality (EM_{it} and $RESTATE_{it}$). All variables are defined in Appendix A. All regressions control for industry fixed effects and year fixed effects. t-statistics is based on standard errors clustered at the firm level. ***, **, and * stand for statistical significance at the 1%, 5% and 10% level, respectively.

4.5.2. The role of labor intensity, legal status, and institutional investors

Next, we explore the role of other factors on the relationship between D&O insurance and labor investment efficiency. The results are reported in Panel B, Table 7. Prior studies suggest that labor-intensive firms have greater labor investment, which makes labor investment efficiency more critical for them (Cao and Rees, 2020; Ghaly et al., 2020; Khedmati et al., 2020). To further explore our results across firms with different labor intensities, we split our sample into high- and low-labor intensive firms based on the median value of the ratio of labor costs to sales. The results are presented in Columns (1) and (2) and suggest that D&O insurance significantly reduces labor investment efficiency only in high labor-intensive firms.

In addition, a firm's legal status might be critical to managers' risk-taking behavior. For example, firms currently with greater exposure to lawsuits might experience more intensive monitoring from outside investors and insurance companies and thus are more likely to invest cautiously. Following Wu et al. (2020), we collect the data of a firm's current lawsuits from *CNRDS* and divide our sample into two groups based on whether firms are currently involved in lawsuits, or not. Columns (3) and (4) of Panel B, Table 7 show that $INSURANCE_{it}$ is only significantly positive in the lower legal risk subsamples. This finding is in line with our prediction that external monitoring can reduce the negative impact of D&O insurance on labor investment efficiency.

Further, Ghaly et al. (2020) suggest that the monitoring of institutional investors can effectively reduce labor investment inefficiency. As such, firms with a lower level of institutional investors would experience less monitoring. To investigate the impact of institutional investors on the relationship between D&O insurance and labor investment inefficiency, we divide the sample into two groups based on the median value of the proportion of shareholding by institutional investors. Consistent with Ghaly et al. (2020), we find that the positive impact of D&O insurance and labor investment inefficiency is more pronounced in the subsample of firms with a low proportion of institutional investor shareholding.[12]

[12] We also divide our sample into two subgroups based on whether a firm has political connections or is state-owned, respectively. Jia et al. (2019) find that political connections protect managers and directors against legal liability, and therefore are substitutes of D&O insurance. However, in untabulated results we find that the significantly positive relationship between *INSURANCE* and *ABRESID* remains for all subsamples, and the coefficients are not significantly different, indicating that D&O insurance induces managers' overinvestment in labor regardless of their political connections.

Table 7

Panel A- Governance quality, internal control quality, and the fraction of female directors.

	LOW GI	HIGH CGI	LOW ICQ	HIGH ICQ	LOW FEMALE	HIGH FEMALE
	(1)	(2)	(3)	(4)	(5)	(6)
	0.042***	−0.011	0.028*	0.010	0.027**	0.016
$INSURANCE_{it}$	(2.64)	(−0.76)	(1.72)	(0.73)	(1.98)	(0.96)
	−0.023***	0.003	−0.009	−0.005	−0.016***	−0.020***
$SIZE_{it}$	(−4.18)	(0.48)	(−1.52)	(−1.02)	(−3.28)	(−3.23)
	0.110***	0.046	0.077**	0.034	0.078**	0.091***
LEV_{it}	(2.81)	(1.56)	(2.50)	(1.05)	(2.33)	(2.90)
	−0.003	−0.002	−0.003	−0.002	−0.003	−0.002
$QUICK_{it}$	(−0.61)	(−0.45)	(−0.96)	(−0.59)	(−0.69)	(−0.67)
	−0.029***	0.005	−0.010**	−0.017***	−0.020***	−0.012***
MB_{it}	(−5.87)	(1.00)	(−2.24)	(−3.76)	(−4.08)	(−2.64)
	−0.045	0.028	0.000	−0.015	−0.003	−0.008
PPE_{it}	(−1.58)	(1.15)	(0.00)	(−0.58)	(−0.10)	(−0.30)
	0.003	0.033	0.006	0.004	0.002	0.019
STD_SALES_{it}	(1.13)	(1.50)	(0.62)	(1.51)	(0.64)	(1.04)
	−0.015	−0.145	0.030	−0.036*	0.000	−0.107*
STD_CFO_{it}	(−0.75)	(−1.28)	(0.44)	(−1.69)	(0.01)	(−1.66)
	0.000	0.000	0.000	−0.000	0.000	−0.000
TOP_{it}	(0.79)	(0.61)	(0.18)	(−0.34)	(0.30)	(−0.05)
	0.422***	0.398***	0.472***	0.356***	0.399***	0.429***
$STD\_NET\_HIRE_{it}$	(16.60)	(13.67)	(16.58)	(14.68)	(15.80)	(15.30)
	0.568***	0.628***	0.792***	0.383***	0.594***	0.640***
$ABINV\_OTHER_{it}$	(4.85)	(4.76)	(6.03)	(3.53)	(5.03)	(5.03)
	1.134***	1.033***	1.332***	0.740***	0.991***	1.081***
ROA_{it}	(9.54)	(7.75)	(11.53)	(6.43)	(8.22)	(9.55)
	−0.004	−0.022**	−0.011	0.002	−0.008	−0.006
SOE_{it}	(−0.42)	(−2.46)	(−1.31)	(0.20)	(−0.94)	(−0.71)
	−0.128	−0.155**	−0.180**	−0.098	−0.131*	−0.181**
$LABOR\_INTENSITY_{it}$	(−1.58)	(−2.26)	(−2.48)	(−1.49)	(−1.94)	(−2.48)
	0.584***	0.027	0.290**	0.258**	0.475***	0.485***
CONSTANT	(4.80)	(0.17)	(2.10)	(2.37)	(4.34)	(3.57)
Year	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES
N	6492	6477	6781	6787	7080	6494
Adj_R^2	0.234	0.222	0.298	0.178	0.223	0.234

Panel B- Labor intensity, legal risk, and the institutional ownership.

	HIGH INTENSITY	LOW INTENSITY	LOW LEGAL RISK	HIGH LEGAL RISK	HIGH INS	LOW INS
	(1)	(2)	(3)	(4)	(5)	(6)
	0.030**	0.020	0.027**	0.009	0.018	0.028*
$INSURANCE_{it}$	(2.00)	(1.34)	(2.25)	(0.36)	(1.35)	(1.69)
	−0.012**	−0.024***	−0.015***	−0.032***	−0.017***	−0.018***
$SIZE_{it}$	(−2.15)	(−4.95)	(−3.73)	(−3.85)	(−3.13)	(−3.33)
	0.063**	0.111***	0.083***	0.090*	0.119***	0.053*
LEV_{it}	(1.99)	(3.45)	(3.17)	(1.88)	(3.39)	(1.76)
	−0.002	−0.003	−0.001	−0.009	−0.001	−0.004
$QUICK_{it}$	(−0.66)	(−0.84)	(−0.24)	(−1.63)	(−0.22)	(−1.15)
	−0.013***	−0.018***	−0.015***	−0.019**	−0.020***	−0.012
MB_{it}	(−3.03)	(−3.36)	(−4.02)	(−2.41)	(−4.11)	(−2.62)
	−0.040	0.014	−0.001	−0.039	−0.002	−0.013
PPE_{it}	(−1.54)	(0.55)	(−0.06)	(−0.87)	(−0.10)	(−0.50)
	−0.012	0.004	0.004	−0.002	0.005	−0.002
STD_SALES_{it}	(−0.68)	(1.47)	(1.35)	(−0.42)	(1.63)	(−0.31)
	0.019	−0.023	−0.025	0.068	−0.032	0.037
STD_CFO_{it}	(0.39)	(−0.97)	(−1.18)	(1.05)	(−0.75)	(0.75)
	−0.000	0.000	0.000	0.000	−0.000	0.000
TOP_{it}	(−0.38)	(0.44)	(0.06)	(0.04)	(−0.02)	(0.22)
	0.423***	0.402***	0.420***	0.388***	0.369***	0.449***
$STD\_NET\_HIRE_{it}$	(15.93)	(15.30)	(19.97)	(9.47)	(14.03)	(17.17)
	0.574***	0.663***	0.606***	0.634***	0.434***	0.763***
$ABINV\_OTHER_{it}$	(4.99)	(5.09)	(6.51)	(2.75)	(3.67)	(6.17)
	0.842***	1.267***	1.000***	1.152***	0.964***	1.122***
ROA_{it}						

(*continued on next page*)

Table 7 (*continued*)

Panel B- Labor intensity, legal risk, and the institutional ownership.

	HIGH INTENSITY	LOW INTENSITY	LOW LEGAL RISK	HIGH LEGAL RISK	HIGH INS	LOW INS
	(1)	(2)	(3)	(4)	(5)	(6)
	(7.56)	(10.40)	(10.87)	(6.23)	(7.89)	(10.08)
SOE_{it}	−0.009	−0.003	−0.012*	0.009	−0.007	−0.008
	(−0.99)	(−0.33)	(−1.68)	(0.72)	(−0.79)	(−0.94)
$LABOR\_INTENSITY_{it}$	−0.107	−0.188**	−0.119**	−0.344***	−0.137*	−0.161**
	(−1.60)	(−2.50)	(−2.18)	(−2.81)	(−1.77)	(−2.43)
CONSTANT	0.382***	0.602***	0.417***	0.840***	0.499***	0.464***
	(3.15)	(5.09)	(4.66)	(4.00)	(4.00)	(3.93)
Year	YES	YES	YES	YES	YES	YES
Industry	YES	YES	YES	YES	YES	YES
N	6817	6757	10,981	2593	6216	7357
Adj_R^2	0.226	0.235	0.228	0.236	0.197	0.259

This table presents our cross-sectional analyses. Panel A reports the results of OLS regressions for subsamples based on Jiang and Yuan's (2018) corporate governance quality metric *CGI* in Columns (1) and (2), internal control quality index (*ICQ*) from Chen et al. (2020) in Columns (3) and (4), and the fraction of female directors in Columns (5) and (6). Panel B reports the results of OLS regressions for subsamples based on labor intensity in Columns (1) and (2), legal risk in Columns (3) and (4), and the institutional ownership in Columns (5) and (6). All variables are defined in Appendix A. All regressions control for industry fixed effects and year fixed effects. t-statistics is based on standard errors clustered at the firm level. ***, **, and * stand for statistical significance at the 1%, 5% and 10% level, respectively.

4.6. Robustness tests

To further ensure that our results are robust, we perform a battery of robustness tests. First, we use alternative labor investment efficiency proxies to ensure the robustness of our findings. Panel A of Table 8 reports the results. Column (1) shows the regression results using the alternative abnormal net hiring based on Cella (2020), where a firm's industry median level of net hiring is used as a proxy for the optimal level. Column (2) presents the results of regression using the alternative abnormal net hiring based on Biddle et al. (2009), where labor investments are a function of sales growth and the absolute value of the residuals is used as the proxy for deviations from the expected investment in labor. Column (3) presents the results using the alternative abnormal net hiring based on Pinnuck and Lillis (2007) with both year and industry fixed effects. All results using the alternative proxies are consistent with our main findings.

Second, to overcome the omitted variable problem, we add additional control variables and various fixed effects. Following Cao et al. (2021), we control for discretionary accruals (EM_{it}), financing constraints (KZ_INDEX_{it}), business cycle (OPR_CYCLE_{it}), and degree of financial slack ($SLACK_{it}$) to control the effect of financial reporting quality, uncertainty, and resources owned by the firm. In addition, we also control for the internal corporate governance quality such as the proportion of independent directors ($INDEP_{it}$), whether CEO is also the chairman of the board ($DUAL_{it}$), and product market competition (HHI_{it}). Companies with poor internal corporate governance may face serious agency problems, and managers may conduct more opportunistic behaviors, leading to lower labor investment efficiency. In addition, product market competition might affect labor investment decisions by setting the industry benchmarking effects, strengthen manager incentives, or impose greater bankruptcy threats. Furthermore, our results may be driven by unobservable time-invariant omitted within firms or omitted variables across provinces. Therefore, we include different fixed effects to further alleviate these concerns. Results are displayed in Panel B of Table 8. We find that our results are robust after including the above-mentioned control variables and various fixed effects. Overall, Table 8 reinforces our main results that D&O insurance leads to lower labor investment efficiency.

Third, as suggested by Jung et al. (2014) and Ben-Nasr and Alshwer (2016), the labor investment of a company may be a supplement to its non-labor investment. Therefore, to exclude the possibility that D&O insurance indirectly affects the labor investment efficiency through non-labor investment, we further control for the non-labor investment of enterprises. Following Luo et al. (2020), we divided our sample into three subsamples based on the relationship between labor investment and non-labor investment. Specifically, we believe that there is a positive relationship if a firm increases or decreases both labor and non-labor investments (more likely to be complements). In contrast, if a firm increases labor investment while decreases non-labor investments, we believe that there is a negative relationship (more likely to be substitutes). The third group consists of firms that do not report any number of other investments. Results are reported in Panel C of Table 8. After controlling for the non-labor investment, the coefficient of $INSURANCE_{it}$ remains positive and significant at a 5% level in both the positive and negative subsamples. The findings suggest after accounting for non-labor corporate investments, the findings remain qualitatively the same.

Table 8
Additional robustness tests.

Panel A: Alternative labor investment efficiency.

	Cella (2020)	Biddle et al. (2009)	Pinnuck and Lillis (2007)
	(1)	(2)	(3)
$INSURANCE_{it}$	0.025**	0.032**	0.032**
	(2.36)	(2.31)	(1.99)
CONSTANT	0.804***	0.513***	1.074***
	(9.76)	(5.12)	(8.37)
Other Controls	YES	YES	YES
Year	YES	YES	YES
Industry	YES	YES	YES
N	13,574	13,574	13,574
Adj_R^2	0.227	0.245	0.190

Panel B: Additional control variables and various fixed effects.

	(1)	(2)	(3)	(4)
$INSURANCE_{it}$	0.022**	0.021**	0.044**	0.044**
	(2.05)	(1.98)	(2.08)	(2.11)
$INDEP_{it}$	0.097*	0.088	−0.074	−0.076
	(1.68)	(1.53)	(−0.79)	(−0.82)
$DUAL_{it}$	0.007	0.007	0.010	0.007
	(0.99)	(0.88)	(0.84)	(0.62)
HHI_{it}	−0.073	−0.084	−0.015	−0.015
	(−1.43)	(−1.64)	(−0.28)	(−0.29)
KZ_INDEX_{it}		0.007**	0.001	0.001
		(2.24)	(0.17)	(0.29)
$SLACK_{it}$		0.011***	0.004	0.004
		(3.18)	(0.83)	(0.79)
OPR_CYCLE_{it}		−0.002	−0.052***	−0.053***
		(−0.57)	(−5.75)	(−5.89)
EM_{it}		0.455***	0.761***	0.758***
		(7.01)	(9.89)	(9.84)
CONSTANT	0.558***	0.379***	0.434	0.403
	(5.60)	(3.58)	(1.40)	(1.28)
Other Controls	YES	YES	YES	YES
Year	YES	YES	YES	YES
Industry	YES	YES	YES	YES
FIRM	NO	NO	YES	YES
PROVINCE	NO	NO	NO	YES
N	13,429	13,368	13,368	13,367
Adj_R^2	0.226	0.232	0.166	0.167

Panel C: The role of non-labor investment.

	POSITIVE	NEGATIVE	ZERO
	(1)	(2)	(3)
$INSURANCE_{it}$	0.031**	0.035**	0.026
	(2.13)	(2.23)	(0.50)
Controls	YES	YES	YES
Year	YES	YES	YES
Industry	YES	YES	YES
N	7200	6247	127
Adj_R^2	0.269	0.218	0.316

This table provides the results of additional robustness tests. Panel A reports the results from regressing alternative measures of abnormal net hiring on employee treatment. We use alternative proxies as suggested by Cella (2020), Biddle et al. (2009), and Pinnuck and Lillis (2007) in Columns (1) to (3), respectively. Panel B reports the results with additional control variables and various fixed effects as suggested by Cao and Rees (2020). Panel C investigates the impacts of non-labor investments on the association between D&O insurance and labor investment efficiency. All variables are defined in Appendix A. All regressions control for industry fixed effects and year fixed effects. t-statistics is based on standard errors clustered at the firm level. ***, **, and * stand for statistical significance at the 1%, 5% and 10% level, respectively.

5. Further analyses

5.1. The effect of D&O coverage length

The impact of D&O insurance on corporate decisions may be affected by the time that insurance is held by a firm. For companies who have recently purchased D&O insurance, the monitoring effect of insurance companies might be stronger whereas the incentive effect of insurance on managers and directors may be less obvious. Meanwhile, the moral hazard problem associated with D&O insurance may increase over time. Therefore, we expect labor investment inefficiency to be positively related to the length of time D&O insurance is held by a firm. We use log(1 + years) to capture the length of D&O insurance coverage ($LENGTH_{it}$) and re-estimate Eq. (2). The results presented in Panel A of Table 9 show that $LENGTH_{it}$ is significantly positively related to the $ABRESID_{it}$, consistent with our predictions.

5.2. The effect of insurance coverage changes and managerial turnover

We further explore how the change of D&O insurance coverage affects the firm's labor decision when chairmen or CEOs are unchanged. Specifically, we generate a dummy variable $\triangle INSURANCE_{it}$, which equals one if a firm changes their coverage policy (mostly from non-insured to insured). In addition, we control for managerial turnover by creating a dummy variable ($NO\_TURNOVER_{it}$) that equals one if the chairman and/or CEO are the same, and then interact it with $\triangle INSURANCE_{it}$ to examine the impact of coverage change and managerial turnover on labor investment efficiency.

The results are presented in Panel B of Table 9. In Columns (1) and (2) report the OLS regression results of the effect of coverage change on the full sample after controlling for the same CEO and chairman, respectively. In Column (3), $NO\_TURNOVER_{it}$ equals one when both the CEO and Chairman are the same and we use the PSM sample to ensure the robustness. The coefficients of $NO\_TURNOVER_{it}$ are statistically negative, suggesting that managerial turnover is negatively associated with labor investment efficiency. However, the coefficients of $INSURANCE_{it}$* $NO\_TURNOVER_{it}$ are significantly positive, suggesting that buying D&O insurance is associated with lower investment efficiency for incumbent chairmen or CEOs.

5.3. Does the first insurance claim affect the monitoring role of insurance companies?

In this subsection, we examine the impact of the first insurance claim[13] on the association between D&O insurance and labor investment decisions. China's insurance policies are typically translated from overseas products, which are often vague with ill-defined liability and exclusions lines. The blurry liability boundary may aggravate moral hazard problems and lead to lower levels of monitoring by insurance companies. The first successful D&O insurance claim that happened in 2012 is a shock for insurance companies to undertake more diligent monitoring and less risk-taking of firm managers, since insurance companies are more concerned about moral hazard issues, whereas managers are concerned about their reputation loss. Therefore, we expect a negative impact of this exogenous event on the association between D&O insurance and labor investment inefficiency. Specifically, we perform a difference-in-difference (DID) analysis based on the matched sample to empirically this relationship. We create a *POST* variable which equals one in the post-event period and zero otherwise. Eq. (2) is then re-estimated after including interaction terms to capture the effect of the first insurance claim over those periods.

The results of Column (1) in Panel C of Table 9 show that *INSURANCE* is significantly positively related to $ABRESID_{it}$, consistent with our previous findings. Moreover, as predicted the interaction term $INSURANCE_{it}$*POST* is significantly negative, indicating that after the first insurance claim, the negative effect of D&O insurance on labor investment efficiency is significantly reduced. The results in overinvestment[14] and PSM samples are reported in Columns (2) and (3), which are consistent with Column (1). Overall, as expected, insurance companies become more diligent external monitors after the first D&O claim, and the heightened external monitoring reduces inefficient labor investment.

5.4. D&O insurance and labor cost stickiness

Prior studies find that when managers have an incentive to build their empires, they are more likely to disproportionately increase wages or salaries when sales increase in order to attract more employees and encourage existing employees to stay (Prabowo et al., 2018; Donangelo, 2014). However, when sales decline, they are less likely to reduce wages or salaries by a proportionate amount as if they do, disgruntled employees might leave resulting in a reduction in labor size (Prabowo et al., 2018). We argue that D&O insurance aggravates labor investment inefficiencies stemming from disproportional use of labor (i.e., labor cost stickiness).

To empirically test the impact of D&O insurance on labor cost stickiness, we follow Ben-Nasr and Alshwer (2016) and Khedmati et al. (2020) by using the following model:

[13] See the Changfeng example in the institutional background for details.

[14] Similar to the findings in Table 8, we only find positive relationship between D&O insurance and labor investment inefficiency in our overinvestment sample. For brevity, we do not report the results of other subsamples. Results are available upon request.

Table 9
The effect of D&O insurance coverage length, policy change, and first D&O claim.

Panel A: The effect of D&O insurance coverage length.

	Log (1 + years)
	(1)
INSURANCE LENGTH$_{it}$	0.010**
	(2.32)
Controls	YES
Year	YES
Industry	YES
N	13,574
Adj_R^2	0.239

Panel B: The effect of insurance coverage changes and managerial turnover.

	Same Chairman	Same CEO	Matched sample
	(1)	(2)	(3)
ΔINSURANCE$_{it}$	−0.003	0.003	0.052
	(−0.13)	(0.10)	(1.14)
DID	0.102***	0.099**	0.126**
	(2.74)	(2.42)	(2.06)
NO_TURNOVER$_{it}$	−0.039***	−0.038***	−0.060**
	(−5.09)	(−4.35)	(−2.35)
Controls	YES	YES	YES
Year	YES	YES	YES
Industry	YES	YES	YES
N	11,022	11,022	1436
Adj_R^2	0.239	0.168	0.196

Panel C: The effect of exogenous event regarding the first insurance claim.

	Full sample	Over investment	Matched sample
	(1)	(2)	(3)
INSURANCE$_{it}$	0.064*	0.155*	0.082***
	(1.75)	(1.82)	(2.76)
INSURANCE$_{it}$*POST*	−0.068**	−0.173**	−0.069**
	(−2.02)	(−2.23)	(−2.13)
POST	0.172***	0.204***	0.008
	(7.56)	(3.54)	(0.15)
Controls	YES	YES	YES
Year	YES	YES	YES
Industry	YES	YES	YES
N	13,574	4207	2949
Adj_R^2	0.189	0.380	0.216

Panel A examines the impact of the insurance coverage length (*INSURANCE LENGTH*) on labor investment inefficiency (*ABRESID*$_{it}$). Panel B presents the regression results of the change of D&O insurance coverage (*ΔINSURANCE*$_{it}$) and managerial turnover (*NO_TURNOVER*$_{it}$ = 1 if there is no change in Chairman in Column (1), no change in CEO in Column (2), and a PSM matched sample with both changes in CEO and chairman in Column (3) on *ABRESID*$_{it}$. Panel C examines the first successful insurance claim on the effectiveness of D&O insurance on labor investment decisions. All variables are defined in Appendix A. All regressions control for industry fixed effects and year fixed effects. t-statistics is based on standard errors clustered at the firm level. ***, **, and * stand for statistical significance at the 1%, 5% and 10% level, respectively.

$$\begin{aligned}\Delta LOGPAY_{it} = {} & \beta_0 + \beta_1 LOG(REV_{it}/REV_{it-1}) + \beta_2 DECR_{it}{*}LOG(REV_{it}/REV_{it-1}) + \beta_3 DECR_{it}{*}LOG(REV_{it}/REV_{it-1}){*}INSURANCE_{it} \\ & + \beta_4 DECR_{it}{*}LOG(REV_{it}/REV_{it-1}){*}AI_{it} + \beta_5 DECR_{it}{*}LOG(REV_{it}/REV_{it-1}){*}SUCC\_DECR_{it} \\ & + \beta_6 DECR_{it}{*}LOG(REV_{it}/REV_{it-1}){*}LOSS_{it-1} + \beta_7 INSUANCE_{it} + \beta_8 CONTROLS_{it} + INDUSTRY + YEAR + \varepsilon_{it}\end{aligned} \quad (5)$$

ΔLOGPAY$_{it}$ represents the difference of wages and salaries and other benefits paid to employees and officers; *REV*$_{it}$ is the total revenue; *DECR*$_{it}$ is a dummy variable equal to one if total revenue decreased from the previous year and zero otherwise; *INSURANCE*$_{it}$ is the main proxy for D&O insurance; *CONTROLS*$_{it}$ include a set of variables: asset intensity (AI$_{it}$) defined as the ratio of total assets to total revenue; whether the firm had a decrease in revenue during the current and the previous year (*SUCC_DECR*$_{it}$); whether the firm reported a loss in the previous year using a dummy variable (*LOSS*$_{it-1}$) equal to 1 if *ROA*$_{it-1}$ is negative and zero otherwise.

Table 10 presents the relationship between D&O insurance and labor cost stickiness. We noticed that the coefficient of log*(ΔREV*$_{it}$*)* is significantly positive, and the coefficient of *DECR*$_{it}$*log(ΔREV*$_{it}$*)* is significantly negative, which confirms that labor costs are sticky in

Table 10
Labor cost stickiness.

	$LOG(LABOR\_COST_{it}/ LABOR\_COST_{it-1})$
	(1)
$LOG(REV_{it}/REV_{it-1})$	0.528***
	(15.04)
$DECR_{it}$* $LOG(REV_{it}REV_{it-1})$	−0.341***
	(−5.65)
$DECR_{it}$* $LOG(REV_{it}/REV_{it-1})$*$INSURANCE_{it}$	−0.112**
	(−2.02)
$DECR_{it}$* $LOG(REV_{it}/REV_{it-1})$*AI_{it}	−0.003***
	(−3.44)
$DECR_{it}$* $LOG(REV_{it}/REV_{it-1})$*$SUCC\_DECR_{it}$	0.198***
	(3.49)
$DECR_{it}$* $LOG(REV_{it}/REV_{it-1})$*$LOSS_{it-1}$	−0.052
	(−1.11)
$INSURANCE_{it}$	0.006
	(0.80)
AI_{it}	−0.004**
	(−2.42)
$SUCC\_DECR_{it}$	−0.004
	(−0.36)
$LOSS_{it-1}$	−0.107***
	(−11.32)
CONSTANT	0.065***
	(3.29)
Year	YES
Industry	YES
N	13,570
Adj_R^2	0.384

This table presents the results for the effect of D&O insurance on labor cost stickiness. All variables are defined in Appendix A. Year and industry effects are controlled. T-statistics are presented in parentheses, with standard errors clustered at the firm level. ***, **, * indicates significance at 1%, 5%, and 10%, respectively.

our sample. More importantly, the coefficient for $DECR_{it}$* $log(\Delta REV_{it})$ *$INSURANCE_{it}$ is negative and significant at the 1% level, suggesting that D&O insurance increases labor cost stickiness consistent with managerial empire building behaviors.

5.5. Inefficient labor investment and future performance

Finally, we investigate whether the poorer labor investment efficiency as a result of D&O insurance is economically meaningful following the prior literature on the relationship between labor investment efficiency and future firm performance (Jung et al., 2014; Luo et al., 2020; Lai et al., 2021). We first follow Jung et al. (2014) by applying the below model to estimate the effect of labor investment inefficiency on changes in ROA. The model assumes that future changes in profitability are a function of current period deviations from expected earnings (*DFE*) and changes in earnings (*CE*) and allows for nonlinear relations:

$$\Delta ROA(t,t+n) = \beta_0 + \beta_{1i} ABRESID_{it} + \beta_2 DFE_{it} + \beta 3 NEG\_DFE_{it} * DFE_{it} + \beta_4 NEG\_DFE_{it} * DFE^2{}_{it} + \beta_5 POS\_DFE_{it} * DFE^2{}_{it} + \beta_6 CE_{it} + \beta_7 NEG\_CE_{it} * CE_{it} + \beta_8 NEG\_CE_{it} * CE^2 + \beta_9 POS\_CE_{it} * CE^2{}_{it} + \varepsilon_{it} \quad (6)$$

The results are presented in Panel A of Table 11. We find that the coefficient on $ABRESID_{it}$ is significantly negative across all three-future time (t + 1, t + 2, t + 3) periods, indicating that labor investment inefficiency is associated with lower future profitability.

We also estimate the impact of labor investment inefficiency on changes in Tobin's Q one-, two-, and three-year ahead.[15] The results are reported in Panel B of Table 11. Similarly, we find negative impact of labor investment inefficiency on future Tobin's Q, suggesting that suboptimal net hiring is costly in terms of future performance and reinforce the economic consequences of D&O insurance.

6. Conclusion

This study examines the effect of a firm's D&O insurance on labor investment efficiency. Using a sample of Chinese listed firms over the period 2006–2018, we find evidence that D&O insurance encourages over-hiring behavior, which is consistent with managerial empire building behaviors. The association is robust to a series of checks including endogeneity concerns, and controlling for additional variables and various fixed effects. Cross-sectional analyses show that the negative effect of D&O insurance on labor investment

[15] The model includes a set of control variables such as ownership concentration (*TOP*), firm size (*SIZE*), profitability (*ROA*), leverage (*LEV*), *SOE*, CEO experience (*TENURE*), industry and year dummies.

Table 11
Future performance.

Panel A: Labor investment inefficiency and changes in ROA.

	D_ROA_{it}	D_ROA_{it+1}	D_ROA_{it+2}
	(1)	(2)	(3)
$ABRESID_{it}$	−0.006***	−0.005**	−0.004**
	(−3.65)	(−2.53)	(−2.56)
DFE_{it}	0.021	−0.230***	−0.558***
	(0.33)	(−3.16)	(−7.25)
$NEG\_DFE\_DFE_{it}$	0.289***	0.204	0.284**
	(2.61)	(1.63)	(2.01)
$NEG\_DFE\_DFE_{it}^2$	10.185***	9.909***	8.256***
	(10.48)	(10.65)	(6.49)
$POS\_DFE\_DFE_{it}^2$	−4.346***	−5.203***	−4.314***
	(−8.60)	(−10.19)	(−7.85)
CE_{it}	−0.184***	−0.113	0.181**
	(−3.06)	(−1.61)	(2.47)
$NEG\_CE\_CE_{it}$	0.328***	0.319***	−0.140
	(3.65)	(3.14)	(−1.23)
$NEG\_CE\_CE_{it}^2$	−0.693*	−1.332***	−2.823***
	(−1.87)	(−3.41)	(−5.53)
$POS\_CE\_CE_{it}^2$	0.509	1.067**	0.166
	(1.21)	(2.37)	(0.34)
CONSTANT	0.016***	−0.005	0.008
	(2.99)	(−0.84)	(1.23)
Year	YES	YES	YES
Industry	YES	YES	YES
N	10,688	9176	7956
Adj_R^2	0.282	0.340	0.374

Panel B: Labor investment inefficiency and changes in Tobin's Q.

	D_TOBINQ_{it}	D_TOBINQ_{it+1}	D_TOBINQ_{it+2}
	(1)	(2)	(3)
$ABRESID_{it}$	−0.080***	−0.115**	−0.048*
	(−3.50)	(−5.37)	(−1.77)
Controls	YES	YES	YES
Year	YES	YES	YES
Industry	YES	YES	YES
N	10,219	8717	7461
Adj_R^2	0.282	0.340	0.374

This table presents the results of estimating the relationship between inefficient labor investment and firm's future return on assets and Tobin's Q. In Panel A, the dependent variables are one-year-ahead changes in *ROA*, as well as average changes over the next two and three years, respectively (D_ROA_{it}, D_ROA_{it+1}, D_ROA_{it+2}). In Panel B, the dependent variables are changes in Tobin's Q in one-, two- and three-year ahead (D_TOBINQ_{it}, D_TOBINQ_{it+1}, D_TOBINQ_{it+2}). All variables are defined in Appendix A. Year and industry effects are controlled. T-statistics are presented in parentheses, with standard errors clustered at the firm level. ***, **, * indicates significance at 1%, 5%, and 10%, respectively.

efficiency is more pronounced for firms with weak corporate governance, a low proportion of female executives, high labor intensity, and firms with low legal risks.

Our further analyses suggest that labor investment inefficiency is positively related to the length of time the D&O insurance is held by a firm. Buying D&O insurance has negative impact on labor investment efficiency especially when CEOs and chairmen are unchanged. In addition, the first successful insurance claim alleviates the positive relationship between D&O insurance and labor investment inefficiency, suggesting that the insurance claim leads to more intensive monitoring of insurance companies which in turn, lowers labor investment inefficiency. Lastly, we show that labor investment inefficiency leads to worse future performance as measured by changes in ROA and Tobin's Q one-, two- and three- year ahead.

Consistent with empire building, our findings show the D&O insurance decreases labor efficiency in those firms that overinvest in labor and this is mainly through firms over-hiring. An obvious question is why D&O insurance influences over, rather than underinvestment in labor. It is possible, that if D&O insurance induces poorer monitoring of management, then management would desire to build bigger (overinvest) rather smaller (underinvest) businesses. In addition, a firm's underinvestment in labor may be more to do with externalities outside of management's control, such as the tightness of labor market conditions in attracting suitably qualified employees. Further, we show that D&O insurance exacerbates labor cost stickiness, which is likely to be detrimental to firm's future performance, particularly during periods of economic downturn. Therefore, future research could examine how various market conditions, including labor market tightness, influence both over and underinvestment in labor and the resulting impact on future performance.

Appendix A. Variable description

Variable	Description
NET_HIRE_{it}	The percentage change in firm i's employees in year t
$SALES\_GROWTH_{it}$	The percentage change in firm i's operating income in year t
ROA_{it}	The ratio of net income on assets in year t for firm i
ΔROA_{it}	The change in return on assets (ROA) in year t for firm i
$RETURN_{it}$	Annual stock return taking into account of the reinvested cash dividends in year t for firm i
$SIZE_{it}$	Natural logarithm of total assets in year t for firm i
$QUICK_{it}$	Quick ratio in year t for firm i
$\Delta QUICK_{it}$	The change in quick ratio in year t for firm i
LEV_{it}	Sum of debt in current liabilities and total long-term debt in year t, divided by total assets in year t for firm i
$LOSSBINX_{it}$	Five loss dummy variables with a interval length of 0.005, If ROA ranges between −0.005 and 0, then LOSSBIN1 = 1, otherwise 0. If it ranges between −0.01 and − 0.005, then LOSSBIN2 = 1, otherwise 0, ect.
$ABRESID_{it}$	The absolute values of the residuals from Eq. (1) for firm i in year t
$INSURANCE_{it}$	A dummy variable that equals 1 if firm i purchase D&O insurance in year t and 0 otherwise
MB_{it}	Market-to-book ratio in year t for firm i
PPE_{it}	Property, plant, and equipment (PPE) scaled by total assets in year t for firm i
STD_SALES_{it}	Standard deviation of firm i's cash flow from sales over the last 5 years (divided by 10^10)
STD_CFO_{it}	Standard deviation of firm i's cash flow from operations over the last 5 years (divided by 10^10)
TOP_{it}	Shareholding ratio of the largest shareholder in year t for firm i
$STD\_NET\_HIRE_{it}$	Standard deviation of firm i's net hiring over the last 5 years
$ABINV\_OTHER_{it}$	Abnormal other (non-labor) investments, defined as the absolute value of the residual from the following equation: $Invest\_Other_{it} = \beta_0 + \beta_1 Sales\_Growth_{i,t-1} + \varepsilon_{it}$, where Invest_Other is the sum of capital expenditure (*CapExp*), research and development expenditures (R&D), less cash receipts from the sale of property, plant, and equipment (PPE), scaled by lagged total assets.
SOE_{it}	A dummy variable that equals one if firm i is a state-owned enterprise and 0 otherwise
$LABOR\_INTENSITY_{it}$	Number of employees divided by total assets in year t for firm i (*10^5)
$MEAN\_INSURANCE_{it}$	The average number of D&O insurance purchasing firms within the same industry, except for the firm itself
$OPENNESS\_INDEX_{it}$	An index of openness at province level compiled by the China Development and Reform Commission (2017)
$RISK1(RISK2)_{it}$	The level of corporate risk-taking reflected by the fluctuation of corporate earnings following Faccio et al. (2011) and John et al. (2008)
EM_{it}	Value of discretionary accruals estimated based on Jones model (Jones, 1991)
$RESTATE_{it}$	A dummy variable that equals one if there is an earnings restatement in year t for firm i and 0 otherwise
CGI_i	Corporate governance index constructed based on nine corporate governance variables (*LARGEST, MHOLD, SOE, INSTITUTION, ANALYST, INDEP, SHARE2_10, BHSHARE, and BIG4*) following Jiang and Yuan (2018).
ICQ	The score of the Internal Control Index of Chinese List Firms developed by Chen et al. (2020).
$FEMALE_{it}$	Female executives ratio in year t for firm i
$LEGAL\ RISK_{it}$	A dummy variable that equals 1 if firm i been litigated in year t and 0 otherwise
INS_{it}	The proportion of shares held by institutional investors for firm i in year t
$TOBINQ_{it}$	The ratio of the market value of firm i to its book value of assets in year t
$INDEP_{it}$	The percentage of independent directors on the board for firm i in year t
$DUAL_{it}$	A dummy variable that equals 1 if firm i's CEO is also the chairman of the board of the same firm and 0 otherwise
HHI_{it}	The Herfindahl-Hirschman Index (HHI) which is calculated as the sum of the squared of market sales using firm's operating income.
KZ_INDEX_{it}	A financial constraint index in year t for firm i following Kaplan and Zingales (1997) and Lamont et al. (2001)
$SLACK_{it}$	The ratio of equity to total debt (Potential Slack) in year t for firm i
OPR_CYCLE_{it-1}	The natural log of the length of the firm i's operating cycle, which is defined as inventory turnover days plus accounts receivable turnover days in year t-1
$LENGTH_{it}$	The natural log of one plus the years a firm has held D&O insurance for firm i in year t
$\measuredangle INSURANCE_{it}$	A dummy variable which equals 1 if a firm changes their D&O insurance coverage policy and 0 otherwise
$NO\_TURNOVER_{it}$	A dummy variable that equals 1 if firm i's chairman or CEO haven't changed in year t and 0 otherwise
POST	A variable which equals 1in the post-event period after the first D&O insurance claim in 2012 and 0 otherwise
$LABOR\_COST_{it}$	Cash paid to and paid for employees for firm i in year t
REV_{it}	The total revenue in year t for firm i
$DECR_{it}$	A dummy variable that equals 1 if total revenue in year t is lower than year t-1 and 0 otherwise
AI_{it}	The ratio of assets to total revenue in year t-1 for firm i
$SUCC\_DECR_{it}$	A dummy variable that equals 1 if a firm had a decrease in revenue during the current and the previous years
$LOSS_{it-1}$	A dummy variable that equals 1 if firm i have negative ROA for financial year t-1
DFE_{it}	E [ROA_{it}] is the fitted value of ROA_{it} for the natural logarithm of total assets ($SIZE_{it-1}$), natural logarithm of the market-to-book ratio (MB_{it-1}) and ROAit-1 regression model in year t-1
CE_{it}	The ratio of net income on assets (ROA) in year t minus ROA in year t-1 for firm i
$POS\_DFE(NEG\_DFE)_{it}$	A dummy variable that equals 1 if firm i have positive(negative) DFE in year t and 0 otherwise
$POS\_CE(NEG\_CE)_{it}$	A dummy variable that equals 1 if firm i have positive(negative) CE in year t and 0 otherwise

Appendix B. Estimating the expected level of net hiring (Eq. (1))

This table reports our measure of abnormal net hiring. We first estimate the expected level based on (1) and the summary statistics of variables used in Eq. (1) are reported in Panel A. The results of the coefficient in Eq. (1) are reported in Panel B. All variables are defined in Appendix A. Year and industry effects are controlled. *T*-statistics are presented in parentheses, with standard errors clustered at the firm level. ***, **, * indicates significance at 1%, 5%, and 10%, respectively.

Panel A: Distributional statistics for variables in Eq. (1).

Variable	N	Mean	Median	S·D	P25	P75
NET_HIRE_{it}	27,774	0.113	0.017	0.464	−0.044	0.129
$SALES\_GROWTH_{it}$	27,774	0.209	0.125	0.496	−0.012	0.301
$SALES\_GROWTH_{it-1}$	27,774	0.217	0.131	0.496	−0.009	0.311
ROA_{it}	27,774	0.036	0.036	0.068	0.011	0.068
ΔROA_{it}	27,774	−0.003	−0.001	0.056	−0.020	0.014
ΔROA_{it-1}	27,774	−0.003	−0.002	0.053	−0.020	0.013
$RETURN_{it}$	27,774	0.187	−0.051	0.725	−0.278	0.418
$SIZE_{it}$	27,774	21.970	21.810	1.275	21.060	22.690
$QUICK_{it}$	27,774	1.497	0.969	1.716	0.605	1.623
$\Delta QUICK_{it}$	27,774	−0.124	−0.031	0.941	−0.233	0.126
$\Delta QUICK_{it-1}$	27,774	−0.158	−0.035	1.188	−0.263	0.133
LEV_{it}	27,774	0.457	0.458	0.209	0.297	0.612
$ABRESID_{it}$	27,774	0.210	0.112	0.374	0.053	0.209

Panel B: Regression results (dependent variable = NET_HIRE_{it}).

	NET_HIRE_{it}
$SALES\_GROWTH_{it}$	0.329***
	(23.38)
$SALES\_GROWTH_{it-1}$	0.035***
	(4.31)
ROA_{it}	0.488***
	(7.96)
ΔROA_{it}	−0.781***
	(−11.00)
ΔROA_{it-1}	−0.212***
	(−3.26)
$RETURN_{it}$	0.024***
	(5.59)
$SIZE_{it}$	0.025***
	(9.47)
$QUICK_{it-1}$	−0.005***
	(−2.98)
$\Delta QUICK_{it}$	−0.028***
	(−8.29)
$\Delta QUICK_{it-1}$	0.001
	(0.34)
LEV_{it-1}	−0.062***
	(−2.76)
$LOSSBIN1_{it-1}$	−0.009
	(−0.44)
$LOSSBIN2_{it-1}$	−0.001
	(−0.05)
$LOSSBIN3_{it-1}$	−0.026
	(−0.91)
$LOSSBIN4_{it-1}$	−0.009
	(−0.24)
$LOSSBIN5_{it-1}$	0.023
	(0.62)
Constant	−0.486***
	(−8.44)
Industry	Yes
N	27,774
Adj_R^2	0.144

Appendix C. Propensity score-matched sample

This table presents the univariate tests of our key variables before and after matching. All variables are defined in Appendix A. ***, **, and * stand for statistical significance at the 1%, 5% and 10% level, respectively.

	Matching	Treat	Control	Difference	T-value
	(1)	(2)	(3)	(4)	(5)
	Before	23.283	22.345	0.938***	(24.26)
$SIZE_{it}$	After	23.283	23.310	−0.027	(−0.40)
	Before	0.548	0.487	0.0613***	(10.28)
LEV_{it}	After	0.548	0.550	−0.002	(−0.22)
	Before	1.079	1.268	−0.189***	(−4.96)
$QUICK_{it}$	After	1.079	1.127	−0.047	(−1.02)
	Before	1.622	1.952	−0.330***	(−9.01)
MB_{it}	After	1.622	1.638	−0.016	(−0.38)
	Before	0.094	0.163	−0.069***	(−6.14)
$DUAL_{it}$	After	0.094	0.114	−0.020	(−1.55)
	Before	0.055	0.049	0.005*	(1.92)
FCF_{it}	After	0.055	0.057	−0.002	(−0.63)
	Before	0.376	0.368	0.008***	(4.73)
$INDEP_{it}$	After	0.376	0.378	−0.002	(−0.68)
	Before	0.080	0.071	0.008***	(3.11)
INS_{it}	After	0.080	0.081	−0.002	(−0.42)
	Before	37.147	35.029	2.118***	(4.51)
TOP_{it}	After	37.147	37.721	−0.574	(−0.87)
	Before	0.049	0.052	−0.003	(−1.62)
ROA_{it}	After	0.049	0.050	−0.001	(−0.36)
	Before	0.770	0.597	0.173***	(11.50)
SOE_{it}	After	0.770	0.748	0.022	(1.22)
	Before	0.066	0.080	−0.014***	(−6.13)
$LABOR\_INTENSITY_{it}$	After	0.066	0.065	0.000	(0.12)
	Before	0.843	0.183	0.660***	(15.04)
STD_SALES_{it}	After	0.843	0.876	−0.032	(−0.22)
	Before	0.159	0.044	0.115***	(21.02)
STD_CFO_{it}	After	0.159	0.174	−0.016	(−0.93)

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