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Independent Decision-Making or Going with the Flow? D&O Insurance and Investment Herding Behavior☆

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ABSTRACT

Imitation among peers is a prevalent behavior in the investment decision-making processes of firms. Directors and officers liability insurance (D&O insurance) transfers the risks associated with managerial decisions, potentially enhancing the effectiveness of their investments; however, it may also induce managerial negligence and herding behavior in investment. This study examines the impact of D&O insurance on managers' investment herding behavior, finding that the insurance significantly mitigates this tendency. A mechanistic analysis reveals that enhanced risk incentives, reduced agency costs, and increased public oversight are key factors to the positive influence of D&O insurance. Furtherly, we also find that purchasing D&O insurance helps mitigate the reduction in investment efficiency caused by herding behavior. These findings provide empirical evidence for firms to encourage managers to diminish herding effects in investments, optimize resource allocation, and maximize the advantages of liability insurance.

1. Introduction

Firms tend to imitate their industry competitors when developing financial strategies, particularly in their investment activities (Lieberman and Asaba, 2006). Such herding behavior not only allows the attribution of investment failures to external market forces (Scharfstein and Stein, 1990) but also relieves less capable managers from the burden of acquiring complex investment information (Palley, 1995). We can find biotechnology herding investments during the COVID-19 pandemic, and the current capital shift from traditional industries to new energy sectors. This imitation, however, can also hinder the development of core competencies and lead to resource misallocation and inefficiencies within the industry (Ahmad and Wu, 2022).

Directors and officers liability insurance (D&O insurance) is widely adopted across firms in mature capital markets to mitigate losses caused by managerial decision-making errors (Boyer and Tennyson, 2015). D&O insurance may help mitigate investment herding through three primary channels: 1) It mitigates managers' liability risks, incentivizing them to engage in risk-taking decisions

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(Hwang and Kim, 2018) and reducing their tendency to imitate peers. 2) It motivates insurance firms to exercise continuous governance through their expertise, curbing managerial hazard practices (Yuan et al., 2016) and reducing agency costs (O'Sullivan, 1997). 3) It increases external oversight from the public, as the purchase of D&O insurance often attracts public attention (Baker and Griffith, 2007), leading managers to reduce peer-imitation for their reputation. Overall, we propose *Hypothesis H1A* as D&O insurance can mitigate firms' investment herding.

However, D&O insurance may also introduce collusion issues, potentially trigger investment herding: 1) It may reduce the litigation risks of firms, then weakening the oversight and governance of firms on managers (Donelson et al., 2018). 2) Insurance firms may impose stringent terms to limit managers' risk-taking to minimize potential payouts, leading them to adopt conservative investment strategies (Baker and Griffith, 2007), as it not only reduces managers' effort but also aligns with the demands of the insurance firms. Overall, we propose competing *Hypothesis H1B* as D&O insurance may drive firms toward investment herding. Based on our theoretical analysis, an interesting research question arises: Does D&O insurance prevent or push managers to engage in herding behavior in investment?

Using data from Chinese firms between 2008 and 2022, we document that D&O insurance significantly reduces firms' herding behavior. On average, firms with D&O insurance exhibit 28 percent points lower herding behavior in investment compared to firms without D&O insurance. Our findings are robust across various tests. Mechanism analysis indicates that the risk incentives, reduced agency costs, and public oversight are the key channels, and further analysis demonstrates that D&O insurance indeed helps mitigate the reduction in investment efficiency caused by herding behavior.

We investigate this research question with a sample of Chinese firms due to two reasons: 1) The performance evaluation for Chinese managers is commonly influenced by the informal institutions such as Confucian culture, which made investment herding behavior particularly prevalent in China, thus providing an ideal context for studying the role of D&O insurance. 2) The adoption rate of D&O insurance among firms in mature capital markets exceeds 80% (Wang and Sun, 2023), making empirical research on D&O insurance lack appropriate control samples. In contrast, only a subset of firms in China purchased D&O insurance, thus providing a sufficient number of control samples for empirical research and allow us have the necessary information to assess the effectiveness of D&O insurance.

We contribute to prior research in several ways. First, we broaden the governance role of D&O insurance from financial performance and risk management to shaping investment behavior, particularly by curbing herding within industries. While prior studies have primarily focused on the impact of D&O insurance on accounting restatements (Kalchev, 2006), earnings conservatism (Chung and Wynn, 2008), cost of equity (Chen et al., 2016), debt financing (Donelson and Yust, 2019), and CSR performance (Zhang et al., 2023), they have also engaged in an ongoing debate on its role from the perspectives of supervision versus managerial self-interest. Given the importance of investment to a firm's development, our findings address the gap concerning the effectiveness of D&O insurance in mitigating herding behavior, thereby contributing to the ongoing debate in the context of investment herding.

Second, we enrich the prior literature on the mitigating factors of managerial herding behavior. Different from prior studies investigating the effects of corporate governance (Ren et al., 2023), corporate strategy (Jiang et al., 2024), and managers characteristics (Ding et al., 2024) on firms' efforts to mitigate investment herding, our research explores whether the purchase of D&O insurance can drive managers toward independent decision-making, rather than herd behavior in investment, and highlighting a perspective on how insurance tools can function as governance mechanisms.

Finally, our study also has practical implications for firms and managers. We examine the mechanisms underlying D&O insurance, showing that it incentivizes managerial risk preferences, reduces agency costs, and enhances public oversight. These findings not only help firms gain a deeper understanding of the benefits and limitations of D&O insurance, but also provide managers with insights on how to achieve better investment performance by leveraging D&O insurance to protect their interests.

2. Research design

2.1. Sample selection and data sources

We utilize Chinese A-share listed firms from 2008 to 2022 as the sample, excluding *ST and ST firms, financial firms, insurance firms, and observations with missing data. This process yields 38,382 firm-year observations. All continuous variables are winsorized at the 1% and 99% levels. Data on D&O insurance and firms' financial information are obtained from the CSMAR database, while the remaining data are sourced from the CNRDS database and the website of China's National Bureau of Statistics.

2.2. Model construction and variable definitions

A double fixed-effects regression model (1) is used to examine the impact of D&O insurance on corporate investment herding behavior:

$$INV_{i,t} = \beta_0 + \beta_1 PEER_{i,t} + \beta_2 DOINS_{i,t} + \beta_3 DOINS_{i,t} \times PEER_{i,t} + \beta_4 Control_{i,t} + \Sigma YEAR + \Sigma FIRM + \varepsilon \quad (1)$$

Where *INV* represents the firm's investment scale. Following Leary et al. (2014) and Markou et al. (2023), *INV* is calculated as the net increase in capital expenditures of a firm during each year, and standardized by the total assets of the year.

PEER represents the investment scale of peers. We calculated *PEER* as the average net increase in capital expenditures of the rest firms within the industry for each year referring the methods of Truong (2023) and Jiang et al. (2024).

DOINS represents whether the firm has purchased D&O insurance. If the firm has disclosed the purchase of D&O insurance in announcements or documents, and the purchase was approved by a shareholders vote, the value of *DOINS* is 1; otherwise, the value is 0 (Yuan et al., 2016; Meng et al., 2024).

For control variables, we follow existing literature (Yuan et al., 2016; Park et al., 2017; Zhang, 2023) by controlling for firms' operational characteristics, shareholder attributes, and governance structure. The detailed variable definitions are provided in Appendix A.

2.3. Descriptive statistics

Table 1 presents the descriptive statistics of the research sample, demonstrating that the statistical characteristics of the variables are consistent with those observed in related studies. We noted that the mean value of the dependent variable *INV* is 0.058, with a standard deviation of 0.084, indicating substantial variation in investment levels among the sample firms. The mean value of the explanatory variable *PEER* is 0.059, with a standard deviation of 0.024, reflecting considerable variation in capital investment across industries. The mean value of *DOINS* is 0.097, indicating that approximately 9.7% of the sample firms have purchased D&O insurance, suggesting that D&O insurance adoption remains relatively uncommon among Chinese firms.

3. Results and discussions

3.1. Baseline results

Columns (1) and (2) of Table 2 show that the regression coefficients for peer investment (*PEER*) on firm investment (*INV*) are significantly positive, indicating the presence of investment herding behavior among firms, consistent with previous studies (Park et al., 2017; Zhang, 2023). Columns (3) and (4) report the impact of D&O insurance on investment herding behavior. The regression results reveal that the interaction term *DOINS* × *PEER* has a significantly negative coefficient at the 1% level, suggesting that D&O insurance effectively reduces the sensitivity of individual firms' investments to peer investments, thereby mitigating investment herding behavior. This finding supports *Hypothesis H1A*.

Notably, in columns (3) and (4), the coefficients for *DOINS* × *PEER* are -0.284 and -0.331 respectively, while the coefficients for *PEER* are 0.409 and 0.491 respectively. These values indicate that firms with D&O insurance exhibit, on average, 28 percentage points lower herding behavior in investment compared to firms without D&O insurance, demonstrating that the mitigating effect of D&O insurance sufficiently offsets the herding effect in corporate investment decisions.

3.2. Robustness tests

3.2.1. Alternative metrics for d&o insurance

Following Boyer et al. (2014), we use the premium of D&O insurance as a proxy variable (*DOINS2*). The regression results in column (1) of Table 3 show that the coefficient for the interaction term *DOINS2* × *PEER* aligns with the results of the baseline regression.

3.2.2. Alternative measurement for inv and peer

Following Richardson (2006), we recalculated firm investment size (*INV2*) as the sum of purchases of fixed assets, intangible assets, and other long-term assets, divided by total assets. Based on *INV2*, we also recalculated the peers investment size (*PEER2*). The regression results in column (2) of Table 3 show that the coefficient for the interaction term *DOINS* × *PEER2* is significantly negative, consistent with the results from the baseline regression.

Table 1
Descriptive Statistics.

	N	MEAN	SD	MIN	P25	P50	P75	MAX
INV	38,408	0.058	0.084	-4.584	0.013	0.037	0.079	2.482
DOINS	38,408	0.097	0.296	0.000	0.000	0.000	0.000	1.000
PEER	38,408	0.059	0.024	-0.036	0.045	0.059	0.072	0.236
SIZE	38,408	22.137	1.474	18.744	21.118	21.926	22.905	27.096
ROE	38,408	0.056	0.161	-0.998	0.029	0.071	0.116	0.444
SOE	38,408	0.378	0.485	0.000	0.000	0.000	1.000	1.000
LEV	38,408	0.441	0.218	0.050	0.269	0.430	0.597	0.981
AGE	38,408	2.885	0.348	1.792	2.708	2.944	3.135	3.555
TOP1	38,408	34.374	15.007	8.400	22.665	32.140	44.600	74.300
GROWTH	38,408	0.181	0.468	-0.636	-0.026	0.110	0.273	3.216
DUAL	38,408	0.271	0.445	0.000	0.000	0.000	1.000	1.000

Table 1 presents the descriptive statistics of the sample. Appendix A defines all variables.

Table 2
Impact of D&O Insurance on a Firm's Herding Behavior in Investments.

	(1) INV	(2) INV	(3) INV	(4) INV
PEER	0.465***	0.386***	0.491***	0.409***
	(19.42)	(16.37)	(20.17)	(17.02)
DOINS			0.017***	0.014***
			(5.02)	(4.06)
DOINS × *PEER*			-0.331***	-0.284***
			(-5.90)	(-5.16)
SIZE		0.005***		0.005***
		(11.77)		(11.79)
ROE		0.020***		0.020***
		(10.50)		(10.58)
SOE		-0.008***		-0.007***
		(-4.28)		(-4.23)
LEV		-0.021***		-0.021***
		(-8.78)		(-8.81)
AGE		-0.087***		-0.086***
		(-19.27)		(-19.13)
TOP1		0.000***		0.000***
		(9.13)		(8.98)
GROWTH		0.008***		0.008***
		(14.10)		(14.12)
DUAL		0.004***		0.004***
		(4.26)		(4.23)
_CONS	0.052***	0.153***	0.050***	0.150***
	(23.23)	(10.63)	(22.25)	(10.42)
N	38,408	38,408	38,408	38,408
Year FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
Adj.R^2	-0.010	0.030	-0.009	0.030

Table 2 presents the association between D&O insurance and investment herding behavior. The values within the parentheses report the t-statistics adjusted for heteroskedasticity-robust standard errors. *, **, and *** represent the significance levels of 10%, 5%, and 1%, respectively. The same applies to other tables in the subsequent text.

Table 3
Robustness Test - Alternative Metrics.

	(1) INV	(2) INV2
DOINS2	0.000	
	(1.64)	
PEER	0.389***	
	(16.46)	
DOINS2 × *PEER*	-0.007**	
	(-2.00)	
DOINS		0.018***
		(4.56)
PEER2		0.393***
		(13.48)
DOINS × *PEER2*		-0.335***
		(-5.68)
Controls	YES	YES
Year FE	YES	YES
Firm FE	YES	YES
N	38,408	38,408
Adj.R^2	0.030	0.009

Table 3 presents the results for the robustness test using alternative metrics for DOINS, INV and PEER.

3.2.3. Alternative research samples of psm or high-tech industry

To mitigate the impact of individual firm characteristics on results, we applied Propensity Score Matching (PSM) to match control group sample for each firm that purchased D&O insurance, obtained 8,508 matched firm-year observations. Appendix B reports the variables involved in the PSM process, along with the changes in their regression coefficients before and after matching. Appendix B shows that, before matching, the regression coefficients of most variables on *DOINS* are significant at the 1% or 5% levels. After matching, the regression coefficients for each variable on *DOINS* either become insignificant or experience a decrease in their

significance levels. This result suggests that factors potentially influencing a firm's decision to purchase D&O insurance have been effectively controlled, and the only difference between the treatment and control groups is the purchase of D&O insurance. Columns (1) of Table 4 report the regression results for the matched sample. The coefficient for the interaction term *DOINS* × *PEER* remains significantly negative, consistent with the baseline regression.

Considering the reliance on investments varies across industries, we also focus on samples with a high reliance on investments for robustness checks. Given that the development of high-tech firms is driven by technological innovation, which is closely tied to R&D investments, the uncertainties of R&D investments often compel managers to reference peer in their investment decisions. Columns (2) of Table 4 report the regression results for the high-tech firms. The coefficient of *DOINS* × *PEER* remains significantly negative, support our findings.

3.2.4. Instrumental variable

We use two instrumental variables (IVs) to mitigate the potential endogeneity.

First, we use the railway operating mileage (*RAILWAY*) in each province in each year as IV for the peer investment level (*PEER*). Railway operations foster economic integration among firms, thereby intensifying competition between peers (Xu et al., 2022). The heightened competition will translate into performance pressures on managers and ultimately influence their investment decisions (Wu et al., 2022), thus satisfying the relevance condition for an IV. Besides, railway construction and operation are majority dominated by governments, and do not directly influence peer-imitation decisions among firms, which meet the exogeneity condition of an IV. Panel A of Table5 presents the results using *RAILWAY* as the IV for *PEER*. The coefficient of *RAILWAY* in column (1) is positively significant, with an F-statistic of 734.31, rejecting the weak instruments hypothesis (standard of experience>10). In the second-stage regression, presented in column (2), the coefficient of the key interaction term *DOINS* × *PEER* is significantly negative at the 1% level, further mitigating concerns about the potential endogeneity.

Second, following Yuan et al. (2018), we use the number of CEOs with overseas work or educational experience (*OVERSEAS*) in each firm per year as the IV for D&O insurance purchase (*DOINS*). Given that D&O insurance is widely adopted in mature capital markets (Wang and Sun, 2023), overseas experience enables CEOs to better understand D&O insurance, making them prefer to utilize it to protect their benefits, thus satisfying the relevance condition for an IV. Besides, the CEO's overseas experience is also independent from the firm's peer-imitation decisions, thus meeting the exogeneity condition for an IV. In the first-stage regression, presented in column (1) of Panel B in Table 5, the F-statistic of regression is 294.39, rejecting the weak instruments hypothesis. In the second-stage regression, the coefficient of the key interaction term *DOINS* × *PEER* is significantly negative at the 1% level, confirming the conclusions of the baseline regression.

4. Mechanism test

4.1. Risk incentive mechanism

To further explore whether D&O insurance indeed empowers managers to make more independent decisions, we employed variables to measure managerial risk preferences and risk-taking behavior, investigating how D&O insurance influences both subjective risk preferences and objective risk-taking involved in investment decisions.

Column (1) of Table 6 reports the impact of D&O insurance on subjective managerial risk preferences (*RISK*) base on the research of Malmendier et al. (2005) and Goldberg et al. (2006). Column (2) and (3) present the effect on objective managerial risk-taking behavior (*CRT* and *VCF*) following Koerniadi et al. (2013) and Li et al. (2014). The regression results show that the coefficients of the interaction term *DOINS* × *PEER* are significantly positive across all columns, suggesting that D&O insurance encourages managers to exhibit higher risk preferences and engage in more risk-taking behavior. With reduced concerns about personal liability, managers are motivated to make more independent, risk-taking decisions. Additionally, the increased tolerance for failure enables firms to pursue more diverse and heterogeneous investment strategies. These findings provide empirical support for the presence of the risk

Table 4
Robustness Test - Alternative Research Samples of PSM or High-Tech Industry.

	(1) PSM sample	(2) High-Tech Industry Firms
DOINS	0.002	0.018**
	(0.43)	(2.31)
PEER	0.314***	0.359***
	(7.52)	(8.27)
DOINS × *PEER*	-0.188***	-0.352***
	(-3.27)	(-3.04)
Controls	YES	YES
Year FE	YES	YES
Firm FE	YES	YES
N	8508	21,959
Adj.R^2	0.371	0.033

Table 4 presents the robustness check results using the PSM or high-tech industry samples.

Table 5
Robustness Test - Instrumental Variable.

Panel A: Railway operating mileage as IV for the peer investment level.		
	(1) First-Stage Regression PEER	(2) Second-Stage Regression INV
RAILWAY (PEER)	0.002***	1.488***
	(4.94)	(13.37)
DOINS	-0.023***	0.033***
	(-31.40)	(5.91)
DOINS × RAILWAY (PEER)	0.416***	-0.631***
	(33.97)	(-6.08)
Weak identification Test	CD Wald $F = 734.31$ (P-value = 0.000)	
Under identification Test	SW Chi-sq.=699.59 (P-value = 0.000)	
Controls	YES	YES
Year FE	YES	YES
Firm FE	YES	YES
N	38,408	38,408
Adj.R²	0.457	0.111
Panel B: CEO's overseas experience as IV for the D&O insurance purchase.		
	(1) First-Stage Regression DOINS	(2) Second-Stage Regression INV
PEER	-1.220***	0.865***
	(-31.88)	(24.50)
OVERSEAS (DOINS)	0.002***	0.054***
	(4.58)	(3.36)
OVERSEAS (DOINS) × PEER	14.451***	-0.853***
	(41.14)	(-3.43)
Weak identification Test	CD Wald $F = 294.39$ (P-value = 0.000)	
Under identification Test	SW Chi-sq.= 294.59 (P-value = 0.000)	
Controls	YES	YES
Year FE	YES	YES
Firm FE	YES	YES
N	38,408	38,408
Adj.R²	0.777	0.146

Table 5 presents the results using the instrumental variable for peer investments and D&O insurance purchase.

Table 6
Mechanism Test - Risk Incentive Mechanism.

	(1) RISK	(2) CRT	(3) VCF
DOINS	-0.065**	-0.041**	-0.008***
	(-2.23)	(-2.02)	(-3.40)
PEER	-1.987***	0.639***	-0.032**
	(-10.88)	(4.37)	(-1.98)
DOINS × PEER	1.255***	0.793**	0.187***
	(2.66)	(2.38)	(4.95)
Controls	YES	YES	YES
Year FE	YES	YES	YES
Firm FE	YES	YES	YES
N	33,040	38,105	34,857
Adj.R²	0.121	0.154	0.109

Table 6 presents the results on the increase in managerial risk preferences and risk-taking levels.

incentive mechanism.

4.2. Supervisory governance mechanism

The second positive effect of D&O insurance lies in its capacity to reduce principal-agent problems. To capture principal-agent costs, we constructed two variables based on a firm's management expenses: the management fee ratio (*MFEE*) and the degree of corporate rent-seeking (*RENT*) (Finkelstein, 1992; Dechow et al., 2012). Additionally, we also include the proportion of on-the-job consumption (*PERK*), following Luo et al. (2011), to provide a more comprehensive assessment of managerial self-interest.

The regression results of Table 7 show that the coefficients of the interaction term *DOINS × PEER* are significantly negative for

Table 7
Mechanism Test - Supervisory Governance Mechanism.

	(1) MFEE	(2) RENT	(3) PERK
DOINS	0.045***	0.009***	0.007***
	(8.11)	(2.83)	(4.60)
PEER	-0.123***	0.116***	0.110***
	(-3.32)	(5.21)	(11.33)
DOINS × *PEER*	-0.640***	-0.134**	-0.090***
	(-7.16)	(-2.57)	(-3.88)
Controls	YES	YES	YES
Year FE	YES	YES	YES
Firm FE	YES	YES	YES
N	37,749	34,834	34,855
Adj.R^2	0.021	0.077	0.247

Table 7 presents the results on the reduction in corporate agency costs.

management fees (*MFEE*), rent-seeking activities (*RENT*), and managerial perks (*PERK*). These findings suggest that D&O insurance enhances the intensity of supervisory governance and reduces agency costs. Lower agency costs indicate fewer opportunities for managerial opportunism, fostering greater alignment of interests between the firm and its managers. It helps mitigating abnormal managerial behavior, thereby promoting better value creation for the firm.

4.3. Public supervision mechanism

The third positive effect of D&O insurance lies in the enhanced external governance facilitated by public oversight. We use the annual internet search frequency of a firm (*BAIDU_INDEX*) as a direct proxy for public attention (Da et al., 2011). Since corporate-specific information is more easily disseminated and absorbed by the market under the scrutiny of minority investors and regulatory bodies, we also calculate the information asymmetry index (*ASY*) and stock price synchronicity (*SYNCH*) to capture the level of investors' attention to firm information and the efficiency with which they process and utilize it (Amihud et al., 1997; Hasbrouck, 2009).

The regression results in Table 8 show that the interaction term *DOINS* × *PEER* is significantly positively associated with the Baidu search index (*BAIDU_INDEX*) and significantly negatively associated with the information asymmetry index (*ASY*) and stock price synchronicity (*SYNCH*). These findings suggest that D&O insurance enhances public attention to firms and increases the market's ability to utilize disclosed information. Strengthened external supervision forces managers to perform their duties diligently and deters them from engaging in herd-like investment behavior.

4.4. Does d&o insurance lead a rational behavior of manager?

Although we observe that D&O insurance reduces CEOs' herding behavior in investment decisions, whether it leads to better resource allocation efficiency for the firm remains to be explored. If these independent investment decisions enhance investment efficiency, then mitigating herding behavior through D&O insurance can be regarded as a rational and beneficial strategy. To assess the economic consequences of D&O insurance, we employed the research designs of Richardson (2006), Biddle (2009), and Chen (2011) to measure over-investment and under-investment within firms.

Table 9 reports the impact of peer investment on the investment efficiency of firms, as well as the moderating effect of D&O insurance on this impact. The regression results in column (1) show that a higher level of peer investment leads to over-investment

Table 8
Mechanism Test - Public Supervision Mechanism.

	(1) BAIDU_INDEX	(2) ASY	(3) SYNCH
DOINS	-0.026***	0.066***	0.137***
	(-6.48)	(3.25)	(2.95)
PEER	0.159***	-1.569***	-0.141
	(5.40)	(-10.68)	(-0.42)
DOINS × *PEER*	0.396***	-2.039***	-1.377*
	(6.06)	(-6.07)	(-1.81)
Controls	YES	YES	YES
Year FE	YES	YES	YES
Firm FE	YES	YES	YES
N	30,240	38,152	36,379
Adj.R^2	0.226	0.377	0.229

Table 8 presents the results on the improvement of the information environment and public oversight.

Table 9
The Investment Efficiency of Firms after the Purchase of D&O Insurance.

	Richardson (2006)		Biddle (2009)		Chen (2011)	
	(1) OverInv	(2) UnderInv	(3) OverInv	(4) UnderInv	(5) OverInv	(6) UnderInv
DOINS	0.025**	0.001	-0.003	-0.006**	-0.007	-0.006**
	(2.53)	(0.12)	(-0.23)	(-2.47)	(-0.66)	(-2.10)
PEER	0.177**	-0.202***	0.086	-0.457***	0.085	-0.455***
	(2.45)	(-5.93)	(1.09)	(-25.15)	(1.16)	(-23.54)
DOINS × *PEER*	-0.441***	0.051	-0.060	0.152***	0.011	0.138***
	(-2.77)	(0.63)	(-0.33)	(3.65)	(0.07)	(3.12)
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES
N	13,066	16,852	11,154	19,533	11,487	19,197
Adj.R^2	0.182	0.057	0.144	0.073	0.137	0.066

Table 9 presents the influence of peer investment on a firm' investment efficiency with purchasing D&O insurance.

behavior by managers, suggesting that herding behavior indeed reduces investment efficiency. However, the regression coefficient of *DOINS* × *PEER* is significantly negative, indicating that D&O insurance effectively mitigates the influence of peer investment on managerial over-investment. The regression results in columns (4) and (6) show that a lower level of peer investment also induces herding behavior in under-investment. However, firms that have purchased D&O insurance exhibit significant higher levels of investment, suggesting that D&O insurance can encourage managers to increase investment when peer firms' investment is insufficient.

5. Conclusion

This study examines the impact of purchasing D&O insurance on firms' investment herding behavior. Our findings show that D&O insurance significantly reduces managerial herding, encouraging managers to engage in independent decision-making and pursue risk-taking strategies. Mechanism tests indicate that the positive effects of D&O insurance operate through three main channels: enhanced risk incentives, reduced agency costs, and strengthened external supervision. Moreover, further analysis shows that D&O insurance can help mitigate the reduction in investment efficiency driven by herding behavior.

Rational investment decisions are essential for a firm's sustainability. Therefore, guiding managerial decision-making and reducing herding behavior in investment activities present critical challenges for firms. This study provides empirical evidence that D&O insurance plays a vital role in curbing investment herding by incentivizing managers and alleviating agency problems. Furthermore, our findings elucidate the pathways through which D&O insurance shapes managerial behavior, offering practical insights for firms to refine insurance contract terms. These findings will help firms better take advantage of the potential of D&O insurance, maximizing its benefits in enhancing governance and fostering strategic investment decisions.

CRediT authorship contribution statement

Chen He: Writing – original draft, Data curation, Conceptualization. **Bo Peng:** Writing – review & editing, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Yahao Dong:** Methodology, Investigation, Data curation. **Yuhan Li:** Methodology, Data curation, Conceptualization. **Bofu Deng:** Supervision, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no conflicts of interest.

Appendix A. Variable Definitions

Variables		Measurement
Dependent Variables	*INV*	Net Capital Investment = (Purchase of Fixed Assets + Purchase of Intangible Assets + Purchase of other Long-Term Assets - Disposal of Fixed Assets - Disposal of Intangible Assets - Disposal of other Long-Term Assets) / Total Assets.
Independent Variable	*DOINS*	If the firm has disclosed the purchase of D&O insurance in announcements or documents, and the purchase was approved by a shareholders vote, the value of *DOINS* is 1; otherwise, the value of *DOINS* is 0.
	PEER	The average value of net increase in capital expenditures of the rest firms within the CSRC industry classification for each year. The net increase in capital expenditures of each firm is calculated using the *INV* metric.
Control Variables	*SIZE*	Firm Size = ln (Total Assets)
	ROE	ROE = (Operating Revenue / Net Assets)

(*continued on next page*)

(*continued*)

Variables		Measurement
	SOE	The value is 1 if firm is controlled by state-owned capital, and 0 otherwise
	LEV	Asset-Liability Ratio = (Total Liabilities / Total Assets)
	AGE	Length of Establishment = ln (Current Year − Establishment Year)
	TOP1	The value of the controlling shareholder's shareholding ratio
	GROWTH	Growth Ratio = (Current Revenue - Previous Revenue) / Previous Revenue
	DUAL	The value is 1 if CEO and Chairman of a firm are the same, and 0 otherwise

Appendix B. PSM Matching Process

Appendix B presents the PSM matching process of the regression in column (1) of Table 4. In the PSM process, we control for factors that may influence a firm's decision to purchase D&O insurance, including the firm's operational characteristics (earnings, firm size, return on equity, net profit growth rate, and financing constraints), external environmental factors (industry competition and analyst coverage), and shareholder characteristics (insurance fund ownership, foreign shareholder ownership, and securities fund ownership).

	(1) Before PSM DOINS	(2) After PSM DOINS
EARNING	*0.000****	*-0.000*
	(4.47)	(-0.45)
HHI	3.822	9.822
	(0.79)	(0.54)
ANALYST	-0.000***	-0.000**
	(-3.11)	(-1.99)
SA	0.219***	-0.009
	(17.24)	(-0.23)
INSURANCE_FUND	0.001***	0.000
	(8.49)	(0.97)
QFII	0.001	0.000
	(0.48)	(0.04)
SECURITY_FUND	-0.004***	-0.004
	(-3.28)	(-0.83)
SIZE	0.012***	0.007
	(7.88)	(1.56)
ROE	-0.004	-0.013
	(-0.60)	(-0.62)
GROWTH	-0.005**	-0.011*
	(-2.34)	(-1.87)
Controls	YES	YES
Year FE	YES	YES
Firm FE	YES	YES
N	38,408	8508
Adj.R^2	0.027	0.130

Data availability

The authors do not have permission to share data.

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