The influence of directors' and officers' liability insurance on management tone manipulation – evidence from China

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Abstract

Purpose – This paper explores the association between directors' and officers' liability insurance (D&O insurance) and management tone manipulation.

Design/methodology/approach – This study uses data from A-share listed non-financial companies from 2009 to 2021 as its sample for empirical tests. In addition, the study relies on text analysis and the construction of models to investigate the relationship between D&O insurance and management tone manipulation.

Findings – The authors find that the purchase of D&O insurance will lead to management tone manipulation in the "management discussion and analysis" part of companies' annual reports, and operating risk and agent cost are the two paths for the effect. Further analysis shows that having a male CEO and employing high-quality auditors can weaken the positive impact of D&O insurance on tone manipulation.

Originality/value – This paper provides a new approach for studying the literature related to D&O insurance and management behavior, and the findings enrich our understanding of the influencing factors and

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the mechanism of management tone manipulation, thus revealing policy implications for further standardization of the terms and system of D&O insurance in China.

Keywords D&O insurance, Management tone manipulation, Enterprise operation risk, Agency cost, Text analysis

Paper type Research paper

1. Introduction

In 2002, the release of the governance standards of listed companies brought "directors' and officers' liability insurance" (abbreviated as "D&O insurance") into the Chinese market. In March 2020, the newly revised "securities law" in China increased the risk of civil litigation, and listed company managers and investors began to attach importance to the economic value of D&O insurance and litigation risk aversion, and thus the demand for D&O insurance increased greatly among enterprises.

At first, the implementation of D&O insurance, which was regarded as an effective occupational-risk-management tool, was intended only to transfer the risks of potential litigation faced by corporate directors and officers. Therefore, the related roles of D&O insurance have been widely studied by scholars. The existing literature has focused primarily on the value of D&O insurance to enterprises (Gutierrez, 2003), debt structure (Li, Padmanabhan, & Huang, 2024), managerial behavior (O'Sullivan, 2002), independent innovation (Huang, Ling, & Lu, 2023; Wang & Zhang, 2020), the corporate governance level, and investment efficiency (Ling & Bai, 2017). However, due to the imperfect legal governance system that oversees insurance in China and the lack of details in guarantee terms, enterprises or their management may engage in opportunistic behavior through loopholes after they have purchased D&O insurance. Hu and Hu (2017) show that the purchase of D&O insurance works as intended in terms of its protective effect, improving the risk-taking level of an enterprise and its management and reducing the loss of compensation caused by inappropriate management decisions. However, in so doing it reduces the deterrence effect on management from the threat of shareholder litigation, and it may lead management to make excessively risky investment decisions and increase overall management risk-taking (Lai, Tang, Xia, & Ma, 2019). Furthermore, it may intensify opportunistic behavior by management and worsen the principal-agent conflict, thus increasing the agent cost (Boubakri, Cosset, & Saffar, 2008). On the one hand, the increase in operational risks enhances the investment risks for investors and banks, thus weakening their willingness to invest. In the face of a possible loss of resources, management may then engage in tone manipulation in order to conceal unstable operations by the enterprise. In addition, an increase in agency cost impairs the consistency of goals between shareholders and management and increases the possibility of management acting in self-interest, rendering management likely to interfere with investors' judgment through tone manipulation, for their own profit (Brockman, Khurana, & Martin, 2017). In that light, these issues make it important to study how best to reduce tone manipulation by management, in an effort to improve the authenticity of the text information released and protect the interests of investors. Although scholars increasingly have shifted their attention from the manipulation of financial information to manipulation of textual information in recent years, most people are focusing on studying the incremental information effect of management tone (Li, Wu, & Xiao, 2019), and the consequent important impact of that tone on corporate investment, financing decisions, and stock prices (Hirst *et al.*, 2008; Larcker & Zakolyukina, 2012; Lin, Zhao, & Song, 2022). Some studies have investigated the influencing factors of text tone manipulation, such as management characteristics (Marquez-Illescas, Zebedee, & Zhou, 2019; Faccio, 2006; Malmendier, Tate, & Yan, 2011), corporate governance as a mechanism (Deboskey, Luo, & Zhou, 2019), and company operating conditions (Schleicher & Walker,

2010). At present, however, there is no literature directly linking D&O insurance and textual tone manipulation, and the relationship and possible influencing mechanism between the two can only be inferred from the above relevant literature.

Given that information gap, this paper takes data from Chinese A-share listed non-financial companies during the period from 2009 to 2021 as the sample for empirical tests. The study finds that the purchase of D&O insurance by enterprises will lead to the intensification of management's textual tone manipulation in the "management discussion and analysis" part of their company's annual report, and the company's operating risk and its agency cost are the two paths that produce those effects. Further analysis shows that both having a male CEO and hiring high-quality auditing can weaken the positive impact of D&O insurance on tone manipulation. From the perspective of text information manipulation, this paper provides a new approach for studying the literature related to D&O insurance and management behavior, enriching our understanding of the influencing factors and the mechanism of management tone manipulation, and providing practical significance for further standardization of the terms and system of D&O insurance in China.

The study's possible contributions offer several benefits. First, in terms of research perspective, it provides a scholarly focus on exploring the relationship between D&O insurance and earnings management, and it pays significant attention to the practice of financial information manipulation. Furthermore, this paper explores that practice from the perspective of text information manipulation, which provides a new idea for the research of D&O insurance and management behavior, thus expanding the related research. Second, this paper not only explores the influence that D&O insurance has on management tone manipulation, it also analyzes the internal mechanism for that influence, in order to systematically understand the rationality of D&O insurance's impact on management tone manipulation from the intermediary roles of enterprise operating risk and agency cost. Finally, from the perspective of insurance, this paper discusses whether the introduction of D&O insurance has played a supervisory role or a risk guarantee effect, and it puts forward relevant suggestions for improving D&O insurance provisions and market supervision.

2. Literature review and hypothesis development

Directors' and officers' liability insurance is usually purchased by a company and its directors and senior officers. Then, if the company is sued for negligence or improper unintentional behavior in the process of conducting its practices, the insurance company bears the relevant compensation and legal expenses. Studies have found that the insured firm's management transfers the litigation risk to the insurance company, thus converting a huge loss into the relatively small cost of purchasing insurance, and paving the way for companies to steadily and profitably develop (Griffith, 2006). For its part, the insurance company evaluates the risk and the litigation probability to formulate corresponding insurance premiums, so that the D&O insurance can supervise the company managers during the entire underwriting period (Boyer & Stern, 2014). However, some scholars believe that although D&O insurance, as a good hedge tool for enterprises, provides protection for managers and reduces their legal recovery or property loss resulting from their negligence and misconduct, it also easily triggers management's opportunistic behaviors and damages the interests of the company (Li & Liao, 2014). In contrast, Gutierrez (2003) believes that D&O insurance disperses risks and bears the corresponding legal expenses when senior officers are sued, and when personal property is insufficient to compensate the shareholders because of lawsuits, the insurance company can share part of the loss to guarantee the shareholders' compensation. Therefore, from the existing research, it remains to be tested whether D&O insurance ultimately plays a positive role or a negative one. The market environment, internal controls, and external supervision will all affect the effectiveness of D&O insurance.

Management tone refers to the optimistic or pessimistic emotional information expressed by management in the statement section titled "Management discussion and analysis" in company annual reports (Feldman, Govindaraj, Livnat, & Segal, 2010). Management is expected to disclose the operating conditions, operating risks, and plans of the enterprise in the written text of the company's annual report, and thus to transmit relevant information to investors. In emerging economies, ordinary investors, who lack expertise and experience, tend to rely more on soft information than on hard financial data (Baginski, Demers, Wang, & Yu, 2016). Most of the existing literature has studied the incremental role of management tone in providing information (Davis, Ge, Matsumoto, & Zhang, 2015), as well as the impact of that information on corporate investment and financing decisions and stock prices (Hirst, 2008; Larcker & Zakolyukina, 2012; Lin *et al.*, 2022). Some of the literature includes studies of the influencing factors of tone manipulation from the perspectives of management characteristics (Marquez-Illescas *et al.*, 2019; Faccio, 2006), corporate governance mechanisms (Deboskey *et al.*, 2019; Lee & Park, 2019), and operating performance (Schleicher & Walker, 2010; Huang, Teoh, & Zhang, 2014). Ru, Zhao, and Su (2023) investigated the moderating effect of litigation risk and CEO personality characteristics on the tone manipulation of management. However, research is still lacking on the influencing factors of D&O insurance on management tone manipulation, thus leaving space for this article to explore the influencing factors of tone manipulation.

The non-financial information disclosed in firms' annual reports is mostly forward-looking information, providing investors with additional text descriptions of the company's operational risks and a forecast of its future prospects (Lin *et al.*, 2022). If having D&O insurance intensifies the degree of tone manipulation, in the case of external investors, the wrong information reflected by the intonation will be quickly perceived by those investors. Therefore, management achieves its intended concealment of the operational risks, for their own profit. In contrast, internal investors may reduce their investment in the company's shares after the disclosure of an abnormally positive tone (Zeng, Zhou, Zhang, & Chen, 2018), going against the protection of openness, fairness, impartiality principles in capital markets and the interests of small and medium-sized investors. Meanwhile, the manipulated intonation will affect the information efficiency and pricing efficiency of the bond market, thus in turn affecting the development of the bond market (Lin *et al.*, 2022).

Based on the above summary, this paper reports on a study that deeply explores the influence of D&O insurance on the management tone manipulation from the perspective of insurance, and it discusses the intermediary effects of enterprise operation risk and agency cost on the level of influence that D&O insurance has on management tone manipulation.

On the one hand, from the perspective of enterprise operations, China's legal environment is relatively "loose." The purchase of D&O insurance transfers part of the management's liability, which then relieves the management of having to worry about the property losses caused by their own misconduct, and makes it easier to engage in high-risk decisions to improve the firm's business risks (Lai *et al.*, 2019). In addition, China's shareholders and creditors tend to invest in low-risk companies. Whereas the purchase of D&O insurance leads to higher risk, thereby increasing the shareholders' and creditors' investment risk and uncertainty, management has a strong motivation to whitewash corporate performance through tone manipulation, thus building an artifact of stability and normal operational risk.

On the other hand, according to the principal-agent theory and the theory of information asymmetry, with C&O insurance protection, the agents (managers) consider their own interests more and deviate from the corporate goals while performing their fiduciary responsibility. The purchase of D&O insurance forms a shelter for management, weakens the deterring influence of fears of shareholder litigation, and reduces management's costs associated with self-interest and illegal behavior, thus aggravating the agency conflict between shareholders and managers, and increasing the agency cost. In addition, due to the

imperfect design of the relevant systems and terms of D&O insurance in China, and their insufficient implementation, there is no clear stipulation on how to scientifically judge negligence on the part of management. Therefore, management has additional space for behaving opportunistically, which aggravates the problem of entrustment and increases the agency cost (Boubakri *et al.*, 2008). It is difficult for shareholders to restrain management's behavior, hence reducing both parties' level of consistency of interest objectives and increasing the possibility that management will behave in its own self-interest. This situation in turn leads managers to strategically manipulate their text tone, thus increasing their personal income. In addition, management can dominate the information provided, which makes it convenient for management to carry out tone manipulation, and will increase the manipulation of the annual report tone driven by interested parties. In summary, this paper proposes that the purchase of D&O insurance will promote the enterprise's management to conduct tone manipulation.

From the above analysis, we make an initial hypothesis.

H1. When other conditions remain unchanged, an enterprise's purchase of D&O insurance aggravates management's tone manipulation.

According to the impression management theory, management may take some measures to cover up any negative image of their enterprise and maximize the positive effects (Buchholz, Jaeschke, Lopatta, & Maas, 2018). On one hand, the purchase of D&O insurance causes an increase in a company's business risks. From the perspective of internal management decisions, in China's relatively loose legal environment, the purchase of D&O insurance transfers part of management's liability for claims made against it or the firm, weakens the legal effects of any shareholder litigation, and minimizes management's worries about property damage as a result of its own misconduct. This leads to a change in management's conservative inclination, pointing it toward investing and making risky decisions, such as taking on overindebtedness and overinvestment, which increase the business's operational risks (Lai *et al.*, 2019). In terms of obtaining external resources, studies have found that companies with a high risk of litigation tend to buy D&O insurance (Core, 1997), whereas the purchase of D&O insurance signals to banks that the firms may be at high risk, consequently reducing the allocation of bank credit resources and the available funds for businesses, and increasing the risk of the insured enterprises' operations.

Furthermore, the rise in firms' operational risk strengthens their managements' motivation for tone manipulation. Because the development of China's capital market is not perfect, most firms are still individual investors, and they are inclined to make low-risk investments. An increase in an enterprise's management risk means that its future profitability and value are difficult to assess, thus creating doubt from investors and bank creditors about the management's operational abilities (Neffati, Fred, & Schalck, 2011), and meanwhile increasing their investors' and creditors' risk and uncertainty. In the face of a loss of resources, managers beautify the image of their enterprise to hide the fact of engaging in high risk to obtain management resources, which triggers tone manipulation.

From the above analysis, this paper maintains that the purchase of D&O insurance increases firms' business risk and then aggravates the degree of management tone manipulation, so we propose the following assumption.

H2. With other conditions remaining unchanged, having D&O insurance increases the operational risks of an enterprise and thus aggravates the degree of its managers' tone manipulation.

According to the principal-agent theory and the information asymmetry theory, an agent considers his own interests more and deviates from the corporate goals when performing his fiduciary responsibility. The purchase of D&O insurance forms a shelter for management,

weakening the deterrent effects of possible shareholder litigation and reducing the self-interest costs of the agency conflict between the shareholders and management and aggravating that conflict, thus increasing the enterprise's agency costs. With the aggravation of the agency problem, the agency costs and the autonomy of management increase, and shareholders find it difficult to restrain the behavior of management, who may strategically manipulate their informational text tone so as to increase their personal income. In addition, management, through the disclosures in the company's annual report, is responsible for disclosing the company's information and is the information-advantage party—a position that improves the feasibility for management to conduct tone manipulation (Lin *et al.*, 2022) and increases the manipulation of the annual report's tone, as driven by specific interests. In summary, the higher the agency cost is, the stronger is the management motivation for tone manipulation.

From the above analysis, this paper concludes that the purchase of D&O insurance increases an enterprise's agency cost and thus prompts management to conduct tone manipulation. Therefore, we make the following assumption.

H3. When other conditions remain unchanged, the acquisition of D&O insurance increases an enterprise's agency cost and thus aggravates the degree to which management will manipulate tone.

3. Research design

3.1 Sample selection and data source

In this paper, we select A-share listed companies for the period 2009–2021 as the object of our research. The starting year 2009 is chosen primarily because China carried out accounting standards reform in 2007, and to avoid the significant impact of that reform and the 2008 financial crisis on the study's conclusions, the data for this study start from 2009.

The study's management tone data are taken from the China Research Data Service (CNRDS) platform. The database measures text information sentiment on the basis of the lists of financial sentiment expressions in the Loughran-McDonald dictionary (the LM dictionary), which is widely used for tone analysis. The data for D&O insurance also come from the China Research Data Services (CNRDS), and other data are all derived from the China Stock Market and Accounting Research (CSMAR) database.

In the sample screening procedure, this study excludes companies listed in the financial industry, samples with excessive missing data of major variables, and the samples that receive special treatment from the stock exchange. The data were processed and analyzed using Stata17.0 software. After screening and processing, there are 21141 samples left. All continuous variables are winsorized at the 1% level at both tails to eliminate the effect of extreme values on the study's conclusions.

3.2 Definition of variables

3.2.1 Dependent variable. First, referring to the prior study of Xie and Lin (2015), we measure the net tone of management using the following model:

$$Tone = (positive\ words - passive\ words)/(positive\ words + passive\ words). \quad (3.2.1)$$

Next, following Zhu and Xu (2018), the value of the regression residual calculated by model (3.2.2) is taken as a measure of the degree of management tone manipulation:

$$Tone_{i,t} = \rho_0 + \rho_1 EARN_{i,t} + \rho_2 RET_{i,t} + \rho_3 BM_{i,t} + \rho_4 STD\_RET_{i,t} + \rho_5 Size_{i,t} + \rho_6 STD\_EARN_{i,t} + \rho_7 AGE_{i,t} + \rho_8 Loss_{i,t} + \rho_9 DEARN_{i,t} + \rho_{10} EARN_{i,t+1} + \varepsilon_{i,t}. \quad (3.2.2)$$

where *Tone* is the net tone of management, calculated from the model (3.2.1); $EARN_{it}$ is the company performance, equal to net profit of this year divided by total assets of the previous year; RET_{it} is the rate of return to maturity of the stock held for 12 months; BM_{it} is the book value of the company's assets divided by the market value of the company (also known as the book-to-market ratio); STD_RET_{it} is the standard deviation of the monthly yield of individual stocks; $Size_{it}$ is the size of the company, equal to the natural logarithm of the total assets; STD_EARN_{it} is the standard deviation of the company's performance in the past five years; AGE_{it} is the age of the company; $Loss_{it}$ is a virtual variable to measure loss in the current period; $DEARN_{it}$ is the difference between the annual net profit of t period and t–1 period divided by the total assets of year t–1; and $EARN_{it+1}$ is the performance of the company in the next period, equal to year t+1 net profit divided by the total assets in year t. The net value of the residual term in model (3.2.2) measures the degree of management tone manipulation (Guo & Li, 2023), and a higher value indicates a more severe level of management tone manipulation (Meng, Du, & Gong, 2024).

3.2.2 Independent variable. The following Ru *et al.* (2023), the virtual variable *D&O* is set to measure whether a listed company buys D&O insurance. If the general meeting of shareholders votes to pass the proposal of purchasing the D&O insurance, the *D&O* variable is assigned a value of 1, otherwise it is assigned 0.

3.2.3 Intermediary variable. Following Lai *et al.* (2019) and John, Litov, and Yeung (2008), three-year volatility of industry-adjusted return on assets is adopted as the proxy variable of enterprise operating risk (*D_Roa*). In addition, based on the research of Li (2007), Yuan, Yue, and Tan (2014), the management expense ratio (*Fee*) is used to measure the agency cost between shareholders and management, and equals the main business income divided the management cost. The greater the *Fee* value is, the higher the agency cost is and the more serious the agency conflict is.

3.2.4 Control variables. Referring to Zhu and Xu (2018) and Faccio, Marchica, and Mura (2011), management tone manipulation is affected by the company's financial situation, its corporate governance, and its own characteristics (Ru *et al.*, 2023; Zhang *et al.*, 2024; D'Augusta & DeAngelis, 2020). Therefore, the control variables selected in this paper are divided into those three dimensions. First, we select the asset-liability ratio (*Lev*), growth rate of main business revenue (*Growth*), profitability (*ROE*, for returns on equity), whether loss occurs (*Loss*), operating cash flow (*OCF*), and current ratio (*LR*) to control for the firm's financial situation. Second, the proportion of independent directors (*Dir*), the equity concentration (*Top1*), and the number of directors on the board of directors (*Board*) are selected to control for the characteristics at the corporate governance level. Moreover, this study controls for the characteristics of enterprises according to company size (*Size*), the book-to-market ratio (*BM*), and duality (*Dual*). Furthermore, industry and annual fixed effects are also controlled for in the model. The specific definitions are shown in Table 1.

3.3 Model specification

(1) The relationship between D&O insurance and management tone manipulation

To test Hypothesis H1, which predicts a positive correlation between D&O insurance and management tone manipulation (*Abtone*), we construct model 3.3.1:

Type of variable	Variable name	Variable symbol	Definitions
Dependent variable	Management tone manipulation	*Abtone*	The net value of the residual term of the model (3.2.2)
Independent variable	D&O insurance	*D&O*	The listed company buys D&O insurance in the current year, and the value is 1, otherwise is 0
Intermediary variable	Operating risk	*D_Roa*	3-year volatility on the industry-adjusted return on assets
	Agency cost	*Fee*	Management expenses/Main business income
Control variables	Company size	*Size*	The natural logarithm of the total assets at the year end
	Asset-liability ratio	*Lev*	Total debt at year end/Total asset at year end
	Growth rate of main business income	*Growth*	Increase of main business income in this period/Main business income of last year
	Return on equity	*ROE*	Net margin/Average net asset balance
	The proportion of independent directors	*Dir*	Number of independent directors/Total number of board members
	Equity concentration	*Top1*	The largest shareholders shareholding ratio
	Loss or not	*Loss*	If the net profit of the year is less than 0, the value is 1, otherwise it is 0
	Operating cash flow	*OCF*	Net cash flow from operating activities/total assets
	Liquidity ratio	*LR*	Current assets/current liabilities
	Book-to-market ratio	*BM*	Book value of total assets/Total market value
	Number of the board of directors	*Board*	The natural logarithm of the number of the board of directors
	Duality	*Dual*	Whether the chairman is concurrently CEO: concurrently = 1, not concurrently = 0
	Industry	*Industry*	Industry virtual variables
	Year	*Year*	Year virtual variables

Source(s): Table by authors

Table 1. Definitions of the variables

$$Abtone_{i,t} = \alpha_0 + \alpha_1 D\&O_{i,t} + \alpha_2 Size_{i,t} + \alpha_3 Lev_{i,t} + \alpha_4 Growth_{i,t} + \alpha_5 Dir_{i,t} + \alpha_6 Top1_{i,t} + \alpha_7 ROE_{i,t} + \alpha_8 Loss_{i,t} + \alpha_9 OCF_{i,t} + \alpha_{10} LR_{i,t} + \alpha_{11} Dual_{i,t} + \alpha_{12} BM_{i,t} + \alpha_{13} Board_{i,t} + \alpha_{14} \sum Industry_{i,t} + \alpha_{15} \sum Year_{i,t} + \varepsilon_{i,t}. \quad (3.3.1)$$

(2) The intermediary role of operating risks

Jiang (2022) and Wen, Wang, Ma, and Meng (2024) suggest that the focus of mediating effect analysis in causal inference studies is the effect of the explanatory variable (here, *D&O*) on the mediating variable. Hence, to test Hypothesis H2, model 3.3.2 is established to test the impact of D&O insurance on the operating risk of enterprises, and to verify the influence of the explanatory variable D&O insurance (*D&O*) on the intermediary variable operating risk (*D_Roa*).

$$D\_Roa_{i,t} = \beta_0 + \beta_1 D\&O_{i,t} + \beta_2 Size_{i,t} + \beta_3 Lev_{i,t} + \beta_4 Growth_{i,t} + \beta_5 Dir_{i,t} + \beta_6 Top1_{i,t} + \beta_7 ROE_{i,t} + \beta_8 Loss_{i,t} + \beta_9 OCF_{i,t} + \beta_{10} LR_{i,t} + \beta_{11} Dual_{i,t} + \beta_{12} BM_{i,t} + \beta_{13} Board_{i,t} + \beta_{14} \sum Industry_{i,t} + \beta_{15} \sum Year_{i,t} + \varepsilon_{i,t}. \quad (3.3.2)$$

(3) The intermediary role of agent costs

In the same way, to test Hypothesis H3, model 3.3.3 is established to test the impact of D&O insurance on the agency cost, and to verify the influence of the explanatory variable D&O insurance (*D&O*) on the intermediary variable agency cost (*Fee*).

$$Fee_{i,t} = \delta_0 + \delta_1 D\&O_{i,t} + \delta_2 Size_{i,t} + \delta_3 Lev_{i,t} + \delta_4 Growth_{i,t} + \delta_5 Dir_{i,t} + \delta_6 Top1_{i,t} + \delta_7 ROE_{i,t} + \delta_8 Loss_{i,t} + \delta_9 OCF_{i,t} + \delta_{10} LR_{i,t} + \delta_{11} Dual_{i,t} + \delta_{12} BM_{i,t} + \delta_{13} Board_{i,t} + \delta_{14} \sum Industry_{i,t} + \delta_{15} \sum Year_{i,t} + \varepsilon_{i,t}. \quad (3.3.3)$$

4. Empirical results and analysis

In this section we begin with a descriptive statistical analysis, and then we perform the correlation analysis for the main variables. After that, we empirically tested the specific impact of D&O insurance on tone manipulation according to model 3.3.1. Then, model 3.3.2 is used to analyze the intermediary role of enterprise operating risk in the influence of D&O insurance on management tone manipulation (H2). Finally, model 3.3.3 is used to analyze the intermediary role of agency cost in the impact of D&O insurance on management tone manipulation (H3). In addition, a robustness test is conducted using the replacement variable method, propensity score matching (PSM), and the instrumental variable approach. We end by comparing the influence of D&O insurance on management tone manipulation between different executive genders and different levels of auditing quality.

Variable	Sample size	Mean	Standard deviation	Minimum value	Median	Maximum value
Abtone	21,141	−0.001	0.110	−0.284	0.005	0.228
D&O	21,141	0.104	0.305	0.000	0.000	1.000
Size	21,141	22.325	1.316	19.438	22.175	26.263
Lev	21,141	0.469	0.209	0.068	0.467	0.979
Growth	21,141	0.459	1.398	−0.753	0.133	10.545
Dir	21,141	0.416	0.075	0.333	0.400	0.667
Top1	21,141	0.335	0.149	0.082	0.311	0.743
ROE	21,141	0.045	0.175	−1.108	0.063	0.349
Loss	21,141	0.128	0.334	0.000	0.000	1.000
OCF	21,141	0.046	0.072	−0.180	0.045	0.250
LR	21,141	1.983	1.742	0.249	1.475	11.300
Dual	21,141	0.221	0.415	0.000	0.000	1.000
BM	21,141	1.096	1.171	0.083	0.711	7.038
Board	21,141	2.131	0.204	1.609	2.197	2.708

Source(s): Table by authors

Table 2. Descriptive statistical analysis

4.1 Descriptive statistics

In this paper, all continuous variables are winsorized to reduce the interference of extreme values, and processed data are used for subsequent regression analyses. Table 2 presents the descriptive statistical analysis results of the main variables. The data in the table list the mean value of tone manipulation as −0.001 and the standard deviation as 0.110. The difference between the maximum and minimum values is large, indicating that there are obvious differences in the degree of tone manipulation conducted by the management of listed companies in China. The average value of D&O insurance (*D&O*) is 0.104, representing 10.4% of the 21141 valid data points and reflecting the fact that 10.4% of the enterprises in this study have acquired D&O insurance.

The statistical results of the control variables are basically consistent with the existing literature and are within a reasonable range. The mean company size (*Size*) is 22.325, and the standard deviation is 1.316, showing that there are great differences in the asset scales of different enterprises. The minimum asset-liability ratio (*Lev*) is 0.068, while the maximum value is 0.979, demonstrating that there are still some enterprises with greater liabilities and financial risks. The mean value of growth (*Growth*) is 0.459 and the standard deviation is 1.398, while the difference between the maximum and the minimum values is large, indicating that there are huge differences in the levels of operating revenue growth of different companies. The mean value of profitability (*ROE*) is 0.045, which shows that the enterprises generally have a favorable development trend. The mean proportion of independent directors (*Dir*) is 0.416, showing that more than one-third of the directors of the listed companies are independent directors, in compliance with the provisions of the relevant policies. The average shareholding ratio of the largest shareholder (*Top1*) is 0.335, and the maximum value is 0.743, indicating that the controlling shareholder has a strong level of control and a significant impact on the enterprise. The maximum and minimum values of operating cash flow (*OCF*), current ratio (*LR*), duality (*Dual*), book-to-market value (*BM*), and number of directors on the board of directors (*Board*) vary greatly, thereby suggesting that there are great differences among different enterprises.

Variable	No D&O insurance purchased		D&O insurance purchased		Difference in means
	Observed value	Mean	Observed value	Mean	
Abtone	18,946	−0.003	2,195	0.016	−0.019***
D_Roa	18,946	0.035	2,195	0.036	−0.001
Fee	18,946	0.096	2,195	0.076	0.020***
Size	18,946	22.229	2,195	23.156	−0.927***
Lev	18,946	0.463	2,195	0.523	−0.061***
Growth	18,946	0.466	2,195	0.399	0.067**
Dir	18,946	0.416	2,195	0.413	0.003*
Top1	18,946	0.334	2,195	0.344	−0.009***
ROE	18,946	0.045	2,195	0.043	0.002
Loss	18,946	0.127	2,195	0.138	−0.011
OCF	18,946	0.046	2,195	0.049	−0.003**
LR	18,946	2.015	2,195	1.706	0.309***
Dual	18,946	0.228	2,195	0.164	0.064***
BM	18,946	1.031	2,195	1.657	−0.625***
Board	18,946	2.128	2,195	2.149	−0.020***

Table 3. Difference-in-means test

Note(s): ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively
Source(s): Table by authors

Variable	VIF	1/VIF
D&O	1.05	0.948
Size	1.99	0.502
Lev	2.38	0.421
Growth	1.03	0.971
Dir	1.12	0.889
Top1	1.10	0.909
ROE	1.88	0.531
Loss	1.80	0.554
OCF	1.14	0.880
LR	1.82	0.549
Dual	1.05	0.948
BM	2.03	0.493
Board	1.22	0.817
VIF mean	1.51	

Source(s): Table by authors

Table 4. Variance inflation factor test

On the basis of the descriptive statistics of the full sample, we divide the sample into two groups according to whether the firm chooses to buy D&O insurance, and we then conduct a difference-in-means test. As can be seen from Table 3, the average of the management tone manipulation is −0.003 in the no-D&O-insurance-purchased group, whereas that value is 0.016 in the D&O-insurance-purchased group, and the mean difference is significant at the 1% level. The results indicate that the degree of tone manipulation in the companies that purchased D&O insurance is higher than that in the no-D&O-insurance-purchased companies, which verifies H1.

In order to ensure the reliability of the model, we also calculated the variance inflation factors (VIFs). The calculation results are given in Table 4, and all of the VIF values for the variables are less than 10, indicating that there is no multicollinearity problem among the variables of the regression model.

4.2 Correlation analysis

Before performing the model regression we conduct a correlation analysis, and the results are given in Table 5, which lists the Pearson correlation coefficients among the variables. From those data, we note that the correlation coefficient between the management tone manipulation (*Abtone*) and whether the firm chooses to buy D&O insurance (*D&O*) is 0.05, which is significant at the 1% level, thus indicating that the management tone manipulation of the enterprises purchasing D&O insurance is stronger. That preliminarily verifies Hypothesis H1.

4.3 Multiple regression analysis

4.3.1 D&O insurance and management tone manipulation. To study the effect of D&O insurance on management tone manipulation, model 3.3.1 was used, and the regression results are shown in Table 6. Column (1) is the full-sample regression without control variables, and we see that the regression coefficient between D&O insurance (*D&O*) and tone manipulation (*Abtone*) is 0.006, which is significant at the 5% level. Column (2) joins the control variables, and meanwhile, we also perform a full sample regression after controlling for industry and annual fixed effects. The results show that the regression coefficient of D&O insurance (*D&O*) and tone manipulation (*Abtone*) is 0.005, which is significant at the 5%

Table 5.
Correlation coefficients

Variable	*Abtone*	*D&O*	*Size*	*Lev*	*Growth*	*Dir*	*Top1*	*ROE*	*Loss*	*OCF*	*LR*	*Dual*	*BM*	*Board*
Abtone	1.00													
D&O	0.05***	1.00												
Size	0.00	0.21***	1.00											
Lev	−0.01	0.09***	0.36***	1.00										
Growth	0.00	−0.01*	−0.02*	0.07***	1.00									
Dir	0.01*	−0.01	−0.02*	−0.02***	0.00	1.00								
Top1	0.00	0.02**	0.26***	0.09***	0.03***	0.03***	1.00							
ROE	−0.00	−0.00	0.14***	−0.20***	0.05***	0.01	0.12***	1.00						
Loss	0.00	0.01	−0.13***	0.19***	−0.03***	−0.02*	−0.11***	−0.66***	1.00					
OCF	−0.01	0.01*	0.07***	−0.18***	−0.09***	−0.01	0.09***	0.26***	−0.19***	1.00				
LR	−0.01*	−0.05***	−0.27***	−0.65***	0.02*	0.02**	−0.06***	0.09***	−0.11***	0.02**	1.00			
Dual	0.02***	−0.05***	−0.12***	−0.09***	−0.01	0.05***	−0.11***	−0.01	0.01*	−0.01	0.08***	1.00		
BM	−0.04***	0.16***	0.63***	0.51***	0.04***	−0.02*	0.16***	−0.06***	0.03***	−0.09***	−0.27***	−0.11***	1.00	
Board	−0.01	0.03***	0.23***	0.13***	−0.03***	−0.32***	0.06***	0.06***	−0.06***	0.05***	−0.13***	−0.18***	0.15***	1.00

Note(s): ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively
Source(s): Table by authors

Variable	(1) *Abtone*	(2) *Abtone*
D&O	0.006**	0.005**
	(2.51)	(2.12)
Size		0.004***
		(5.27)
Lev		−0.001
		(−0.22)
Growth		0.000
		(0.77)
Dir		0.024**
		(2.25)
Top1		0.025***
		(4.64)
ROE		−0.009
		(−1.63)
Loss		−0.001
		(−0.21)
OCF		−0.013
		(−1.22)
LR		−0.003***
		(−6.06)
Dual		0.001
		(0.72)
BM		−0.008***
		(−8.25)
Board		0.014***
		(3.34)
_cons	−0.034***	−0.166***
	(−5.29)	(−8.31)
Year	Yes	Yes
Industry	Yes	Yes
N	21141.000	21141.000
r2_a	0.081	0.089

Note(s): ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Numbers in parentheses are the *t*-values
Source(s): Table by authors

Table 6. D&O insurance and management tone manipulation

level, thus indicating that the degree of management tone manipulation is stronger in companies that have purchased D&O insurance, thus verifying H1.

4.3.2 D&O insurance, operating risk, and management tone manipulation. To test the mediating effect of operational risk on the influence of D&O insurance on management's tone manipulation, we built model 3.3.2. The regression results are shown in Table 7. The regression coefficient of *D&O* insurance is 0.006 and the *t*-value is 4.91, which is significant at the 1% level, indicating that the firm's operating risk is increased after purchasing D&O insurance. Although there are other intermediary roles, H2 is verified.

4.3.3 D&O insurance, agency cost and management tone manipulation. In a similar procedure, to test the intermediary role of agency cost in the influence of D&O insurance on management's manipulation of tone, we use our constructed model 3.3.3. The regression results of the impact of D&O insurance on tone manipulation are given in Table 6 column (2), which shows that the managers of the companies purchasing D&O insurance engage in a stronger degree of tone manipulation. In a second step we verify whether the influence of D&O insurance on the intermediary variable agent cost (*Fee*) is significant, and the

Variable	(1) *D_Roa*
D&O	0.006***
	(4.91)
D_Roa	
Size	−0.008***
	(−20.20)
Lev	0.077***
	(27.43)
Growth	0.001***
	(4.86)
Dir	−0.011**
	(−2.02)
Top1	−0.022***
	(−8.08)
ROE	−0.059***
	(−20.58)
Loss	0.027***
	(18.45)
OCF	0.017***
	(3.08)
LR	0.003***
	(9.18)
Dual	0.002*
	(1.71)
BM	−0.009***
	(−17.95)
Board	−0.012***
	(−5.64)
_cons	0.230***
	(22.81)
Year	Yes
Industry	Yes
N	21141.000
r2_a	0.242

Note(s): ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Numbers in parentheses are the *t*-values
Source(s): Table by authors

Table 7.
D&O insurance, operating risk, and management tone manipulation

regression results are shown in Table 8. The *D&O* insurance regression coefficient is 0.006, and the *t*-value is 3.13, which is significant at the 1% level, indicating that D&O insurance worsens the agency conflict between shareholders and management. Thus, agency cost plays an intermediary role in the influence of D&O insurance on tone manipulation, and H3 is verified.

4.4 Robustness tests

The regression results demonstrate that D&O insurance prompts the management to manipulate the tone of the information it provides, but the reliability of this conclusion may be affected by many factors, such as omitted variable bias and sample selection bias. Therefore, to make the regression results more robust, we adopt the replacement variable method, the propensity score matching method, and the instrumental variable approach.

Variable	(1) *Fee*
D&O	0.006***
	(3.13)
Fee	
Size	−0.019***
	(−31.08)
Lev	−0.014***
	(−3.40)
Growth	0.002***
	(5.82)
Dir	0.016**
	(2.05)
Top1	−0.048***
	(−12.54)
ROE	−0.035***
	(−8.65)
Loss	0.045***
	(21.58)
OCF	−0.074***
	(−9.40)
LR	0.003***
	(7.93)
Dual	0.001
	(0.46)
BM	−0.003***
	(−3.81)
Board	0.002
	(0.55)
_cons	0.500***
	(34.97)
Year	Yes
Industry	Yes
N	21141.000
r2_a	0.288

Note(s): ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Numbers in parentheses are the *t*-values
Source(s): Table by authors

Table 8. D&O insurance, agency cost, and management tone manipulation

4.4.1 A measure of replacement tone manipulation. Previously, we calculated management tone manipulation by using financial emotion translation vocabulary provided by the LM dictionary's Sentiment Word Lists, applied to information found in the CNRDS database containing companies' management discussion and analysis documents. The tone of the full text of each company's annual report is analyzed. The data on a firm's management are compared with lists from the LM dictionary and used to calculate the net tone (*Tone*) for that company by dividing the difference between the number of positive words and the number of negative words in the firm's annual report by the total number of words in that annual report, and then the tone manipulation is remeasured. Here, we first replaced *Tone* substitution variables into model 3.2.2 to obtain the net value of the regression fitted residuals and obtain the tone manipulation index (*Abtone1*). After controlling for the fixed effects, we obtained the regression results listed in Table 9 (column 1). The regression coefficient of D&O insurance (*D&O*) on tone manipulation is 0.005 and the *t*-value is 1.97,

Variable	(1) *Abtone1*	(2) *DUM_Abtone*	(3) *Abtone2*
D&O	0.005**	0.106**	0.005***
	(1.97)	(2.12)	(2.85)
Size	0.004***	0.076***	0.001**
	(4.59)	(4.63)	(2.04)
Lev	−0.003	−0.014	0.010**
	(−0.53)	(−0.13)	(2.30)
Growth	0.000	0.007	0.001
	(0.70)	(0.69)	(1.54)
Dir	0.025**	0.432**	0.007
	(2.30)	(2.02)	(0.92)
Top1	0.027***	0.354***	0.011***
	(5.00)	(3.39)	(2.61)
ROE	−0.011*	−0.063	−0.013***
	(−1.91)	(−0.56)	(−2.98)
Loss	−0.010***	−0.001	0.004*
	(−3.44)	(−0.02)	(1.91)
OCF	−0.003	−0.344	−0.022**
	(−0.24)	(−1.60)	(−2.57)
LR	−0.003***	−0.056***	−0.001***
	(−6.01)	(−4.95)	(−3.07)
Dual	0.001	0.037	0.000
	(0.64)	(1.03)	(0.22)
BM	−0.008***	−0.131***	−0.003***
	(−8.03)	(−6.93)	(−4.12)
Board	0.015***	0.200**	0.010***
	(3.52)	(2.46)	(3.32)
_cons	−0.156***	−2.756***	0.016
	(−7.80)	(−6.98)	(1.04)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	21141.000	21134.000	10893.000
r2_a	0.087		0.066

Note(s): ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Numbers in parentheses are the *t*-values
Source(s): Table by authors

Table 9.
Regression results after replacing tone manipulation measures

which is significant at the 5% level. The results once again prove that acquiring D&O insurance aggravates the degree of tone manipulation by management.

Second, following Zhu and Xu (2018), when the abnormal tone residual in the tone separation model is greater than 0, the value of the virtual variable *DUM_Abtone* is set to 1, and otherwise it is set to 0, and logit regression is performed on model 3.3.1. As the regression results reveal in Table 9 (column 2), the regression coefficient of D&O insurance (*D&O*) on tone manipulation is 0.106 and the *t*-value is 2.12, which is significant at the 5% level, indicating that the results are still robust.

Third, because this paper explores the issue of D&O insurance promoting positive tone manipulation by management, in accord with the impression management theory and the principal-agent theory, we exclude the samples with negative abnormal tone residuals in the tone separation model and then perform the model 3.3.1 regression. The results are given in Table 9 (column 3), and we see that the regression coefficient of D&O insurance (*D&O*) on tone manipulation is 0.005, while the *t*-value is 2.85, which is significant at the 1% level. Therefore, our conclusion is shown to be robust.

4.4.2 Propensity score matching model. At present, the proportion of listed companies buying D&O insurance in China is relatively low, and large differences exist in the governance characteristics and profitability among different companies. These differences not only affect the demand of enterprises for D&O insurance, they also affect the behavior of management, thus making it unclear whether management's manipulation of tone is due to the purchase of D&O insurance or is based on the role of covariates related to D&O insurance, which would lead to sample selection bias. Therefore, to explore the real role of D&O insurance in management tone manipulation, it is necessary to control for the deviation of sample selection. To minimize this bias and alleviate any endogeneity, in this study we utilize the PSM model for regression. The specific operations are detailed next.

First, we divide the sample into two groups on the basis of whether the company purchased D&O insurance—that is, one group is composed of the companies that purchased D&O insurance and a second group comprises the companies that did not. Next, following Hu and Hu (2017) and Lai *et al.* (2019), we use the characteristics of enterprise size (*Size*), growth ability (*Growth*), the proportion of independent directors (*Dir*), and the largest

		Mean			*t*-test	
Variable	Sample	Treatment group	Control group	Standard deviations	*t*-stat	*p*-value
Size	Before matching	23.16	22.23	64.50	0	1.67*
	After matching	23.15	23.16	−0.400	−0.120	0.902
Growth	Before matching	0.399	0.466	−5	0.0330	0.78*
	After matching	0.395	0.399	−0.300	−0.120	0.901
Dir	Before matching	0.413	0.416	−3.800	0.100	0.88*
	After matching	0.413	0.412	1	0.330	0.741
Top1	Before matching	0.344	0.334	6.200	0.00500	1.050
	After matching	0.344	0.347	−2	−0.660	0.507
ROE	Before matching	0.0431	0.0450	−1.100	0.621	1.25*
	After matching	0.0445	0.0508	−3.400	−1.170	0.242
Loss	Before matching	0.138	0.127	3.200	0.149	
	After matching	0.136	0.137	−0.300	−0.0900	0.930
OCF	Before matching	0.0493	0.0461	4.500	0.0470	0.970
	After matching	0.0494	0.0479	2.200	0.740	0.462
LR	Before matching	1.706	2.015	−19	0	0.70*
	After matching	1.709	1.746	−2.300	−0.800	0.422
Dual	Before matching	0.164	0.228	−16.10	0	
	After matching	0.164	0.159	1.300	0.450	0.652
BM	Before matching	1.657	1.031	44.40	0	2.42*
	After matching	1.645	1.685	−2.800	−0.790	0.431
Board	Before matching	2.149	2.128	9.900	0	1.030
	After matching	2.149	2.153	−1.700	−0.550	0.583

Source(s): Table by authors

Table 10. Propensity score matching procedure

shareholder shareholding ratio (*Top1*) as matching variables to calculate the propensity matching score of whether the enterprise buys D&O insurance. Pairing is performed by one-to-one nearest-neighbor matching, with paired samples of a control group and a group with similar multidimensional characteristics of listed companies that purchased D&O insurance (treatment group) generated. Finally, the matched samples were subjected to regression analysis.

The matching effect is shown in Table 10. Looking at the standard deviations, we note that the standard deviation of each after-matching variable is significantly different from that of the pre-matching sample. The value of the error between the matched treatment group and the control group significantly decreases to less than 10%, indicating that a good matching effect is achieved. Next, we note that most of the variables are significantly different between the treatment group and control group before matching, while none of the variables are significantly different after matching, further indicating that the results after the match pass the "balance hypothesis test."

The regression test results after PSM are given in Table 11, and the regression coefficient of D&O insurance (*D&O*) for management tone manipulation (*Abtone*) is 0.006, with a *t*-value

Variable	(1) *Abtone*
D&O	0.006*
	(1.75)
Size	0.003*
	(1.95)
Growth	−0.003**
	(−2.22)
Dir	0.045*
	(1.68)
Top1	0.028**
	(2.20)
ROE	−0.034**
	(−2.55)
Loss	−0.008
	(−1.20)
OCF	−0.014
	(−0.52)
LR	−0.005***
	(−3.77)
Dual	0.007
	(1.39)
B/M	−0.008***
	(−4.81)
Board	−0.016*
	(−1.66)
_cons	−0.069
	(−1.53)
Year	Yes
Industry	Yes
N	3872.000
r2_a	0.129

Note(s): ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively Numbers in parentheses are the *t*-values
Source(s): Table by authors

Table 11.
Regression results using PSM

of 1.75, which is significant at the 10% level—thus indicating that after propensity score matching, the sample selection bias is controlled for, but the purchase of D&O insurance still aggravates the degree of management's manipulation of tone. Hence, the research conclusion of this paper is still robust.

4.4.3 Instrumental variable approach. Propensity score matching can only solve the endogeneity caused by sample selection bias, and there is also the possibility of endogeneity from reverse causation and omitted variables in the regression model. This study therefore next selects the lagged average ratio of D&O insurance purchases of firms within the same industry (Tang, He, Su, & Zhou, 2023; Zhang & Wang, 2024) as an instrumental variable. The industry average ratio of D&O coverage tends to be an important factor in deciding whether to purchase D&O insurance, but it does not correlate

Variable	(1) *First D&O*	(2) *Second Abtone*
L.Mean_D&O	0.850***	
	(8.18)	
D&O		0.103***
		(2.80)
Size	0.040***	−0.000
	(12.70)	(−0.07)
Lev	0.054***	0.003
	(2.86)	(0.42)
Growth	−0.001	0.001
	(−0.60)	(0.75)
Dir	−0.022	0.025**
	(−0.64)	(1.97)
Top1	−0.035**	0.030***
	(−2.02)	(4.54)
ROE	−0.010	−0.006
	(−0.48)	(−0.81)
Loss	0.010	−0.002
	(1.04)	(−0.64)
OCF	0.029	−0.029**
	(0.84)	(−2.13)
LR	0.002	−0.003***
	(0.90)	(−4.35)
Dual	−0.028***	0.005**
	(−5.12)	(2.06)
BM	0.013***	−0.009***
	(3.22)	(−7.36)
Board	−0.023*	0.017***
	(−1.70)	(3.42)
Constant	−0.801***	−0.050
	(−11.33)	(−1.31)
Observations	15,587	15,587
R-squared		0.022
Year	Yes	Yes
Industry	Yes	Yes
N	15,587	15,587
r2_a		0.0180

Note(s): ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively
Source(s): Table by authors

Table 12. Regression based on the instrumental variable approach

with management manipulation, which meets the requirements of exogeneity. Meanwhile, following Zhang and Wang (2024), we consider the possibility that after the introduction of D&O insurance there may be a time lag effect—that is, the purchase of D&O insurance in year t may affect management manipulation in year $t+1$, but it is impossible for management manipulation in year $t+1$ to affect the purchase of D&O insurance in year t. Furthermore, the lagged average ratio of D&O insurance correlates to the purchase of D&O insurance but does not directly correlate to management tone manipulation, which means that it meets the requirement of exclusion restriction. Therefore, the sample is lagged behind and brought into the model for regression, and the results are listed in Table 12.

Thus, to test the correlation between the D&O insurance (*D&O*) and the instrumental variable (*L.Mean_D&O*), the following model is constructed to conduct the first stage of regression, while controlling for the industry and annual fixed effects, as is shown in model 4.4.1:

$$\begin{aligned} D\&O_{i,t} = {} & \mu_0 + \mu_1 L.Mean\_D\&O_{i,t} + \mu_2 Size_{i,t} + \mu_3 Lev_{i,t} + \mu_4 Growth_{i,t} \\ & + \mu_5 ROE_{i,t} \mu_6 Dir_{i,t} + \mu_7 Top1_{i,t} + \mu_8 Loss_{i,t} + \mu_9 OCF_{i,t} + \mu_{10} LR_{i,t} \\ & + \mu_{11} Dual_{i,t} + \mu_{12} BM_{i,t} + \mu_{13} Board_{i,t} + \mu_{14} \sum Industry_{i,t} + \mu_{15} \sum Year_{i,t} + \varepsilon_{i,t}. \end{aligned} \tag{4.4.1}$$

The estimate of the explanatory variable (*D&O*) is obtained using model 4.4.1, which was re-introduced into model 3.3.1 before the second stage of regression. The two-stage regression results are given in Table 12. The regression results in the first stage show that the regression coefficient of the instrumental variable (*L.Mean_D&O*) on the explanatory variable (*D&O*) is significantly positive, thus indicating that the lagged industry average ratio of D&O coverage has an impact on the purchase of D&O insurance, and therefore meets the requirements of relevance. Second, the test results of the weak instrumental variables are listed in the table, which shows that D&O is an endogenous variable, and the results pass the test of the weak instrumental variables.

In the second stage of regression, the regression coefficient of the estimated value of the D&O insurance (*D&O*) is 0.103, and the t-value is 2.80, which is significant at the 1% level. Those results indicate that management's manipulation of tone is enhanced after an enterprise's purchase of D&O insurance—a finding that is consistent with the results of the principal regression, and indicates that our conclusion is robust.

4.5 Further analysis

4.5.1 Group and test by executive gender. In recent years, with the continuous improvement of women's status, female employees have begun to join corporate executive teams, participate in the important decisions of their companies, and influence their companies' operation and management activities (Adams & Ferreira, 2009). However, because of the inherent physiological and psychological differences between men and women, the two genders eventually exhibit heterogeneous characteristics in the company's decision-making behavior and effects. The annual report text is an important channel for investors to obtain information. Byrnes, Miller, and Schafer (1999) point out that compared with men, women are less inclined to be overconfident, are more risk-averse, and are also more willing to adhere to the principle of prudent behavior. However, Liu and Li (2018) argue that female CFOs will consider occupational safety beyond their concerns of compliance risk and ethics, so female CFOs are more motivated to engage in earnings management. Furthermore, Zhu and Xu (2018) show that tone manipulation is positively associated with earnings management.

Variable	Abtone (1) Male CEO	Abtone (2) Female CEO
D&O	0.004	0.021**
	(1.44)	(2.57)
Size	0.004***	0.005*
	(4.99)	(1.91)
Lev	0.000	−0.024
	(0.07)	(−1.29)
Growth	0.000	−0.000
	(0.72)	(−0.00)
Dir	0.025**	0.013
	(2.20)	(0.36)
Top1	0.026***	0.003
	(4.64)	(0.17)
ROE	−0.011*	0.009
	(−1.85)	(0.49)
Loss	−0.001	0.005
	(−0.26)	(0.51)
OCF	−0.013	−0.033
	(−1.11)	(−0.97)
LR	−0.003***	−0.007***
	(−5.40)	(−3.30)
Dual	0.001	0.001
	(0.29)	(0.14)
B/M	−0.009***	0.000
	(−8.70)	(0.00)
Board	0.011**	0.024*
	(2.51)	(1.77)
_cons	−0.162***	−0.172***
	(−7.70)	(−2.67)
Year	Yes	Yes
Industry	Yes	Yes
N	19206.000	1935.000
r2_a	0.089	0.122

Note(s): ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Numbers in parentheses are the *t*-statistics
Source(s): Table by authors

Table 13. D&O insurance and management tone manipulation: Heterogeneity in gender of CEO

In addition, Davis and Tama-Sweet (2012) verified that managers tend to use more positive words in their report text to coordinate with earnings management behavior. Therefore, this study groups male CEOs and female CEOs to test whether there is any gender difference in the influence of the purchase of D&O insurance on management tone manipulation, and the results are given in Table 13. Column (1) shows that if the CEO of an enterprise is male, the influence of D&O insurance is less significant on managers' tone manipulation than if the CEO is female, and column (2) indicates that when the CEO of an enterprise is female, the purchase of D&O insurance's impact on tone manipulation is significant, which is consistent with the analysis above.

4.5.2 Group and test by auditing quality. Enterprise management discussions and text information disclosures have developed rapidly in China. In addition to providing useful information, management discussions and analysis and text information disclosures may also become a strategic information disclosure behavior of management, thus implying or concealing the real information, reducing the quality of corporate information disclosure,

and misleading investors and creditors (Davis & Tama-Sweet, 2012). External audits serve as an important mechanism for providing external supervision, and auditors can use their professional knowledge and skills to accurately verify financial reports and thereby to improve the quality of financial information, elevating the credibility of enterprises' information disclosures, enhancing the level of enterprise risk-taking (Connelly, Tihanyi, Certo, & Hitt, 2010), and helping enterprises attract additional investments. Professional doubt, on the other hand, makes auditors more alert to auditing evidence with subjective emotions (Fink & Gibson, 1999). Especially when the information delivered by an abnormally positive tone is inconsistent with the content of the company's financial information, auditors are likely to raise their own vigilant consciousness, suspecting that the auditee has a high risk of significant misstatement, identifying the opportunistic behaviors of management, and inhibiting management's manipulation of text information. Hence, external audits can play a role in information supervision and governance (Kang & Zhou, 2022).

Existing research shows that significant differences exist in the quality of auditing services provided by different accounting firms. Compared with the non-Big Four international accounting firms, the auditors hired by the Big Four international accounting firms provide higher professional abilities and higher-quality auditing services. High-quality auditing services mean that the auditors' professional scrutiny can detect client manipulations in a timely manner (Cai, Wang, Chen, & Li, 2022), and can prompt enterprises to optimize their governance level and improve their financial position (Hu, Li, & Zhao, 2020). In addition, if the enterprise employs a member of the Big Four to conduct high-quality auditing, the accounting firm demonstrates that it can form effective supervision over the enterprise and the management, thus giving management less space for engaging in tone manipulation. To summarize, this thinking holds that the accounting supervision in enterprises with low-quality auditing is not as effective as is that in enterprises that employ high-quality auditing, and that in the low-quality auditing enterprises, D&O insurance plays a stronger role in tone manipulation. Therefore, in this paper we select whether enterprises have employed one of the Big Four to measure their auditing quality, and we test whether high-quality external auditing can play a role in the influence of D&O insurance on tone manipulation.

The regression results are shown in Table 14. Column (1) lists the regression results of the companies that are with the Big Four, and column (2) gives the results of companies that do not use a Big Four auditor. As can be seen from column (1), the regression coefficient of the explanatory variable D&O insurance (*D&O*) is 0.009, and the *t*-value is 1.25, which is not statistically significant. That finding indicates that the use of a Big Four auditing firm plays the expected and important role of auditing supervision, forms the regulation of management, and reduces the space and opportunistic motivations for manipulation, effectively restraining the positive effect of D&O insurance on tone manipulation. In contrast, in column (2), the regression coefficient of D&O insurance (*D&O*) is 0.007, which is significant at the 5% level and shows that the enterprises without Big Four auditing supervision find it easier to carry out tone manipulation after acquiring the protection of D&O insurance. There were significant differences between the two groups of results, indicating that high-quality external auditing can effectively curb the tone manipulation that is fostered by D&O insurance.

5. Conclusions and policy recommendations

Using data for all A-share non-financial listed companies in China for the period from 2009 to 2021 provided in the China Research Data Service Database, we conclude that enterprises' purchase of directors' and officers' insurance leads to an increased degree of tone manipulation by management, particularly in the management discussion and analysis

	Abtone	
	(1)	(2)
Variable	Big4 = 1	Big4 = 0
D&O	0.009	0.007**
	(1.25)	(2.52)
Size	−0.004	0.006***
	(−1.26)	(6.22)
Lev	0.007	−0.004
	(0.22)	(−0.69)
Growth	0.003	0.000
	(1.10)	(0.64)
Dir	0.065	0.020*
	(1.43)	(1.79)
Top1	−0.021	0.027***
	(−0.99)	(4.91)
ROE	−0.010	−0.010*
	(−0.27)	(−1.66)
Loss	−0.024	0.001
	(−1.53)	(0.28)
OCF	−0.018	−0.011
	(−0.34)	(−0.95)
LR	−0.008**	−0.003***
	(−2.32)	(−5.72)
Dual	0.010	0.001
	(1.11)	(0.37)
BM	−0.008***	−0.008***
	(−2.78)	(−7.60)
Board	−0.004	0.015***
	(−0.28)	(3.41)
_cons	−0.001	−0.191***
	(−0.01)	(−8.96)
Year	Yes	Yes
Industry	Yes	Yes
N	1300.000	19841.000
r2_a	0.194	0.088

Note(s): ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Numbers in parentheses are the *t*-values
Source(s): Table by authors

Table 14. D&O insurance and management tone manipulation: heterogeneity in auditing quality

section of their firms' annual reports. The intermediary mechanism tests show that, on one hand, the purchase of D&O insurance raises the enterprise's operational risk and then increases the degree of its management's tone manipulation. In addition, the purchase of D&O insurance increases the management's tone manipulation by increasing the agency cost. Furthermore, a heterogeneity analysis shows that both having a male CEO and using high-quality auditing can weaken the positive impact of D&O insurance on tone manipulation. Moreover, the acquisition of D&O insurance intensifies an enterprise's management tone manipulation, which conveys wrong information to investors, misleading the investors' judgment and infringing on the interests of small and medium investors. That effect on investors violates the openness, fairness, and impartiality of the capital market, thereby affecting the information efficiency and pricing efficiency of the bond market. With regard to the topic of text information manipulation, this paper provides a new idea for studying the literature related to D&O insurance and management behavior, enriches our understanding of the influencing factors and the mechanism of management tone

manipulation, and provides practical significance for further standardization of the terms and system of D&O insurance in China.

The study's findings have practical significance for the improvement of relevant national regulations, the enhancement of enterprises' internal control systems, and the supervision by external regulatory agencies and investors.

First, the country should establish and improve the legal system that oversees D&O insurance, and should standardize how information is disclosed. To prevent D&O insurance from exerting the opposite effect of the intended one, and to avoid worsening the principal agency problem, the state should constantly improve and clarify the guarantee scope and regulations for D&O insurance, lower the threshold for shareholder litigation, and formulate a liability insurance system that is suitable for the conditions in China. In addition, China should form a systematic disclosure and supervision system for the text information submitted by companies in their annual reports and elsewhere, to prevent management from seizing the loopholes and harming the interests of their company.

Second, managers of enterprises, especially female managers, should comprehensively evaluate project risks when making investment decisions, and should make fewer decisions that will increase the risks to the enterprise. Such efforts will promote effective operations, provide investors with more accurate information reports, and ensure the effective and normal operation of the enterprise.

Finally, external regulators and investors should supervise corporate behavior in a timely manner. High-quality external audits can restrain D&O insurance's positive effect on management tone manipulation. External regulators should make full use of their professional suspicions and vigilance and should work diligently to discover in a timely period any problems that exist in an enterprise, help investors effectively supervise the management and prevent bad behaviors, and restrain management information manipulation, thereby protecting the interests of investors and the markets.

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