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Directors’ and officers’ liability insurance and corporate digital transformation

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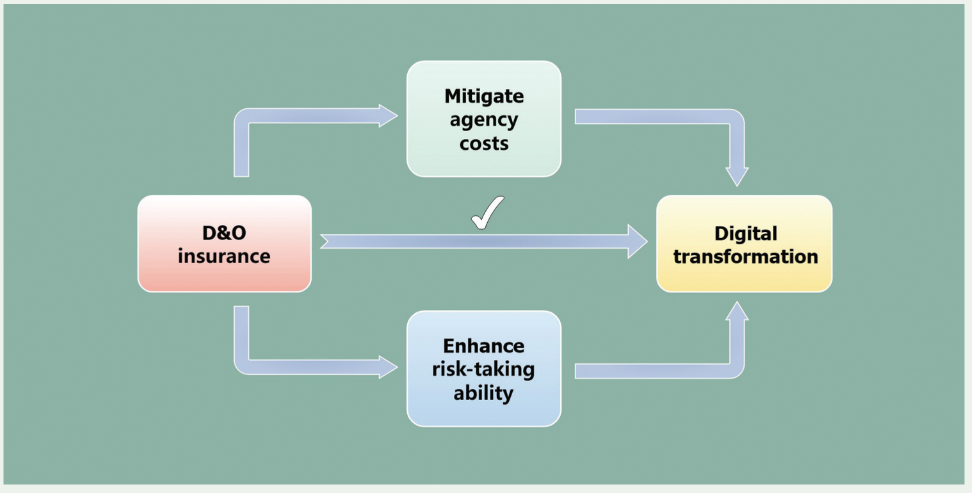
ABSTRACT
In the digital era, digital transformation has become imperative for enterprises to seek better development opportunities. Using a sample of Chinese A-share listed firms from 2007 to 2020, we document a positive relationship between directors’ and officers’ liability insurance (D&O insurance) and corporate digital transformation. This correlation is robust to a series of robustness tests. Further mechanism tests reveal that mitigating agency costs and enhancing risk-taking ability are two potential channels. Additional heterogeneity analyses show that the impact of D&O insurance on digital transformation is more pronounced for non-state-owned firms, firms perceiving more economic policy uncertainty, firms with less media coverage and firms in highly competitive industries. These findings suggest that companies should pay attention to the positive governance effect of D&O insurance and it’s more advisable for companies with severe agency conflict and weak risk-taking ability to purchase D&O insurance to facilitate digital transformation.



KEYWORDS
D&O insurance; corporate digital transformation; agency cost; risk-taking ability

JEL CLASSIFICATION
G22; G31; M21

I. Introduction

Digital transformation is an inevitable trend in the modern fast-paced and technology-driven world. It has also become a hotspot in academia. Extant literature has identified several determinants of digital transformation. First, from the perspective of the external environment, both judicial informatization and government digital attention contribute to digital transformation (Zheng et al. 2024; Xu et al. 2024). Second, in terms of corporate governance, Zhang et al. (2023) reveal an inverted U-shaped nonlinear relationship between controlling shareholders’ equity pledge and digital transformation. Finally, at the individual level, leadership characteristics are also important influential factors of digital transformation. For example, when the managers’ pursuit is better aligned with the business mission, the company tends to have a higher level of digital transformation (Porfírio et al. 2021). Despite the growing literature uncovering the determinants of digital transformation, few studies have systematically examined the impact of directors’ and officers’ liability insurance (D&O insurance) on digital transformation.

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D&O insurance was introduced in China early in 2002 but didn't get much attention compared to its prevalence in the developed markets. Existing literature points out that D&O insurance can decrease crash risk (Yuan, Sun, and Cao 2016), enhance managers' risk-taking (Wang et al. 2020) and inhibit over-investment (Wang and Sun 2023). However, few studies delve further into whether and how D&O insurance would influence firms' major strategic decisions like digital transformation. Therefore, this study aims to fill this void.

We argue that D&O insurance contributes to digital transformation in at least two ways: alleviating agency conflict and enhancing risk-taking ability. First, the purchase of D&O insurance introduces the insurance firm as an external monitoring role, with which the insured firm's agency conflict can be mitigated to some extent (Yuan, Sun, and Cao 2016; Wang and Sun 2023). When agency conflict is alleviated, managers are more willing to fulfil their duties from the perspective of corporate development instead of self-interest. Digital transformation is just such a process that calls for managers' alignment with the corporate mission since it is characterized as long-term and full of uncertainty. Therefore, D&O insurance may promote digital transformation. Second, D&O insurance ensures that managers dare to make risky but also valuable decisions as it frees managers from the duty of misconduct. In other words, D&O insurance can enhance the insured firms' risk-taking ability (Wang et al. 2020). Considering that the process of digital transformation is full of risks, a strengthened risk-taking ability helps firms maintain investments in digital technology and thus ultimately promote digital transformation. Based on the above analyses, we propose the hypothesis:

H1: D&O insurance is positively associated with corporate digital transformation.

Our study contributes to existing literature in two ways. First, this paper is the first to document a positive relationship between D&O insurance and digital transformation, including keywords frequency, input, and output of digital transformation. Second, we also delve further into the impact of D&O insurance on digital transformation by identifying two potential channels: mitigating agency costs and enhancing risk-taking ability.

II. Methodology

Following Niu et al. (2023), we use Python techniques to identify digital transformation keywords[1] in the annual reports and then use the natural logarithm of the occurrence frequency of the keywords plus one to measure digital transformation. Other financial data are sourced from the China Stock Market & Accounting Research (CSMAR) database and the Chinese Research Data Services (CNRDS) database.

Our initial sample includes Chinese A-share firms listed between 2007 and 2020.[2] We exclude firms in financial industries,[3] firms that receive special treatment (ST)[4] from stock exchanges, and observations with missing values. We further winsorize all continuous variables at 1% and 99% percentiles to exclude the effect of outliers. Our final sample consists of 27,770 firm-year observations, covering 3,456 firms.

To examine D&O insurance's impact on digital transformation, we build the following OLS regression model:

$$DLTN_{i,t}=\alpha_0+\alpha_1 D\&O_{i,t}+\alpha_k \sum Controls_{i,t} +\sum Year+\sum Industry+\varepsilon_{i,t} \qquad (1)$$

where *D&O* is the independent variable which equals 1 if a firm purchases D&O insurance in year t, and 0 otherwise. *DLTN* is the dependent variable which is calculated as aforementioned. The vector *Controls* consist of a set of variables that may affect digital transformation. We also control year- and industry-fixed effects. Detailed definitions of variables used in the baseline regression are presented in Appendix B in the online supplementary material.

[1]The dictionary of digital transformation keywords is presented in Appendix A in the online supplementary material.
[2]We begin from the year 2007 because China has implemented the new accounting standards since 2007 and we end in the year 2020 to avoid the impact of the COVID-19 pandemic.
[3]We conduct the treatment because financial industries are quite different from other industries in financial statements.
[4]This is a signal from stock exchanges that the company is in a bad financial condition. We exclude these samples because they are suspected of financial fraud.

III. Empirical tests and analyses

Descriptive statistics

The descriptive statistics of variables used in the baseline regression are presented in Appendix C in the online supplementary material. The table shows that only 7.3% of observations purchase D&O insurance, reflecting D&O insurance's limited prevalence in China. The mean and standard deviation of digital transformation are 2.439 and 1.415, respectively, indicating a divergent level of digital transformation within our sample. All sample distributions exhibit a consistency with existing literature.

Baseline regression

Table 1 reports the results of the baseline regression. The coefficients on *D&O* are positive and significant at the 1% level throughout both regressions without or with control variables. The results suggest that D&O insurance promotes corporate digital transformation, providing support for our hypothesis.

Robustness tests

In this section, we conduct a series of robustness tests to enhance the reliability of our conclusion including placebo tests, lagging independent variables, PSM procedure, entropy balancing matching approach, using alternative digital transformation measures, and instrumental variable method. It turns out that our baseline results remain broadly unchanged after all the robustness tests.[5]

Mechanism tests

Mitigating agency costs

As our hypothesis proposes, D&O insurance can help alleviate agency conflict and thus promote digital transformation. To test the effect, we use real earning management (*REM*) to proxy for agency costs. Columns (1) and (2) of Table 2 reveal that D&O insurance effectively reduces real earning management and thus facilitates digital transformation. The Sobel test shows a significance level of 1% for this mechanism.

Enhancing risk-taking ability

D&O insurance may also prompt digital transformation by enhancing risk-taking ability. To examine the mechanism, we use three-year (*t-1, t, t + 1*) stock return volatility (*SRV*) to proxy for risk-taking ability. As shown in columns (3) and (4) of Table 2, the coefficients on *D&O* and *SRV* are positive and significant, indicating that D&O insurance effectively increases corporate risk-taking ability and thus contributes to digital transformation. The Sobel test shows a significance level of 10% for this mechanism.

Heterogeneity analyses

We further conduct cross-sectional tests to investigate whether the promotion effect of D&O insurance on digital transformation differs for firms in different situations. First, non-state-owned firms face more severe resource constraints and may have lower risk-taking ability compared to state-owned firms. Second, firms

Table 1. Baseline regression.

Variables	(1) *DLTN*	(2) *DLTN*
D&O	0.154***	0.101***
	(0.025)	(0.025)
CONTROLS	No	Yes
CONSTANT	0.563***	−3.070***
	(0.060)	(0.149)
YEAR	Yes	Yes
INDUSTRY	Yes	Yes
OBS	27,770	27,770
ADJ-R^2	0.428	0.453

[5]Due to the limitation of words required by the journal, we report the detailed testing process and regression results in Supplementary Figure 1 and Appendix D-1 to Appendix D-7 in the online supplementary material.

Table 2. Mechanism tests.

Variables	(1) *REM*	(2) *DLTN*	(3) *SRV*	(4) *DLTN*
D&O	−0.030***	0.082***	0.018**	0.115***
	(0.005)	(0.025)	(0.009)	(0.028)
REM		−0.416***		
		(0.030)		
SRV				0.087***
				(0.021)
CONTROLS	Yes	Yes	Yes	Yes
CONSTANT	−0.071**	−3.109***	1.873***	−3.110***
	(0.030)	(0.149)	(0.050)	(0.168)
YEAR	Yes	Yes	Yes	Yes
INDUSTRY	Yes	Yes	Yes	Yes
SOBEL Z	5.484***		1.863*	
OBS	27,436	27,436	23,671	23,671
ADJ-R^2	0.091	0.459	0.454	0.425

perceiving more economic policy uncertainty tend to be more cautious and conservative and have lower risk-taking ability. Third, firms with less media coverage suffer from more severe agency conflict. Finally, intense industry competition imposes more pressure on management, thus leading to serious managerial myopia and severe agency conflict. Therefore, we predict that the impact of D&O insurance on digital transformation will be more prominent for non-state-owned firms, firms perceiving more economic policy uncertainty, firms with less media coverage and firms in highly competitive industries. Subgroup regression results (presented in Appendix E in the online supplementary material) are all consistent with our predictions. Inter-subgroup coefficient difference tests exhibit a statistical significance.

IV. Conclusion and discussion

In this paper, we reveal that D&O insurance can facilitate corporate digital transformation by mitigating agency costs and enhancing risk-taking ability. Additionally, this correlation is more prominent for non-state-owned firms, firms perceiving more economic policy uncertainty, firms with less media coverage and firms in highly competitive industries. Our findings provide two valuable implications for corporate governance. First, while D&O insurance is still not prevalent in China, our study documents that it effectively helps improve corporate governance and thus contributes to better digital transformation. Firms can consider purchasing D&O insurance if they seek successful digital transformation. Second, based on each firm's situation, it is more advisable for firms with severe agency conflict and weak risk-taking ability to utilize D&O insurance to facilitate digital transformation.

The limitations of this study are as follows. First, our analysis is based on the Chinese market and it may not be directly applicable to companies in other developed markets. Therefore, additional empirical tests based on other developed or global markets should be conducted in the future. Second, although we have used digital intangible asset and digital patent as alternative measures of digital transformation in the robustness tests, it is still difficult to distinguish different stages of digital transformation. With the availability of better data to depict digital transformation, future studies can delve further into the impact of D&O insurance on corporate digital transformation.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Data availability statement

Data will be made available on request.

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