



# Peer Effects in Directors' and Officers' Liability Insurance: Evidence from China

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## ABSTRACT

This study finds the purchase of liability insurance for a firm's directors and officers (D&Os) is positively influenced by whether its peer firm purchases such insurance. Firms are considered to be peers if their executives are university alumni. Despite the fact that China has the second largest insurance industry in the world, D&O insurance coverage in Chinese listed firms is relatively low. Our study hence suggests an important new determinant of D&O insurance purchases in China (i.e., executive social ties).

## 1. Introduction

Directors' and officers' liability insurance (hereafter D&O insurance) is a liability cover that protects corporate directors and officers from legal liability for decisions and actions taken in the course of their regular duties.<sup>1</sup> D&O insurance can change the liability risk profile of a company's D&Os, therefore, influencing their incentives in decision making (Zou et al., 2008).<sup>2</sup> This study examines whether executive alumni peer effects are associated with corporate decisions to purchase D&O insurance. The study is relevant as it provides indirect evidence of the extent to which D&Os' risk perceptions are affected by peer effects. We conduct our study in China because, first, the Chinese market is characterised by relationship-based transactions (Allen et al., 2005), and the behaviour of individuals and organisations is heavily influenced by *guanxi* (also known as connections) (Wong, 2016). Second, the high degree of collectivism in Chinese society makes China an ideal laboratory for studying executive peer effects. Knowledge sharing among in-group members is more easily stimulated in this environment. Third, given that D&O insurance coverage is relatively small in Chinese companies (Wang et al., 2020), it is essential to understand the determinants of D&O insurance purchases.

Our study is built on social network theory which suggests that information flows through networks and influences both individual

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<sup>1</sup> D&O insurance does not cover actions that are knowingly fraudulent or unlawful.

<sup>2</sup> For example, D&O insurance can motivate directors and officers to pursue the best interests of shareholders, therefore mitigating agency costs, stimulating firm innovation (Wang et al., 2020), enhancing both investor protection and firm value (Yuan et al., 2016). However, D&O insurance can also induce unintended moral hazards or information asymmetry, leading to increased audit fees (Chung et al., 2015) and cost of equity (Chen et al., 2016), while reducing the effectiveness of independent directors (Jia & Tang, 2018).

and firm decisions (Newman, 2010). Prior literature documents that information is disseminated through executives' social networks, leading to corporate practices to cluster (Shue, 2013). We focus on shared education networks (i.e., mutual alma mater) to measure executive alumni peer effects because the executive ties formed through this network are observable and strong. Any two firms whose executives are alumni can share a direct link or a third-party mutual connection. These multiple links strengthen shared normative expectations in the network (Granovetter, 2005). Executive education ties are formed early in life and are therefore far less likely to be affected by exposure to mutual macroeconomic level changes. This allows a cleaner identification of peer effects at the managerial level.

We find that the likelihood of a firm purchasing D&O insurance is positively associated with that of its peer firm when the executives of the two firms are university alumni. Our study has several contributions. First, to the best of our knowledge, this study is the first to examine the peer effects of executive alumni on D&O insurance purchases, thus enriching the literature on the roles of social networks in corporate decision making. Second, the study extends the understanding of determinants of D&O insurance purchases through the lens of non-institutionalised personal ties. We find that executive alumni effects drive D&O insurance purchases, suggesting that informal networks are an important channel through which information gets incorporated into firm decisions. Third, considering that the existing literature in this field largely focuses on developed economies, our study complements the research on the determinants of D&O insurance purchases from the perspective of China, the most important emerging market. The salience of the 'word-of-mouth' effect identified in this study is particularly insightful for D&O insurance providers, given the rapidly growing insurance market in China but the relatively low level of D&O insurance coverage.

The remainder of the paper is organised as follows. Section 2 provides a summary of the literature and presents the hypothesis. Section 3 describes the data and research method. Section 4 reports the main results and robustness tests. Section 5 concludes.

## 2. Literature Review and Hypothesis Development

### 2.1. Literature Review

Guthrie et al. (2020) describe operational risks as the "bigger risks" faced by firms, which relate closely to important topics such as corporate governance and agency costs. These risks include fraud, physical assets, cybersecurity (Najaf et al., 2021a; 2021c), environmental and social risks (Najaf et al., 2022), corruption (Najaf et al., 2021d), political and legal risks (Najaf & Najaf, 2021a; Najaf and Najaf, 2021b), which often arise from inadequate corporate governance, such as the impact of executive tenure on corporate risk-taking (Atayah et al., 2022), or external shocks, for example, COVID-19 on financial decisions (Najaf et al., 2021b), and the relationship between financial performance and green policy implementation (Dhief et al., 2021). Since D&O insurance is a common tool in corporate risk management (Jia & Tang, 2018), our study relates to the literature in this area. Prior literature on the determinants of purchasing D&O insurance primarily focuses on firm-specific characteristics.<sup>3</sup> This study extends this field by investigating the role of executives' non-institutionalised social bonds in D&O insurance purchases. In addition, our study links to the extant literature validating the effects of executive networks on corporate decisions and performance.

### 2.2. Hypothesis Development

We posit that executive alumni peer effects influence D&O insurance purchases because alumni identity creates a labelling effect; thereby increasing subjects' willingness to share information through the alumni networks and facilitating the process of knowledge spill-over due to the high level of trust and homophily amongst executive alumni through their mutual qualities and experiences (McPherson et al., 2001). University relationships are persistent and influential. Executives who attended the same university tend to have similar attitudes, preferences and norms that may lead uninsured executives to pressure their firms to purchase D&O insurance. Relationships formed based on an affinity for individuals with similar characteristics or membership categories have a profound effect on corporate decision-making processes (Guo et al., 2021).

## 3. Data and Method

We retrieve D&O insurance data from the Chinese Research Data Services Platform and firm financial information and executives' demographics from the China Stock Market and Accounting Research Database.<sup>4</sup> We begin with an initial sample of 43,261 firm-year observations from 2008 to 2017 after matching the two databases. Since firms can have different numbers of executives and each executive can be connected to multiple peer firms through their alumni, to ensure fairness, we randomly select one executive for each firm and also one of the executive's peers in any one year.<sup>5</sup> The final sample consists of 8,165 observations with 5,422 executives, all of whom graduated from one of a total of 598 universities.

We use the following logistic model to examine alumni peer effects on the likelihood of purchasing D&O insurance:

<sup>3</sup> For example, the proportion of independent directors (Core, 1997) and managerial ownership (O'Sullivan, 1997), conflicts between shareholders and managers (Zou et al., 2008), and firms' political connections (Jia et al., 2019).

<sup>4</sup> Chinese Research Data Services (CNRDS) obtains information on the purchase of D&O insurance from annual reports, minutes of the board and shareholders' meetings, and media reports. CNRDS data has been used in a growing number of accounting studies (e.g., Zhang et al., 2020).

<sup>5</sup> Our method of identifying peers is similar to that of Zhang et al. (2018).

$$\text{FirmD\&O}_{i,t} = \alpha_i + \beta_1 \text{PeerFirmD\&O}_{i,t-1} + \beta_2 \text{Controls}_{i,t-1} + \text{IndustryFE} + \text{YearFE} + \text{FirmFE} + \varepsilon_{i,t-1} \quad (1)$$

Following prior studies on D&O insurance (Yuan et al., 2016), the dependent variable  $\text{FirmD\&O}_{i,t}$  is a dummy variable that equals one if a firm  $i$  purchases D&O insurance in year  $t$ , and zero otherwise.  $\text{PeerFirmD\&O}_{i,t-1}$  is also a dummy variable that measures whether a randomly selected peer firm within the focal firm  $i$ 's university peer group has purchased D&O insurance in year  $t-1$ . Following Zou et al. (2008),  $\text{Controls}_{i,t-1}$  includes the following measured in year  $t-1$ : *Size*, *ROA*, *Leverage*, *BTM*, *CrossList*, *OwnershipConcentration*, *BoardIndependence*, *Violation*, *ManagementHolding*, *SOE*, *ExecutiveAge* and *ExecutiveGender*. In all analyses, we apply firm and year fixed effects and use double clustered standard errors by firm and year to control for potential heteroskedasticity and autocorrelation. Our use of lagged independent variables helps mitigate concerns about reverse causality. Table 1 defines variables.

Descriptive statistics are presented in Table 1. About 7% of our sample firms have D&O insurance coverage, showing that D&O insurance is a relatively new concept that is still evolving. Approximately 32% of the sample are SOEs, while 7% of the firms are cross-listed and have violation records. In addition, 85% of the sample executives are male and the average age of the executives is 48. The standard deviations of size, ROA and leverage are relatively high, suggesting wide variations in firm size, financial performance and leverage. We find a statistically significant positive correlation between *PeerFirmD&O* and *FirmD&O*, supporting our argument. In

**Table 1**  
Descriptive Statistics.

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) median	(6) max	(7) Correlation with FirmD&O	(8) Definition
<i>D&amp;O Variables</i>								
FirmD&O	8,165	0.07	0.25	0	0	1		A dummy variable. 1 = Firms with D&O insurance; 0 = otherwise
PeerFirmD&O	8,165	0.17	0.37	0	0	1	0.0419***	A dummy variable. 1 = Peer firms with D&O insurance; 0 = otherwise
UniversityD&O_Mean	7,796	0.13	0.12	0	0.12	1	0.1808***	Average D&O insurance purchases of all firms within the university peer group
UniversityD&O_Median	7,796	0.02	0.12	0	0	1	0.1337***	Median D&O insurance purchases of all firms within the university peer group
<i>Firm Variables</i>								
Number of firms	1,661							
Number of industries	80							
Size (logasset)	8,165	22.05	1.63	16.16	21.76	30.89	0.4103***	Firm size, measured as the natural logarithm of total assets
ROA	8,165	0.05	1.24	-4.74	0.04	108.40	-0.0068	Firm performance, measured as net income divided by total assets
Leverage	8,165	0.46	1.27	-0.20	0.41	96.96	0.0359**	Measured as total liabilities divided by total assets
Book-to-Market (BTM)	8,165	0.59	0.24	0.01	0.60	1.46	0.1950***	Book-to-market ratio
CrossList	8,165	0.07	0.26	0	0	1	0.4176***	A dummy variable. 1 = Firms cross listed overseas; 0 = otherwise
OwnershipConcentration (H_Index)	8,165	0.15	0.12	0.00	0.11	0.81	0.0476***	Measured as the sum of squares shareholding by the largest shareholder
ManagementHolding	8,165	0.11	0.18	0	0.00	0.89	-0.152***	Measured as the percentage of shares owned by the top management team
SOE	8,165	0.32	0.47	0	0	1	0.2104***	State-owned enterprises, 1 = SOEs, 0 = otherwise
Violation	8,165	0.07	0.25	0	0	1	-0.0022	A proxy of litigation risk. A dummy variable. 1 = Firm violates law or regulation in a year; 0 = otherwise
BoardIndependence	8,165	0.37	0.06	0.10	0.33	0.80	0.0227**	Measured as the percentage of independent directors on the board
ExchangeDummy	8,165	0.77	0.42	0	1	1	-0.1681***	A dummy variable. 1 = Firms listed on Shanghai Stock Exchange; 0 = otherwise
MarketIndex	8,063	7.84	1.70	0.02	7.94	9.97	0.0684***	Market Index of China's provinces developed by Wang et al. (2019)
LawIndex	8,063	6.27	2.21	-1.67	6.50	12.68	0.0551***	Law Index of China's provinces developed by Wang et al. (2019)
<i>Executive Variables</i>								
Number of executives	5,422							
Number of universities	598							
ExecutiveEducation	7,642	3.68	0.76	1	4	5	0.0077	Executive education level. 1 = vocational diploma; 2 = tertiary diploma; 3 = bachelor; 4 = master including MBA/EMBA, and 5 = PhD
ExecutiveAge	8,165	47.62	8.93	24	47	80	0.0858	Executive age
ExecutiveGender	8,165	0.85	0.36	0	1	1	0.0151	Executive gender. 1 = Male; 0 = Female

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

addition, the correlation coefficients between *FirmD&O* and other control variables are largely significant, confirming the overall validity of our model.

#### 4. Empirical Results

##### 4.1. Baseline Regression

Table 2 columns (1) to (4) report our main regression results using Equation (1) and different fixed effects models. In all specifications, the coefficients for *PeerFirmD&O* are positive and significant, indicating that executive alumni peer effects significantly increase the likelihood of purchasing D&O insurance. The size of the coefficients for *PeerFirmD&O* are relatively stable across all specifications, showing that the explanatory power of *PeerFirmD&O* is not driven by other common factors found to explain D&O insurance purchases. In terms of economic significance, our baseline results in column (4), which control for firm and year fixed effects, show that the presence of D&O insurance among peer firms increases the odds that a focal firm will purchase D&O insurance by a factor of 1.39 (calculated as  $e^{0.328}$  following Nofsinger et al. (2019)). Given that approximately 7% of Chinese listed firms have D&O insurance coverage, and our analysis is based on randomly selected peer firm pairs while each firm may have multiple peer firms, this peer influence is sizeable. The baseline results suggest that executives' social connections, i.e., non-institutionalised personal ties, are an influential channel in shaping the behaviour of Chinese listed firms. With a high level of trust between executive alumni, this channel promotes knowledge sharing and drives the process of knowledge application. Executives are induced to emulate their peers, prompting uninsured executives to exert pressure on their firms to purchase D&O insurance. More importantly, this education-linked peer influence can play a crucial role, via events such as alumni reunions, many years after executives have graduated. As for the control variables, the findings are broadly consistent with prior studies (e.g., Jia et al., 2019). Large, cross-listed firms and SOEs are more inclined to seek D&O insurance coverage, while managerial ownership and ownership concentration are negatively associated with D&O insurance purchases.

**Table 2**  
Baseline Regression Results: Alumni Peer Effects and D&O Insurance.

VARIABLES	(1) FirmD&O	(2) FirmD&O	(3) FirmD&O	(4) FirmD&O
PeerFirmD&O	0.352*** (0.131)	0.340*** (0.131)	0.383*** (0.137)	0.328** (0.138)
Size	0.455*** (0.0365)	0.437*** (0.0391)	0.339*** (0.0577)	0.522*** (0.0436)
ROA	-0.643*** (0.222)	-0.616*** (0.232)	-0.467* (0.241)	-0.506 (0.314)
Leverage	-0.00346 (0.0188)	0.00217 (0.0185)	0.00465 (0.0234)	-0.107 (0.119)
Book-to-Market (BTM)	-0.340 (0.268)	-0.177 (0.289)	0.181 (0.330)	-0.499 (0.323)
CrossList	1.325*** (0.153)	1.377*** (0.157)	1.810*** (0.183)	1.622*** (0.182)
OwnershipConcentration	-1.907*** (0.396)	-1.852*** (0.397)	-1.447*** (0.479)	-1.244*** (0.436)
ManagementHolding	-6.899*** (1.182)	-7.057*** (1.208)	-6.223*** (1.118)	-2.964*** (0.975)
SOE	0.494*** (0.115)	0.486*** (0.116)	0.561*** (0.128)	0.324** (0.127)
Violation	0.295 (0.198)	0.262 (0.202)	0.383* (0.200)	0.326 (0.224)
BoardIndependence	0.553 (0.828)	0.454 (0.829)	1.271 (0.921)	0.696 (0.961)
ExecutiveGender	-0.0104 (0.155)	-0.000520 (0.158)	0.0282 (0.164)	0.00493 (0.172)
ExecutiveAge	0.000408 (0.00616)	-0.000428 (0.00618)	0.00490 (0.00643)	-0.00503 (0.00645)
Constant	-13.07*** (0.831)	-12.97*** (0.866)	-12.25*** (1.466)	-13.11*** (0.996)
Observations	8,165	8,135	7,160	6,131
All Controls	YES	YES	YES	YES
Year FE	NO	YES	YES	YES
Industry FE	NO	NO	YES	NO
Firm FE	NO	NO	NO	YES

Note: This table reports the logistic regression results regressing firm D&O insurance purchase (*FirmD&O*) in year *t* on lagged peer firm D&O insurance purchase (*PeerFirmD&O*) and control variables in year *t*-1. Robust standard errors clustered by firm and year are in parentheses.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

#### 4.2. Endogeneity – Heckman Two-Stage Test and Propensity Score Matching (PSM)

Even though we use the lagged independent variables, firm and year fixed effects, and our results are based on randomly selecting an executive for each firm, we run further tests to address any remaining concerns about endogeneity. First, we run the Heckman two-stage test to address self-selection bias, as a firm's decision to purchase D&O insurance may be non-random. The first stage runs a logistic model that regresses *PeerFirmD&O* on all control variables in Equation (1), and an instrumental variable that is correlated with *PeerFirmD&O*, but not with *FirmD&O*. We employ two instruments: peer firm provincial average D&O insurance purchase (*PeerProvinceAvg*) and peer firm industry average D&O insurance purchase (*PeerIndustryAvg*). We argue that a peer firm is more likely to purchase D&O insurance if it is in a province and industry where more firms purchase D&O insurance, but the peer firm provincial and industry average D&O insurance purchases are unlikely to be related to *FirmD&O*. The first-stage regression results in columns (1) and (3) of Table 3 show that the coefficient estimates for both *PeerProvinceAvg* and *PeerIndustryAvg* are significant and positive, confirming our conjecture above. The inverse mills ratios (IMR) generated from the first stage are then included in the second stage to control for sample selection bias. The second stage results in columns (2) and (4) reveal that the coefficient estimates on *PeerFirmD&O* are still significant and positive, consistent with the baseline regression results reported in Table 2.

Additionally, we adopt PSM to match insured firms with control firms that have similar characteristics according to the propensity

**Table 3**  
Heckman Two-Stage Test and PSM.

	IV = PeerProvinceAvg		IV = PeerIndustryAvg		PSM
	(1) First-stage	(2) Second-stage	(3) First-stage	(4) Second-stage	(5)
VARIABLES	PeerFirmD&O	FirmD&O	PeerFirmD&O	FirmD&O	FirmD&O
PeerFirmD&O		0.315** (0.144)		0.205** (0.0827)	0.373* (0.197)
Size	0.0406 (0.0330)	0.520*** (0.0439)	0.00395 (0.0374)	0.284*** (0.0238)	0.701*** (0.104)
ROA	0.0403 (0.0263)	-0.512 (0.315)	0.0347*** (0.0112)	-0.316* (0.188)	-4.375** (1.986)
Leverage	0.00002 (0.0163)	-0.112 (0.124)	-0.00536 (0.0136)	-0.0880 (0.0861)	-0.420 (0.628)
Book-to-Market (BTM)	-0.0973 (0.188)	-0.468 (0.324)	-0.204 (0.214)	-0.356** (0.162)	-0.929 (0.618)
CrossList	-0.0794 (0.165)	1.604*** (0.183)	-0.0873 (0.191)	0.923*** (0.0959)	1.179*** (0.309)
OwnershipConcentration	0.584** (0.271)	-1.270*** (0.439)	0.804** (0.321)	-0.645*** (0.227)	-0.627 (0.753)
ManagementHolding	0.306 (0.215)	-2.987*** (0.977)	0.509** (0.240)	-1.175*** (0.413)	-3.191** (1.569)
SOE	-0.0346 (0.0841)	0.321** (0.127)	-0.0413 (0.0983)	0.160** (0.0643)	0.243 (0.218)
Violation	-0.0220 (0.127)	0.320 (0.224)	-0.0780 (0.141)	0.164 (0.109)	0.390 (0.402)
BoardIndependence	0.469 (0.556)	0.735 (0.964)	0.175 (0.652)	0.690 (0.494)	0.581 (1.842)
ExecutiveGender	0.0305 (0.0892)	0.0286 (0.175)	0.0495 (0.102)	-0.0275 (0.0844)	-0.298 (0.296)
ExecutiveAge	0.000247 (0.00367)	-0.00543 (0.00645)	-0.00125 (0.00422)	-0.00418 (0.00322)	-0.00628 (0.0117)
IMR		-0.0149 (0.0759)		0.0463 (0.0457)	
PeerProvinceAvg	24.82*** (1.099)				
PeerIndustryAvg			6.278*** (0.232)		
Constant	-4.194*** (0.725)	-13.05*** (1.029)	-2.076*** (0.805)	-7.158*** (0.543)	-16.45*** (2.007)
Observations	8,120	6,107	8,103	6,094	1,657
All Controls	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES

Note: Columns (1) to (4) report Heckman two-stage regression results, and Column (5) reports the PSM regression results of firm D&O insurance purchase (*FirmD&O*) in year *t* on lagged peer firm D&O insurance purchase (*PeerFirmD&O*) and control variables in year *t*-1. The calculation of *PeerProvinceAvg* and *PeerIndustryAvg* does not include the peer firm itself. For PSM, we calculate a propensity score for each firm which is the conditional probability that the firm purchases D&O insurance given all the observable data. For each D&O insured firm, it is then matched to one control firm with the closest propensity score. We then re-run Equation (1) by using the insured and matched control samples. We perform the balance test to confirm the effectiveness of the matching, as shown in Appendix A. Robust standard errors clustered by firm and year are in parentheses.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

**Table 4**

Subsample Analyses, More Controls and Alternative Measures.

<i>Panel A: Subsample Analyses</i>										
	(1) Size > Median	(2) Size < Median	(3) ROA > Median	(4) ROA < Median	(5) Leverage > Median	(6) Leverage < Median	(7) SOE=1	(8) SOE=0	(9) BTM > Median	(10) BTM < Median
VARIABLES	FirmD&O	FirmD&O	FirmD&O	FirmD&O	FirmD&O	FirmD&O	FirmD&O	FirmD&O	FirmD&O	FirmD&O
PeerFirmD&O	0.275* (0.165)	0.478* (0.278)	-0.120 (0.283)	0.466*** (0.163)	0.293* (0.161)	0.525* (0.289)	0.135 (0.175)	0.528** (0.224)	0.282* (0.171)	0.397* (0.239)
Observations	3,017	2,626	2,550	3,143	3,074	2,631	1,987	3,682	2,854	2,907
All Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
<i>Panel B: More Controls and Alternative Measures</i>										
	(1) More Controls			(2) Alternative Measures			(3)			
VARIABLES	FirmD&O			FirmD&O			FirmD&O			
PeerFirmD&O	0.350** (0.142)									
UniversityD&O_Mean				3.697*** (0.403)						
UniversityD&O_Median							1.922*** (0.279)			
ExchangeDummy	0.828* (0.496)									
MarketIndex	0.295*** (0.0816)									
LawIndex	-0.153** (0.0597)									
ExecutiveEducation	-0.0381 (0.0733)									
Observations	5,726			5,912			5,912			
All Controls	YES			YES			YES			
Year FE	YES			YES			YES			
Firm FE	YES			YES			YES			

Note: This table reports the regression results of the likelihood of firm D&O insurance purchase (*FirmD&O*) in year *t* on lagged peer firm D&O insurance purchase (*PeerFirmD&O*) in year *t*-1 by performing subsample analyses, incorporating additional controls and using alternative measures of *PeerFirmD&O*. Robust standard errors clustered by firm and year are in parentheses. \*\*\**p*<0.01, \*\**p*<0.05, \**p*<0.1

to purchase D&O insurance. This allows us to more clearly attribute any observed effects to the D&O insurance purchase itself, rather than to the firm characteristics associated with the D&O insurance purchase. The results in column (5) of Table 3 show that the coefficient estimate on *PeerFirmD&O* is significant and positive when endogeneity concern is mitigated, consistent with the baseline results.

#### 4.3. Subsample Analyses and Robustness Checks

We perform the subsample analyses by median values of firm size, profitability (*ROA*), leverage and book-to-market ratio, and ownership structure. We confirm the robustness of our results in the subsamples in Panel A of Table 4. Consistent with Jia et al. (2019), the coefficient of *PeerFirmD&O* is not significant for SOEs as SOEs are politically connected that give them an advantage in corporate litigation and therefore have a lower demand for D&O insurance. The insignificant coefficient of *PeerFirmD&O* for better performing firms suggests that profitable firms tend to face lower litigation risk and are therefore less susceptible to peer influence from executive alumni to purchase D&O insurance. To further check the robustness of our results, we add several possible omitted variables to Equation (1), including the stock exchanges dummy (*ExchangeDummy*), the legal (*LawIndex*) and market environment (*MarketIndex*), and executive education level (*ExecutiveEducation*). The results are reported in column (1) of Table 4 Panel B, where the coefficient on *PeerFirmD&O* remains significantly positive. Interestingly, firms located in regions with high marketization and weak legal environments are more likely to seek D&O insurance cover, implying that firms in developed markets are more sensitive to changes in economic policies and competitor behaviour (Wang et al., 2014), while firms in weak legal environments tend to have heightened litigation risk due to increased information asymmetry (Jia et al., 2019); thus, executives in these firms may require D&O insurance to be purchased for them.

We then employ two alternative measures for alumni peer influence, *UniversityD&O.Mean* and *UniversityD&O.Median*, which are the respective average and median D&O insurance purchases of all firms within the peer group defined by the executives' university study experience. These measures capture the relationship between the focal firm and university peer group on average. We re-run Equation (1) using the two alternative measures and document a persistent alumni peer influence as shown in columns (2) and (3) of Table 4 Panel B. The magnitude of peer influence between a firm and a university peer group is greater than the influence between two randomly selected firms per the baseline results. This is intuitive, because some peer groups have many members, resulting in economically greater influence between a firm and a university peer group. Further, we conduct several additional robustness checks. First, we partition the sample on a four-year basis and find that peer influence is greater in the period from 2014 to 2017, indicating the rising importance of peer influence. Second, we winsorize the sample at the 1% and 99% levels to reduce the possible impact of outliers. Third, we redefine our sample by excluding the finance firms and special treatment firms. Our main results and conclusion remain unchanged in all these redefined samples. The results are available in Appendix B.

## 5. Conclusion

This study finds executive alumni peer effects shape corporate decisions to purchase D&O insurance, suggesting that social networks are important for the flow of information between firms and executives leading to correlated behaviour across firms. The peer influence persists in the subsample analyses, but its strength varies with firm characteristics. Our findings provide important practical implications to policymakers and practitioners on understanding the role of non-institutionalised personal ties in corporate decision making and in advancing the D&O insurance market. Due to the data limitations, several unaddressed questions may warrant future research. For example, whether greater peer influence exists for executives holding the same degree. Further, whether peer influence becomes stronger when D&O insurance coverage increases.

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## CRediT Author Statement

### Authors' Contribution

Both authors contributed equally. Both authors read and approved the final manuscript.

## Declarations of interest

none

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## Appendix A. PSM Balance Test Results

We adopt the balance test following Wang et al. (2020) to ensure the PSM matching is satisfactory. The test results are presented below. The results show the standardized deviations (% bias) of variables after matching are significantly reduced, and the standardized deviations of all variables are less than 20%. Moreover, the t-test results show the differences between the treated and the control samples after matching are all insignificant. All the above indicates that the matching effect is effective.

Variable	Unmatched Matched	Mean		%bias	%reduct bias	t-test		V(T)/ V(C)
		Treated	Control			t	p>t	
Size	U	22.164	22.015	9.2		3.23	0.001	1.22*
	M	22.164	22.192	-1.7	81.3	-0.43	0.671	0.94
ROA	U	0.03838	0.04105	-4.6		-1.58	0.113	1.11
	M	0.03838	0.03851	-0.2	95.1	-0.06	0.952	1.22*
Leverage	U	0.44504	0.4245	8.8		2.99	0.003	1.03
	M	0.44504	0.44124	1.6	81.5	0.42	0.674	0.98
Book-to-Market (BTM)	U	0.59857	0.58997	3.6		1.21	0.225	1.04
	M	0.59857	0.59961	-0.4	87.9	-0.11	0.911	0.99
CrossList	U	0.0823	0.0708	4.3		1.5	0.134	.
	M	0.0823	0.08449	-0.8	81	-0.21	0.836	.
OwnershipConcentration	U	0.15113	0.14302	6.6		2.27	0.023	1.12*
	M	0.15113	0.15036	0.6	90.6	0.16	0.874	1.01
ManagementHolding	U	0.10875	0.11505	-3.5		-1.16	0.245	0.93
	M	0.10875	0.10794	0.4	87.2	0.12	0.905	1.00
SOE	U	0.33139	0.31357	3.8		1.29	0.195	.
	M	0.33139	0.33066	0.2	95.9	0.04	0.968	.
Violation	U	0.06846	0.06858	0		-0.02	0.987	.
	M	0.06846	0.06919	-0.3	-502.7	-0.08	0.94	.
BoardIndependence	U	0.374	0.37225	3.3		1.12	0.263	1.07
	M	0.374	0.37433	-0.6	81.1	-0.16	0.872	1.06
ExecutiveGender	U	0.85361	0.84749	1.7		0.58	0.565	.
	M	0.85361	0.85506	-0.4	76.2	-0.11	0.914	.
ExecutiveAge	U	47.841	47.557	3.2		1.08	0.282	1.06
	M	47.841	47.899	-0.6	79.8	-0.17	0.865	1.12*

\* If variance ratio outside [0.90; 1.11]

## Appendix B. Robustness Checks

VARIABLES	(1) 2008-2013 FirmD&O	(2) 2014-2017 FirmD&O	(3) Winsor1% FirmD&O	(4) Non-finance Firm FirmD&O	(5) Non-ST Firm FirmD&O
PeerFirmD&O	0.127 (0.203)	0.472** (0.195)	0.326** (0.137)	0.280* (0.149)	0.283** (0.141)
Size	0.600*** (0.0674)	0.524*** (0.0707)		0.275*** (0.0594)	0.498*** (0.0491)
ROA	-0.561 (0.431)	-0.380 (0.628)		-0.349 (0.362)	-0.620 (0.532)
Leverage	-0.664* (0.385)	0.532 (0.420)		-0.336 (0.249)	0.276 (0.361)
Book-to-Market (BTM)	-0.374 (0.460)	-1.068** (0.481)		0.206 (0.348)	-0.577* (0.344)
CrossList	1.007*** (0.269)	2.358*** (0.265)	1.661*** (0.180)	1.803*** (0.196)	1.705*** (0.189)
OwnershipConcentration	-1.404** (0.645)	-0.734 (0.580)	-1.050** (0.432)	-1.017** (0.472)	-1.205*** (0.446)
ManagementHolding	-3.469** (1.387)	-2.052 (1.261)		-2.526*** (0.891)	-2.785*** (0.964)
SOE	-0.120 (0.191)	0.713*** (0.173)	0.311** (0.127)	0.511*** (0.138)	0.311** (0.131)
Violation	0.549* (0.313)	0.136 (0.337)		0.256 (0.238)	0.316 (0.234)
BoardIndependence	-1.112 (1.414)	2.445* (1.362)		1.480 (1.036)	0.604 (0.964)
ExecutiveGender	-0.270	0.329	0.00828	-0.0853	-0.0505

(continued on next page)



(continued)

VARIABLES	(1) 2008-2013 FirmD&O	(2) 2014-2017 FirmD&O	(3) Winsor1% FirmD&O	(4) Non-finance Firm FirmD&O	(5) Non-ST Firm FirmD&O
ExecutiveAge	(0.264) 0.00449 (0.00911)	(0.246) -0.0182* (0.00975)	(0.172)	(0.178) 0.00172 (0.00673)	(0.175) -0.00618 (0.00664)
Constant	-13.45*** (1.366)	-13.76*** (1.623)	-13.30*** (1.119)	-8.811*** (1.210)	-12.57*** (1.054)
Observations	2,927	2,789	6,131	5,871	5,768
All Controls	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES

Note: This table reports the results of robustness tests of firm D&O insurance purchase (*FirmD&O*) in year *t* on lagged peer firm D&O insurance purchase (*PeerFirmD&O*) and control variables in year *t*-1. Robust standard errors clustered by firm and year are in parentheses. A special treatment (ST) firm refers to a firm with a loss in two consecutive financial years.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

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