# Outcome model or substitute model of D&O insurance on IPO pricing without information asymmetry before issuance

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## ARTICLE INFO

## ABSTRACT

Because of information asymmetry and agency costs associated with investment bankers, initial public offerings (IPOs) are severely underpriced in many countries. Furthermore, investors may sue the managers of an IPO firm if the stock trading price decreases after stock issuance. Therefore, to mitigate the litigation risk, IPO firms purchase directors and officers (D&O) liability insurance. This study proposes outcome and substitute models of D&O insurance risk avoidance to examine whether holding D&O insurance influences IPO pricing. The outcome model implies that firms purchase D&O insurance owing to directors' and officers' conservative stance and reluctance to take aggressive decisions. The substitute model implies that directors and officers are aggressive when they have D&O insurance. Our empirical results support the outcome model, which is based on information concerning retail subscription, suggesting that firms purchase D&O insurance because directors and officers are conservative. However, IPO firms under D&O insurance coverage become aggressive when making pricing decisions, as evidenced by the strong retail subscription; thus, the substitute model dominates.

## 1. Introduction

The decision to go public and the pricing of initial public offerings (IPOs) are accompanied by risks. The crucial decision of going public entails setting the price of an IPO, that is, setting an initial price range and a final offer price. Tinic (1988) claims that investors are more likely to sue the managers of overpriced IPOs. IPO firms underprice offerings to avoid lawsuit risk. International evidence suggests that the universal principle of IPO underpricing is adopted; financial economists attribute this to information asymmetry and agency costs between underwriters and issuers (Chang et al., 2017).

This study examines whether a firm's IPO pricing is affected by its decision to purchase D&O insurance by examining Taiwanese IPO markets because of their unique institutional features. Prior research posits that information asymmetry is a major factor driving the underpricing of IPOs. Since Taiwan uses pre-IPO trading utilizing the Emerging Stock Market Platform (ESM) established in 2002, the information asymmetry for unlisted firms is greatly diminished. Unlisted stocks must be traded on the ESM for at least 6 months before being listed. The presence of the ESM reduces the effects of information asymmetry on the pricing of IPOs. Chang et al. (2017) indicate that ESM prices are informative for IPO pricing before and after issuance. Because Taiwan is an emerging market dominated by retail investors, the influence of underpricing in eliciting information from institutional investors is weakened. This is particularly evident in Taiwan's hybrid book-building process, in which sophisticated bidders may reveal their information during the 4-day book-

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building period. The allocation process favors retail investors when subscription levels are high, thereby preventing institutional investors from openly revealing their demands.

Another ongoing trend in the Taiwan IPO market is the increasing tendency to purchase D&O insurance. Purchasing D&O insurance indemnifies managers from risks associated with IPO mispricing. Given the fewer litigation risks for IPO issuers with D&O insurance, it is indeed an empirical issue as to whether managers price their IPOs less aggressively or more aggressively if they have purchased D&O insurance. Finally, we examine the relationship between the purchase of D&O insurance and the extent of IPO underpricing in Taiwan. The Securities Investors and Futures Traders Protection Act (the Act, hereinafter) became effective on January 1, 2003, in Taiwan. The Securities and Futures Investors Protection Center (the Center, hereinafter) was established under the Act to provide litigation services on behalf of investors, especially retail investors, who are expected to be more irrational than institutional investors. From 2009, the Center as well as retail investors, with assistance from the Center, can sue the directors and officers of listed firms for their misconduct when investors suffer losses. Thus, D&O insurance has become more relevant since 2009. Finally, studies on the influence of D&O insurance purchase on IPO pricing are limited. Chalmers et al. (2002) report a significant relationship between the amount of D&O insurance purchased and subsequent firm performance in a sample of US firms during 1992–1996. However, that study is limited by its small sample size (72 IPOs), dated results, and the lack of investigation of IPO pricing decisions. Boyer and Stern (2014) study a Canadian IPO sample with a focus on D&O insurance. They emphasize the pricing of D&O insurance premiums and whether D&O insurance can predict post-IPO returns and risks. However, they do not examine the effect of D&O insurance on managerial behavior regarding IPO pricing.

In the extant literature, the theoretical and empirical implications of purchasing D&O insurance have been discussed. In the context of IPOs, conservative or risk-averse managers and directors could purchase D&O insurance to mitigate litigation risks associated with issuing IPOs (Chalmers et al., 2002). After they have purchased the insurance, they could set low prices of the IPOs, which further increases the levels of underpricing. By using the terminology given by La Porta et al. (2000), we label this phenomenon as the "outcome" model. Accordingly, the outcome model indicates a positive relation between D&O insurance coverage and the conservatism of directors and officers. By contrast, the alternative model argues that directors and officers require D&O insurance against the lawsuit risks that could result from their aggressive decisions. Therefore, if managers and directors realize that litigation risks associated with overpriced issues are no longer a problem, they could price the IPOs more aggressively. We label this the "substitute" model by using the parlance provided by La Porta et al. (2000). Accordingly, D&O insurance serves as a substitute for the protection of aggressive directors and officers, wherein the insurance coverage increases with the aggressiveness of directors and officers.

This study examines whether D&O insurance is a complement or substitute for risk avoidance, and distinguishes between the outcome and substitute models of D&O insurance in the context of Taiwan, an economy with little value uncertainty and information asymmetry. By contrast, moral hazard implies that D&O insurance exerts a substitute effect on risk avoidance, and that directors and officers make more aggressive or riskier pricing decisions when they are under D&O insurance coverage. However, D&O insurance has a complementary effect on risk avoidance, and directors and officers under D&O coverage avoid making aggressive or risky pricing decisions. Because Taiwanese IPO markets have little information asymmetry, we expect the outcome model to dominate the substitute model of D&O insurance. However, IPO firms can adjust the final offer price after they observe retail demands. Generally, weak feedback from the public induces conservative IPO pricing, whereas strong feedback induces aggressive IPO pricing.

Our study contributes to the literature in several ways. First, we address two research aspects, the effect of D&O insurance on managerial behavior and the underpricing of IPOs. This is especially relevant because Taiwan features different institutional settings with information asymmetry, which is a key driver of underpricing in IPO markets. Second, we empirically examine the role of governance in IPO underpricing. The key question is whether managers holding D&O insurance become more aggressive in pricing IPOs in the presence of an audit committee. Third, we examine how managers incorporate the demand for an IPO through retail subscription into the setting of the final offer price.

The findings of the study are summarized as follows. High-risk IPOs entail higher D&O insurance coverage before issuance. D&O insurance coverage reduces IPO pricing efficiency. IPOs with D&O insurance coverage are discounted relative to the price in the pre-IPO market and are underpriced relative to the aftermarket price. D&O coverage is a complement rather than a substitute for directors' and officers' risk avoidance behaviors without observing the retail subscription. Outcome model dominates if IPO firms observe low retail subscription, whereas substitute model dominates in case of high retail subscription.

The remainder of the paper is organized as follows. In Section 2, we discuss the literature and develop models that underpin our empirical tests. In Section 3, we describe our data sources and provide variable definitions. Furthermore, in Section 4, we report empirical results of the effect of D&O insurance on IPO price setting. Thereafter, in Section 5, we report the effects of D&O insurance after issuance. Finally, we provide our conclusion in Section 6.

## 2. Literature review

### 2.1. D&O insurance

Directors and officers behave differently under D&O insurance coverage because D&O insurance mitigates the liability risk posed to them. Core (1997) explains the reasons for the purchase of D&O insurance by firms. First, risk-averse directors and officers induce firms to purchase D&O insurance to mitigate risk. Second, D&O insurance is purchased as part of the corporate insurance program to comply with the corporate insurance policy. Third, firms purchase D&O insurance as a governance mechanism to mitigate managerial entrenchment because D&O insurers assess D&O insurance purchasers. Core (1997) reveals that directors and officers purchase D&O

insurance to protect their own interests. The incidence of seeking D&O insurance is positively associated with the degree of controlling–minority shareholder incentive conflicts.

O'Sullivan (1997) mentions that firms with more outside directors are more likely to purchase D&O insurance. D&O insurance reduces the lawsuit risk posed to directors and officers on account of frauds or mistakes concerning corporate decisions. Firms subject to earnings management and/or related party transactions are more likely to purchase D&O insurance. This practice indicates that D&O insurance protects directors and officers against the potential lawsuit risk for expropriation of minority shareholders. Accordingly, D&O insurance can be considered a proxy measure of a firm's governance. D&O insurers urge the insurance purchasing firms to maintain solid corporate governance, including board independence and board composition, to monitor managerial behaviors.

Holderness (1990) and Core (2000) claim that D&O insurance is beneficial for minority shareholders because D&O insurers monitor directors and officers to avoid lawsuit liability and protect insurers' interests. Zou et al. (2008) argue that D&O insurance premium can be considered a proxy measure of governance risk since insurers charge insurance premium based on their assessment of a firm's governance risk. Gutiérrez (2003) and Boyer (2014) reveal that D&O insurers serve as monitors of the insured firm against managerial incompetence to improve shareholder wealth. Zou and Adams (2008) and Boyer (2014) indicate that D&O insurance compensates shareholders for the losses from managerial frauds.

Mayers and Smith (1982) argue that D&O insurance attracts qualified directors and managers, thereby enhancing firm performance. Bradley and Chen (2011) indicate that D&O insurance improves a firm's credit ratings, thereby enhancing firm performance.

Research suggests that according to the moral hazard hypothesis, directors and officers under D&O insurance coverage could become more aggressive and are more likely to adopt high-risk investment projects. Moreover, managers could more aggressively set IPO pricing, thus resulting in lower levels of underpricing, which is consistent with the substitute model of D&O insurance. By contrast, D&O insurance could complement the risk-avoidance behavior of directors and officers, as indicated by the results of the outcome model of D&O insurance. Risk-averse directors and officers encourage firms to purchase D&O insurance and make less risky decisions under the insurance coverage. Because risk-averse directors and officers tend to purchase higher D&O insurance coverage, they are implied to be more conservative in IPO pricing.

### 2.2. D&O insurance in Taiwan

The first D&O insurance policy in Taiwan was issued in 1996. Prior to 2000, less than 10% of Taiwanese listed firms purchased D&O insurance. Enron and WorldCom accounting scandals around 2001 and the passage of the Sarbanes–Oxley Act of 2002 increased interest in D&O insurance in Taiwanese stock exchange. In 2003, approximately 30% of listed firms in Taiwan purchased D&O insurance. Furthermore, 66%–69% and approximately 76% of listed firms purchased insurance in 2016 and in 2017, respectively, to avoid potential lawsuit risk against their officers and directors. Securities and Futures Bureau (Taiwan) requires all listed firms in Taiwan to purchase D&O insurance from 2019 owing to increased lawsuits by the Center in recent years. In 2005, 13 insurance companies sold D&O insurance in Taiwan. In 2016, there were 29 D&O insurers for listed firms in Taiwan.

Anecdotal evidence has indicated that the D&O insurance premium for a medium-size listed firm is approximately 5/1000 of the coverage limit. Chen and Pang (2008) reveal that the D&O insurance premium is approximately 0.89% of the D&O coverage. Moreover, they report that the D&O insurance premium of firms in Taiwan increases with debt ratio, ownership of inside directors, and number of shareholders but decreases with foreign investment, compensation for directors, and ownership of outside directors. In essence, D&O insurance premium depends on lawsuit risks.

The competition for D&O insurance proceeds increases with the increased number of insurers over time. The Herfindahl–Hirschman index (HHI), which is the sum of the squares of insurers' market shares based on D&O coverage in a year, measures industry competition. A high HHI implies a low industry competition. During our sample period, HHI declined from 0.228 in 2008 to 0.179 in 2015.

Until now, no study has investigated the effect of D&O insurance on IPO pricing in the Taiwanese context. We therefore review relevant international research.

### 2.3. D&O insurance and IPOs

Tinic (1988) indicates that overpriced IPOs more likely face lawsuit risk. Information asymmetry and value uncertainty reinforce the potential litigation and lawsuit risk. Chalmers et al. (2002) indicate that IPO firms purchase D&O insurance to serve as protection from lawsuit risks in order to be able to provide overpriced offerings under managerial opportunism, leading to a negative relationship between post-issuance performance and D&O insurance.

Chalmers et al. (2002) study a sample of US IPOs and report that the IPO price charged by the D&O insurers provides valuable insights into the uncertainty of the IPO firms. Similarly, Boyer and Stern (2012) show that Canadian IPOs with high prices set by D&O insurers experience worse first-year post-IPO stock performance. A higher D&O insurance premium is charged on IPOs with high aftermarket volatility. D&O insurance for IPOs can be considered a proxy measure of IPO uncertainty. Boyer and Stern (2014) claim that D&O insurers have information about IPOs' prospects even with high level of information asymmetry inherent to the IPO firms. Therefore, price of D&O insurance is valuable to market participants.

The present study differs from previous studies on D&O insurance for IPOs. Although previous studies have investigated D&O insurance for IPOs in terms of IPO uncertainty or information asymmetry, they have not examined the effect of D&O insurance on IPO pricing. We therefore address this gap in the current study. Furthermore, IPO uncertainty and information asymmetry before issuance are not critical factors for pricing in Taiwan because of the availability of price behavior before issuance. This study therefore focuses

on the outcome and substitute models of D&O insurance to examine the risk-avoidance behaviors of directors and officers of IPO firms. Moreover, we examine two major decision variables with respect to IPO pricing—initial price range and final offer price.

## 3. Data source and variable definition

We collect all the data concerning IPOs in Taiwan from 2008 to 2015 from the Taiwan Economic Journal (TEJ) database as TEJ included data on D&O insurance from 2008 and the Act for investor protection was effective from 2009. Firms began purchasing D&O insurance from 2008 to assess the effectiveness of the Act. Our IPO list only includes data upto 2015 because we must calculate the aftermarket long-run performance of IPOs. IPO data variables such as the filing date, initial price range, offer date, offer price, number of shares offered, lead underwriters, venture capitalist, audit committee, D&O insurance coverage,[1] trading data in ESM are collected from the TEJ database, the statistics on the website of Taiwanese Securities Association, and the prospectus of IPOs available on the market observation post system of Taiwan stock exchange.

### 3.1. Variable measurements

A. D&O insurance coverage (*D&O_Dummy*, *D&O_Asset*, *D&O_MV*)

We follow Lin et al. (2011) measure of D&O insurance coverage. The dummy variable *D&O_Dummy* equals 1 if an IPO firm has D&O insurance and 0 otherwise. Lin et al. (2011) recommend scaling the limit of coverage[2] by the market value of equity because Baker and Griffith (2007) demonstrate that both D&O insurance coverage and damage awards increase with the market capitalization of an insuree.

Considering the skewness of D&O insurance coverage, *D&O_Asset* and *D&O_MV* are the logarithms of 1 plus annual D&O insurance coverage limit scaled by lagged total assets and market value of equity, respectively.

B. Audit committee (*AuditCommittee*)

*AuditCommittee* equals 1 if an IPO firm forms an audit committee before going public and 0 otherwise. Audit committee of an IPO firm serves as a corporate governance mechanism that monitors the management of IPO firms. Moreover, an audit committee in Taiwan comprises only independent directors concerned about the potential lawsuit risk related to the decision to go public.

Beasley and Salterio (2001), Bédard et al. (2008) and Venkataraman et al. (2008) show that audit committees play a crucial role in improving the credibility, quality, and quantity of financial and nonfinancial information. By improving financial reporting quality, an audit committee mitigates information asymmetry between investors and issuers, particularly for IPO firms. Kao and Chen (2020) further show that a pre-IPO audit committee reduces agency conflicts between issuers and underwriters, thereby improving IPO pricing efficiency. Under the outcome model of D&O insurance, IPO firms purchase D&O insurance because they are conservative. A pre-IPO audit committee reduces discounts on the initial price ranges and final offer prices of an IPO and reinforces the effect of D&O insurance before issuance of these discounts.

C. Price discount of initial price range (*RangeDiscount*)

Chang et al. (2017) and Kao and Chen (2019) use the discount of the midpoint of the IPO's initial price range relative to the ESM price to evaluate the price range set initially. The setting of an initial price range is crucial for Taiwanese IPOs because the final offer price must fall within the price range. *RangeDiscount* measures the price level discount of the initial price range relative to the trading price in ESM prior to the filing of the price range. The price level of initial price range is measured by the midpoint of the range.

$$RangeDiscount = 1 - \frac{P_M}{P_{M\_EMS}}$$

(1)

where $P_M$ denotes the midpoint of the initial price range, and $P_{M\_EMS}$ denotes the trading price in ESM prior to the filing of the initial price range.

D. Retail subscription (*Subscription*)

Agarwal et al. (2008) use the subscription ratio to measure the demands of retail investors regarding IPOs. *Subscription* indicates the ratio of the number of shares subscribed to the number of shares offered. *Subscription* represents the retail demand for IPOs.

Amihud et al. (2003) and Lu et al. (2012) indicate a positive relationship between subscription and IPO underpricing according to the winner's curse model. A lower IPO price is positively related to IPO subscription. Therefore, retail subscription to an IPO is positively related to discounts in the initial price range and final offer prices and initial return of an IPO. Strong feedback from the

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[1] D&O insurance premium in Taiwan is not publicly available.
[2] Coverage limit is the maximum amount that an insurer pays for the legal fees, settlement, and other costs if directors or officers of a company are sued for alleged wrongful acts covered under D&O insurance.

public induces IPO firms to be aggressive in setting the final offer price under D&O insurance coverage. By contrast, weak feedback from the public hinders IPO firms from making aggressive offer price decisions even under D&O insurance coverage.

E. Offer price discount and underpricing (*Discount, InitialReturn*)

Chang et al. (2017) and Kao and Chen (2019) use the discount on the final offer price relative to the ESM price to evaluate the setting of final offer prices of IPOs. *Discount* provides a measure of the offer price discount relative to the trading price in the ESM before the final offer price is set.

$$Discount = 1 - \frac{P_o}{P_{o\_ESM}} \tag{2}$$

where $P_o$ denotes the offer price, and $P_{o\_ESM}$ denotes the price in ESM prior to the setting of the final offer price.

IPO underpricing (*InitialReturn*) is typically measured by its initial return in previous studies such as Liu and Ritter (2011) and Lowry et al. (2017).

$$InitialReturn = \frac{P_1}{P_o} - 1 \tag{3}$$

where $P_1$ denotes the close price of the first trading day in the aftermarket.[3]

Fig. 1 illustrates the timeline of price observation data.

F. IPO characteristics before issuance

Size of an IPO is measured by market capitalization (*ESMMV*) of the issued equity, which is the product of the price right before issuance in ESM and the number of shares offered to the public. *lnESMMV* is the logarithm of *ESMMV* considering the skewness of market capitalization. R&D is a risky and innovative decision of the IPO firms. Aboody and Lev (2000) and Guo et al. (2006) show that R&D expenditure is a source of information asymmetry of IPOs. *RD* denotes the ratio of the annual R&D expenditure prior to issuance to lagged assets. Carter and Manaster (1990) and Carter et al. (1998) argue that underwriter reputation reduces the information asymmetry between issuer and investors. Underwriter reputation (*Underwriter*) is measured by the market share of the lead underwriter in the IPO market during the sample period. Teoh et al. (1998) and Armstrong et al. (2016) show that accounting earnings influence IPO valuation. Operating income (*ROA*) is measured by return on assets prior to issuance. Lu et al. (2012) note that most of IPOs in Taiwan are in high-tech industries. *TECH* denotes a dummy variable for high-tech IPOs.[4] Titman and Trueman (1986) note that the outside auditor of an IPO firm signals the reliability of financial reports. *Auditor* denotes a dummy for auditors from the two largest audit firms.[5] Lee and Wahal (2004) document the certification role of venture capital on IPO pricing. *VentureCapital* equals 1 for venture-backed IPOs and 0 otherwise. Chen and Pang (2008) find that D&O insurance premium of Taiwanese firms increases with ownership of inside directors. The ownership of directors and officers (*Ownership*) measures the power of the directors and offices to make decisions.

Beatty and Ritter (1986) measure IPO uncertainty with the standard deviation of IPO daily returns in the aftermarket because price history before issuance is not available. The standard deviation of daily stock returns during [−60, −30] is calculated to capture the uncertainty of IPOs prior to issuance (*ESMstd*). Moreover, Chalmers et al. (2002) and Boyer and Stern (2012) indicate that D&O insurance premium increases with stock volatility. Compared with the previous studies that have used the standard deviation of daily returns in the early aftermarket to measure IPO uncertainty, we measure IPO uncertainty before issuance by using the trading prices in ESM. With price history in ESM, we can measure IPO uncertainty before issuance more precisely by using the prices before issuance rather than those after issuance.

G. Characteristics after issuance

The one-year stock return over day-1 price to day 250 (*Ret250*) measures the long-run aftermarket performance of IPOs excluding initial return. *D&O_Dummy1* denotes a dummy variable for IPO firms purchasing D&O insurance during the year after issuance. D&O insurance coverage during year one after issuance divided by lagged assets and market value is denoted by *D&O_Asset1* and *D&O_MV1*, respectively. IPO stock volatility after issuance (*STD1*) is measured by the standard deviation of the daily stock return during the first 250 trading days after issuance. The growth potential of an IPO after issuance is measured using the market-to-book ratio at the end of year one (*Market_Book1*). *ROA1* denotes the operating performance during year one. *RD1* denotes the ratio of R&D expenditure during year one to lagged assets. Ownership of directors and officers at the end of the year after issuance is denoted as *Ownership1*.

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[3] In addition to the initial return, we use the market-adjusted initial return to adjust for the market return during the corresponding period as the underpricing of an IPO and to qualitatively reach similar results.

[4] According to the categories of Ministry of Science and Technology Taiwan, pharmaceutical, OA, computer equipment, electronics and communications, medical equipment, precision machinery, optoelectronics equipment, and aerospace industry are defined as high-tech industries.

[5] The biggest two auditors in Taiwan are Deloitte Touche and PricewaterhouseCoopers.
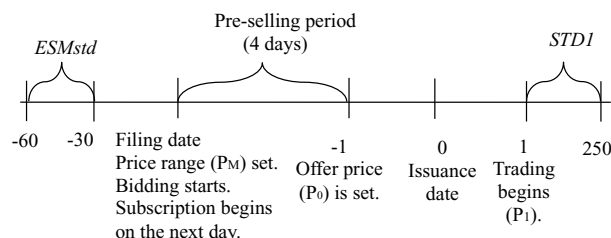
Fig. 1. Timeline of a hybrid book-building IPO process in Taiwan.

### 3.2. Descriptive statistics

Table 1 reports the descriptive statistics of the variables for the entire sample. Table 1 indicates that 44.6% of the IPO firms purchase D&O insurance before issuance and that D&O insurance coverage is approximately 4.7% and 6.5% of the total assets and market equity of an IPO firm, respectively. Furthermore, 57.8% of the IPOs in our sample have a Big 2 auditor in Taiwan, 34.2% of the IPOs are ventured back before issuance, and 75.1% of the sample is in high-tech industries. The market share of the lead underwriters during our sample period is 9.2% on average. The standard deviation of daily stock return from ESM during the window period of $[-60, -30]$ is 2.9%. On average, the subscription ratio is 60.186, with a maximum value at 308.991. IPOs generally attract retail subscribers because of a high price discount and high initial return. On average, the midpoint of the price range and the final offer price of an IPO are discounted by 27% and 27.8%, respectively, compared with their corresponding trading prices in the pre-IPO market. The final offer price of the IPO is underpriced by 41.6% relative to the closing price of the first trading day in the aftermarket.

**Table 1**
Descriptive statistics.

| Variable | Mean | Std | Min | Median | Max |
| --- | --- | --- | --- | --- | --- |
| Characteristics before issuance | | | | | |
| D&O_Dummy | 0.446 | 0.497 | 0 | 0 | 1 |
| D&O_Asset | 0.047 | 0.103 | 0.000 | 0.000 | 1.075 |
| D&O_MV | 0.068 | 0.139 | 0.000 | 0.000 | 1.334 |
| Auditor | 0.578 | 0.495 | 0.000 | 1.000 | 1.000 |
| VentureCapital | 0.342 | 0.475 | 0.000 | 0.000 | 1.000 |
| TECH | 0.751 | 0.433 | 0.000 | 1.000 | 1.000 |
| Underwriter | 0.092 | 0.085 | 0.002 | 0.078 | 0.533 |
| ESMstd | 0.029 | 0.018 | 0.000 | 0.024 | 0.109 |
| RangeDiscount | 0.270 | 0.159 | −0.156 | 0.256 | 0.841 |
| Subscription | 60.186 | 48.615 | 0.427 | 47.675 | 308.991 |
| Discount | 0.278 | 0.149 | −0.122 | 0.259 | 0.841 |
| InitialReturn | 0.416 | 0.613 | −0.202 | 0.275 | 7.279 |
| RD | 0.018 | 0.029 | −0.001 | 0.008 | 0.150 |
| ROA | 0.062 | 0.093 | −0.693 | 0.044 | 0.552 |
| Ownership | 0.308 | 0.174 | 0.004 | 0.247 | 0.949 |
| Characteristics after issuance | | | | | |
| D&O_Dummy1 | 0.589 | 0.492 | 0 | 1 | 1 |
| D&O_Asset1 | 0.075 | 0.102 | 0 | 0.047 | 0.664 |
| D&O_MV1 | 0.083 | 0.111 | 0 | 0.052 | 0.829 |
| Ret250 | −0.015 | 0.920 | −4.963 | −0.150 | 5.624 |
| Market_Book1 | 2.675 | 2.423 | 0.402 | 2.051 | 31.601 |
| STD1 | 0.137 | 0.125 | 0.009 | 0.102 | 1.493 |
| Ownership1 | 0.265 | 0.152 | 0.027 | 0.215 | 0.863 |

In Table 1, we provide descriptive statistics of key variables. *D&O_Dummy* is a dummy variable taking the value of "1" if the firm purchases D&O insurance before IPO issuance. *D&O_Asset* and *D&O_MV* are logarithm of (1 + D&O coverage limit before issuance scaled by lagged assets and market value of equity, respectively). *Auditor* is a dummy variable taking the value of "1" if an auditor belongs to a Big 2 auditors in Taiwan. *VentueCapital* is a dummy variable taking the value of "1" for venture-backed IPOs. *TECH* is a dummy variable taking the value of "1" for IPOs in high-tech industries. *Underwriter* captures underwriter reputation measured by market share of the lead underwriter. *ESMstd* captures IPO uncertainty measured by standard deviation of daily stock returns in ESM. *RangeDiscount* captures the discount of mid-point of price range relative to the corresponding price in ESM. *Subscription* is the ratio of number of shares subscribed to the number of shares offered. *Discount* is the discount of final offer price range relative to the corresponding price in ESM. *InitialReturn* is the initial return from final offer price to day one price in the aftermarket. *RD* is R&D expenditure measured by R&D expenses to lagged assets before issuance. *ROA* is net income to lagged assets before issuance. *Ownership* is the ownership of directors and officers before issuance. *D&O_Dummy1* is a dummy variable taking the value of "1" if the firm purchases D&O insurance during the year after issuance. *D&O_Asset1* and *D&O_MV1* are logarithm of (1 + D&O coverage limit during the year after issuance scaled by lagged assets and market value of equity, respectively). *Ret250* is year one stock return of an IPO after issuance. *Market_Book1* is market-to-book ratio year one after issuance. *STD1* is the standard deviation of daily stock return during year one after issuance. *Ownership1* is ownership of directors and officers year one after issuance.

The price discount and initial return of an IPO imply that the final price in ESM is lower than the aftermarket price by 2.3%.[6] On average, R&D expenditure and operating income before issuance are 1.8% and 6.2% of lagged assets, respectively. The directors and officers hold 30.8% of the ownership before issuance.

In addition, Table 1 reports IPO characteristics after issuance. Director and officer ownership is 26.5% at the end of year one, which is lower than that before issuance because of dilution effect due to issuance. D&O insurance coverage to total assets and market value increase to 7.5% and 8.3%, respectively, during year one after issuance. This increase implies that firms purchase higher D&O insurance coverage because directors and officers of listed firms are more likely to be sued at the listed stage than at the unlisted stage. Stock volatility (*STD1*) after issuance over the [1, 250] trading period is 0.137. *STD1* is higher than *ESMstd* because *STD1* is calculated on a 250-day basis, whereas *ESMstd* is calculated on a 30-day basis. Without initial return, the one-year return after issuance is −1.5%. The negative one-year return implies that the day-one price is likely overpriced.

Table 2 describes the mean and median of IPO characteristics by D&O insurance coverage. As indicated in the table, 44.6% of the IPO firms purchase D&O insurance before issuance. IPO firms that purchase D&O insurance before issuance are more likely to be venture backed, in high-tech industries, and with higher R&D intensity. However, Table 2 does not indicate whether the outcome or substitute model of D&O insurance dominates.

## 4. Impact of D&O Insurance on setting IPO prices

Before unlisted firms go public, they are rarely sued by their stockholders because stockholders of private firms are not protected by the Act, and the ownership of private firms are concentrated in Taiwan. The decision to go public exposes the directors and officers of the IPO firms to potential lawsuit risk. An essential decision to go public that attracts a potential lawsuit risk is the setting of IPO prices such as an initial price range and a final offer price. A potential lawsuit may most likely occur when investors suffer losses due to a considerable decline in the stock price. Therefore, directors and officers of an IPO firm are more likely to be sued when the IPO is set at a higher price. In this section, we examine how D&O insurance affects the initial price range and final offer price. To address the potential endogeneity problems, we follow the methodology described by Lin et al. (2011).

### 4.1. Endogeneity of D&O insurance

A 2SLS regression is employed by using the industry median coverage ratio as an instrumental variable. Table 3 presents the first-stage regressions for the determinants of the coverage of directors and officers. As expected, the instrument variables—industry mean of the D&O dummy, industry median of the coverage limit scaled by assets, and market value—always positively influence the IPO firms' decisions of purchasing D&O insurance. Furthermore, the results of the F-tests as well as partial $R^2$ always exceed 10%, suggesting that our instrument is relevant in explaining the potential variation in the endogenous D&O variables.

Furthermore, our results suggest that the higher the R&D expenditure, profitability, and director and officers' ownership, the higher the D&O insurance coverage. In addition, our result indicates that venture-backed IPOs and IPOs with an audit committee are more likely to purchase D&O insurance, and these IPOs have higher D&O coverage before IPO issuance. Consistent with the results of univariate correlation analyses, Table 3 indicates that high-risk IPOs have higher levels of D&O insurance coverage. Moreover, good governance, as indicated by the presence of an audit committee, results in a higher D&O insurance coverage limit.

### 4.2. Effect of D&O coverage on setting an initial price range

The outcome model of D&O insurance for managerial risk avoidance implies a complementary effect. IPO firms purchase D&O insurance owing to the conservative stance of their directors and officers. Accordingly, IPO firms take conservative decisions even after directors and officers are covered under D&O insurance. The substitute effect of D&O insurance on risk avoidance implies that D&O insurance attracts IPO firms to take aggressive decisions when directors and officers are covered under D&O insurance.

The final offer price for Taiwanese IPOs must fall within the price range. Therefore, setting the initial price range is crucial in Taiwan. IPOs are traded in ESM before issuance for at least 6 months. The price level of the initial price range relative to the ESM price is measured using the discount on the midpoint of the price range relative to the ESM price. A higher level of price range indicates a lower discount on the midpoint of price range. If directors and officers take advantage of the D&O insurance coverage, the filed price level of the price range should be higher. If directors and officers are sufficiently conservative to urge IPO firms to raise D&O insurance coverage, then D&O coverage does not raise the price level of the initial price range. Rather, D&O insurance adversely impacts the price level of the initial price range and is positively related to the discount on the midpoint of the price range.

Our results are presented in Tables 4 and 5. Table 4 presents OLS regressions to examine the effect of D&O insurance on the price level of the initial price range (*RangeDiscount*). The choice of control variables follows prior works such as Lu et al. (2012) and Kao and Chen (2019). A 2SLS regression is further employed to deal with the endogeneity of D&O insurance in Table 5. Our results suggest that D&O insurance is positively related to the discount of the price level of the initial price range. That is, directors and officers are conservative in setting a higher initial price range even though they are under a higher D&O insurance coverage, thereby supporting the outcome model of D&O insurance. Tables 4 and 5 further indicate that price range discount increases with IPO uncertainty (*ESMstd*) but decreases with underwriter reputation (*Underwriter*).

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[6] 0.416–0.278-0.416*0.278 = 0.023.

**Table 2**

Descriptive statistics by D&O coverage.

| | Without D&O insurance before issuance $N = 180$ 55.4% | | With D&O insurance before issuance $N = 145$ 44.6% | | |
| --- | --- | --- | --- | --- | --- |
| | Mean | Median | Mean | Median | *t*-test |
| Characteristics before issuance | | | | | |
| D&O_Asset | 0.000 | 0.000 | 0.106 | 0.070 | −9.51*** |
| D&O_MV | 0.000 | 0.000 | 0.153 | 0.104 | −10.48*** |
| Auditor | 0.544 | 1.000 | 0.621 | 1.000 | −1.38 |
| VentureCapital | 0.300 | 0.000 | 0.393 | 0.000 | −1.76* |
| TECH | 0.694 | 1.000 | 0.821 | 1.000 | −2.69*** |
| Underwriter | 0.092 | 0.067 | 0.093 | 0.078 | −0.04 |
| ESMstd | 0.028 | 0.024 | 0.030 | 0.024 | −0.88 |
| RangeDiscount | 0.279 | 0.267 | 0.260 | 0.241 | 0.71 |
| Subscription | 57.292 | 46.426 | 63.778 | 49.192 | −1.17 |
| Discount | 0.282 | 0.271 | 0.272 | 0.254 | 0.60 |
| InitialReturn | 0.435 | 0.267 | 0.393 | 0.282 | 0.64 |
| RD | 0.016 | 0.007 | 0.021 | 0.008 | −1.66* |
| ROA | 0.056 | 0.043 | 0.070 | 0.045 | −1.36 |
| Ownership | 0.308 | 0.248 | 0.308 | 0.246 | −0.03 |
| Characteristics after issuance | | | | | |
| D&O_Asset1 | 0.051 | 0.000 | 0.106 | 0.067 | −4.85*** |
| D&O_MV1 | 0.059 | 0.000 | 0.113 | 0.080 | −4.51*** |
| Ret250 | −0.062 | −0.178 | 0.043 | −0.122 | −1.03 |
| Market_Book1 | 2.659 | 2.028 | 2.695 | 2.120 | −0.14 |
| STD1 | 13.191 | 10.345 | 14.463 | 10.005 | −0.89 |
| Ownership1 | 26.601 | 22.310 | 26.504 | 21.140 | 0.06 |

In Table 2, we provide descriptive statistics of key variables by D&O insurance purchase before issuance. 55.4% of sample firms do not purchase D&O insurance before issuance while 44.6% of sample firms purchase D&O insurance before issuance. *D&O_Dummy* is a dummy variable taking the value of "1" if the firm purchases D&O insurance before IPO issuance. *D&O_Asset* and *D&O_MV* are logarithm of (1 + D&O coverage limit before issuance scaled by lagged assets and market value of equity, respectively). *Auditor* is a dummy variable taking the value of "1" if an auditor belongs to a Big 2 auditors in Taiwan. *VentueCapital* is a dummy variable taking the value of "1" for venture-backed IPOs. *TECH* is a dummy variable taking the value of "1" for IPOs in high-tech industries. *Underwriter* captures underwriter reputation measured by market share of the lead underwriter. *ESMstd* captures IPO uncertainty measured by standard deviation of daily stock returns in ESM. *RangeDiscount* captures the discount of mid-point of price range relative to the corresponding price in ESM. *Subscription* is the ratio of number of shares subscribed to the number of shares offered. *Discount* is the discount of final offer price range relative to the corresponding price in ESM. *InitialReturn* is the initial return from final offer price to day one price in the aftermarket. *RD* is R&D expenditure measured by R&D expenses to lagged assets before issuance. *ROA* is net income to lagged assets before issuance. *Ownership* is the ownership of directors and officers before issuance. *D&O_Dummy1* is a dummy variable taking the value of "1" if the firm purchases D&O insurance during the year after issuance. *D&O_Asset1* and *D&O_MV1* are logarithm of (1 + D&O coverage limit during the year after issuance scaled by lagged assets and market value of equity, respectively). *Ret250* is year one stock return of an IPO after issuance. *Market_Book1* is market-to-book ratio year one after issuance. *STD1* is the standard deviation of daily stock return during year one after issuance. *Ownership1* is ownership of directors and officers year one after issuance.

***, ** and * represent the significance levels at 1%, 5% and 10%, respectively.

The formation of an audit committee before issuance (*AuditCommittee*) reduces the discount on the price level of price range. The existence of an audit committee improves corporate governance of the IPO and raises the price level of the range. However, we determine that the interaction between the presence of an auditor committee and D&O insurance is significantly positive. This interaction implies that D&O coverage mitigates the negative effect of an audit committee on the price range discount. The positive coefficient of the interaction term *D&O_Dummy* *AuditCommittee* in regression (2) suggests that directors and officers of IPO firms do not take advantage of the D&O coverage to further set a higher price level of the initial price range due to the existence of an audit committee. Similar results are found in regressions (4) and (6) when we use the following interaction terms - *D&O_Asset*AuditCommittee* and *D&O_MV*AuditCommittee*. Rather, D&O coverage reduces the possibility that an audit committee increases the price level of the initial price range and implies conservative stance of directors and officers. The positive coefficient of D&O insurance and positive interaction between D&O insurance and the presence of an audit committee imply that the presence of an audit committee reinforces the positive effect of D&O insurance on the price range discount. Moreover, the price range discount increases with D&O insurance even without the presence of an audit committee. That is, governance from the presence of an audit committee is not dominant.[7]

With the establishment of ESM prices, IPO firms are less likely to be sued because the market price of an IPO before issuance is available in the pre-IPO market, thereby leading to fewer chances of violation of fiduciary duties concerning the pricing decision of an IPO. Aggressive firms tend to not purchase D&O insurance if they are less likely to be sued. Rather, conservative firms tend to

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[7] We thank an anonymous referee for raising this to us.

**Table 3**
First-stage regression analyses of D&O insurance coverage before issuance.

| | D&O_Dummy (1) | D&O_Asset (2) | D&O_MV (3) |
|---|---|---|---|
| Intercept | −5.473*** | −0.001 | 0.012 |
| | (−3.99) | (−0.01) | (0.17) |
| D&O_IV | 5.077*** | 0.198** | 0.357** |
| | (3.62) | (2.28) | (2.23) |
| ESMstd | 5.383 | 0.169 | 0.160 |
| | (0.71) | (0.51) | (0.36) |
| RD | 10.056* | 0.835*** | 1.032*** |
| | (1.90) | (3.83) | (3.53) |
| ROA | 3.963** | 0.141** | 0.183** |
| | (2.22) | (2.11) | (2.04) |
| Underwriter | −0.325 | 0.055 | 0.056 |
| | (−0.21) | (0.78) | (0.60) |
| VentureCapital | 0.095* | 0.025** | 0.031* |
| | (1.65) | (1.98) | (1.83) |
| Ownership | 0.142* | 0.074** | 0.101** |
| | (1.65) | (2.20) | (2.26) |
| lnESMMV | 0.075 | −0.007 | −0.010 |
| | (0.51) | (−1.12) | (−1.24) |
| Auditor | 0.400 | 0.004 | 0.007 |
| | (1.48) | (0.32) | (0.43) |
| AuditCommittee | 1.755*** | 0.051*** | 0.075*** |
| | (3.96) | (2.90) | (3.16) |
| TECH | 0.031 | 0.013 | 0.016 |
| | (0.08) | (0.90) | (0.83) |
| Year FE | yes | yes | yes |
| Pr > ChiSq/Pr > F | 0.0001 | 0.0001 | 0.0001 |
| Pseudo $R^2/R^2$ | 0.2352 | 0.1330 | 0.1375 |

In Table 3, we report the first-stage logistic regression in Regression 1 and OLS regression analyses in Regressions 2 and 3 using D&O insurance coverage of IPO firms before issuance as dependent variables. *D&O_Dummy* is a dummy variable taking the value of "1" if the firm purchases D&O insurance before IPO issuance. *D&O_Asset* and *D&O_MV* are logarithm of (1 + D&O coverage limit before issuance scaled by lagged assets and market value of equity, respectively). *D&O_IV* is the instrumental variable for D&O insurance which is the industry mean for *D&O_Dummy* and industry median for *D&O_Asset* and *D&O_MV*. *ESMstd* captures IPO uncertainty measured by standard deviation of daily stock returns in ESM. *RD* is R&D expenditure measured by R&D expenses to lagged assets before issuance. *ROA* is net income to lagged assets before issuance. *Underwriter* captures underwriter reputation measured by market share of the lead underwriter. *VentueCapital* is a dummy variable taking the value of "1" for venture-backed IPOs. *Ownership* is the ownership of directors and officers before issuance. *lnESMMV* captures size of an IPO firm using logarithm of market capitalization in ESM. *Auditor* is a dummy variable taking the value of "1" if an auditor belongs to a Big 2 auditors in Taiwan. *AuditCommittee* is a dummy variable taking the value of "1" if an IPO firm forms a pre-IPO audit committee. *TECH* is a dummy variable taking the value of "1" for IPOs in high-tech industries. *Year FE* captures year fixed effects. Logistic regression is used for *D&O_Dummy* regression; OLS is used for *D&O_Asset* and *D&O_MV* regressions. Coefficient estimates are presented with t-statistics in parentheses. Heteroskedasticity consistent standard errors are used. ***, ** and * represent the significance levels at 1%, 5% and 10%, respectively.

purchase D&O insurance even if they are less likely to be sued. Consequently, the outcome model of D&O risk avoidance dominates the substitute model of D&O risk avoidance. IPO firms purchase D&O insurance because their directors and officers are conservative and not aggressive under D&O insurance coverage.

### 4.3. D&O coverage and final offer price

Tables 4 and 5 indicate that IPO firms do not take advantage of D&O coverage to set a higher level of price range. Rather, they set a lower level of price range even if they are covered by insurance. Retail subscription reveals public demand for the offerings. Chang et al. (2017) indicate that subscription ratio denotes investor demand. During the book-building process in Taiwanese IPO markets, retail demand is available and IPO firms can take advantage of the feedback from the public to adjust the final offer price. Strong feedback from the public induces IPO firms to be aggressive in setting the final offer price under D&O insurance coverage. Weak feedback from the public, however, hinders IPO firms to be aggressive on the offer price decision even under D&O insurance coverage.

The discount on final offer price relative to ESM price (*Discount*) and the initial return on final offer price relative to aftermarket day-one price (*InitialReturn*) examine the price level of the final offer price. Similar to the results in Table 5, 2SLS regressions in Tables 6 and 7 report that D&O coverage positively impacts offer price discount and initial return, respectively. Tables 6 and 7 further indicate that D&O insurance reduces the effect of an audit committee on the setting of the final offer price relative to the ESM and aftermarket prices. Tables 6 and 7 report the negative effect of *AuditCommittee* on *Discount* and *InitialReturn* and a positive interaction

**Table 4**

OLS regression analyses of discount of initial price range.

| | Dependent variable: *RangeDiscount* | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Intercept* | 0.150** | 0.149** | 0.152** | 0.150** | 0.150** | 0.148** |
| | (2.06) | (2.05) | (2.12) | (2.08) | (2.09) | (2.06) |
| *D&O_Dummy* | 0.009** | 0.004** | | | | |
| | (2.04) | (2.20) | | | | |
| *D&O_Asset* | | | 0.164** | 0.087* | | |
| | | | (2.14) | (1.94) | | |
| *D&O_MV* | | | | | 0.132** | 0.073* |
| | | | | | (2.32) | (1.86) |
| *ESMstd* | 1.026** | 1.045** | 0.994** | 1.013** | 1.004** | 1.021** |
| | (2.27) | (2.31) | (2.21) | (2.26) | (2.24) | (2.28) |
| *RD* | −0.152 | −0.153 | −0.307 | −0.319 | −0.307 | −0.314 |
| | (−0.51) | (−0.52) | (−1.03) | (−1.07) | (−1.03) | (−1.06) |
| *ROA* | −0.050 | −0.052 | −0.081 | −0.083 | −0.082 | −0.086 |
| | (−0.55) | (−0.57) | (−0.90) | (−0.93) | (−0.92) | (−0.96) |
| *Underwriter* | −0.225** | −0.223** | −0.235** | −0.248*** | −0.234** | −0.249*** |
| | (−2.39) | (−2.36) | (−2.51) | (−2.64) | (−2.50) | (−2.65) |
| *VentureCapital* | −0.004 | −0.003 | −0.008 | −0.006 | −0.008 | −0.006 |
| | (−0.21) | (−0.18) | (−0.46) | (−0.37) | (−0.46) | (−0.35) |
| *Ownership* | 0.009 | 0.009 | −0.003 | −0.006 | −0.005 | −0.007 |
| | (0.21) | (0.20) | (−0.06) | (−0.14) | (−0.10) | (−0.16) |
| *lnESMMV* | 0.019** | 0.019** | 0.020** | 0.020** | 0.020** | 0.020** |
| | (2.20) | (2.22) | (2.33) | (2.39) | (2.37) | (2.42) |
| *Auditor* | 0.005 | 0.004 | 0.003 | 0.005 | 0.003 | 0.005 |
| | (0.29) | (0.23) | (0.22) | (0.34) | (0.20) | (0.32) |
| *AuditCommittee* | −0.046* | −0.018** | −0.057** | −0.074*** | −0.059** | −0.078*** |
| | (−1.87) | (−2.44) | (−2.39) | (−2.80) | (−2.45) | (−2.89) |
| *D&O_Dummy*AuditCommittee* | | 0.042* | | | | |
| | | (1.83) | | | | |
| *D&O_Asset*AuditCommittee* | | | | 0.239** | | |
| | | | | (1.99) | | |
| *D&O_MV*AuditCommittee* | | | | | | 0.186* |
| | | | | | | (1.94) |
| *TECH* | 0.003 | 0.002 | −0.001 | −0.000 | −0.001 | −0.001 |
| | (0.15) | (0.12) | (−0.04) | (−0.01) | (−0.06) | (−0.04) |
| Year FE | yes | yes | yes | yes | yes | yes |
| $Pr > F$ | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| $R^2$ | 0.3272 | 0.03287 | 0.3365 | 0.3413 | 0.3382 | 0.3433 |

In Table 4, we report the OLS regression analyses using discount of mid-point of price range as dependent variable (*RangeDiscount*). *D&O_Dummy* is a dummy variable taking the value of "1" if the firm purchases D&O insurance before IPO issuance. *D&O_Asset* and *D&O_MV* are logarithm of (1 + D&O coverage limit before issuance scaled by lagged assets and market value of equity, respectively). *ESMstd* captures IPO uncertainty measured by standard deviation of daily stock returns in ESM. *RD* is R&D expenditure measured by R&D expenses to lagged assets before issuance. *ROA* is net income to lagged assets before issuance. *Underwriter* captures underwriter reputation measured by market share of the lead underwriter. *Ventue-Capital* is a dummy variable taking the value of "1" for venture-backed IPOs. *Ownership* is the ownership of directors and officers before issuance. *lnESMMV* captures size of an IPO firm using logarithm of market capitalization in ESM. *Auditor* is a dummy variable taking the value of "1" if an auditor belongs to a Big 2 auditors in Taiwan. *AuditCommittee* is a dummy variable taking the value of "1" if an IPO firm forms a pre-IPO audit committee. *TECH* is a dummy variable taking the value of "1" for IPOs in high-tech industries. *Year FE* captures year fixed effects. Coefficient estimates are presented with t-statistics in parentheses. Heteroskedasticity consistent standard errors are used. ***, ** and * represent the significance levels at 1%, 5% and 10%, respectively.

between *AuditCommittee* and D&O insurance. The tables indicate that D&O insurance mitigates the effect of *AuditCommittee* on *Discount* and *InitialReturn*.

Table 6 reports a positive relation between retail subscription (*Subscription*) and offer price discount (*Discount*). Table 7 reports a positive relation between retail subscription (*Subscription*) and IPO initial return (*InitialReturn*), indicating that a low IPO price is closely associated with retail subscriptions. Furthermore, Tables 6 and 7 report a significantly negative interaction between retail subscription and D&O insurance (see regressions 2, 4 and 6 of Tables 6 and 7). This implies that D&O coverage can mitigate the positive relation between offer price discount (initial return) and retail subscription.

The outcome model implies that the price discount on IPOs with D&O insurance is higher than that on IPOs without D&O insurance; the substitute model implies that the price discount on IPOs with D&O insurance is lower than that on IPOs without D&O insurance.

We assess the validity of these models both with and without an audit committee. For the sample with an audit committee, our empirical results show that the outcome model dominates when the subscription level is below 41. For a subscription level above 41,

**Table 5**
Second-stage regression analyses of discount of initial price range.

| | Dependent variable: *RangeDiscount* | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Intercept* | 0.167** | 0.166** | 0.153 | 0.149 | 0.150** | 0.143* |
| | (2.16) | (2.14) | (1.23) | (0.84) | (2.06) | (1.89) |
| *D&O_Dummy_hat* | 0.050* | 0.055* | | | | |
| | (1.75) | (1.71) | | | | |
| *D&O_Asset_hat* | | | 0.205* | 0.309* | | |
| | | | (1.75) | (1.86) | | |
| *D&O_MV_hat* | | | | | 0.168** | 0.323* |
| | | | | | (2.21) | (1.88) |
| *ESMstd* | 0.991** | 1.013** | 0.684** | 0.521** | 1.000** | 0.992** |
| | (2.14) | (2.18) | (2.44) | (2.23) | (2.17) | (2.08) |
| *RD* | −0.271 | −0.270 | −1.887 | −2.865 | −0.344 | −0.601 |
| | (−0.80) | (−0.80) | (−0.28) | (−0.29) | (−0.39) | (−0.65) |
| *ROA* | −0.097 | −0.099 | −0.351 | −0.520 | −0.089 | −0.140 |
| | (−0.88) | (−0.89) | (−0.30) | (−0.31) | (−0.50) | (−0.75) |
| *Underwriter* | −0.230** | −0.227** | −0.342** | −0.424** | −0.236** | −0.272** |
| | (−2.39) | (−2.36) | (−2.07) | (−2.16) | (−2.23) | (−2.46) |
| *VentureCapital* | −0.005 | −0.004 | −0.054 | −0.080 | −0.009 | −0.013 |
| | (−0.27) | (−0.24) | (−0.27) | (−0.27) | (−0.30) | (−0.44) |
| *Ownership* | 0.009 | 0.009 | −0.144 | −0.235 | −0.008 | −0.037 |
| | (0.21) | (0.19) | (−0.23) | (−0.26) | (−0.09) | (−0.37) |
| *lnESMMV* | 0.017** | 0.018** | 0.033** | 0.042** | 0.020* | 0.023* |
| | (2.00) | (2.02) | (2.55) | (2.48) | (1.66) | (1.85) |
| *Auditor* | 0.000 | −0.001 | −0.003 | −0.005 | 0.003 | 0.004 |
| | (0.03) | (−0.04) | (−0.08) | (−0.08) | (0.18) | (0.24) |
| *AuditCommittee* | −0.066* | −0.034* | −0.154** | −0.236* | −0.061* | −0.106* |
| | (−1.85) | (−1.71) | (−2.37) | (−1.93) | (−1.93) | (−1.91) |
| *D&O_Dummy_hat*AuditCommittee* | | 0.047** | | | | |
| | | (2.00) | | | | |
| *D&O_Asset_hat*AuditCommittee* | | | | 0.331** | | |
| | | | | (1.99) | | |
| *D&O_MV_hat*AuditCommittee* | | | | | | 0.261** |
| | | | | | | (2.51) |
| *TECH* | −0.006 | −0.007 | −0.026 | −0.040 | −0.002 | −0.006 |
| | (−0.28) | (−0.30) | (−0.23) | (−0.25) | (−0.08) | (−0.23) |
| *Year FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| *Pr > F* | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| $R^2$ | 0.3187 | 0.3211 | 0.3316 | 0.3371 | 0.3302 | 0.3353 |

In Table 5, we report the second-stage regression analyses using discount of mid-point of price range as dependent variable (*RangeDiscount*). *D&O_Dummy_hat*, *D&O_Asset_hat*, and *D&O_MV_hat* are the fitted value from first-stage regressions in Table 3. *ESMstd* captures IPO uncertainty measured by standard deviation of daily stock returns in ESM. *RD* is R&D expenditure measured by R&D expenses to lagged assets before issuance. *ROA* is net income to lagged assets before issuance. *Underwriter* captures underwriter reputation measured by market share of the lead underwriter. *VentureCapital* is a dummy variable taking the value of "1" for venture-backed IPOs. *Ownership* is the ownership of directors and officers before issuance. *lnESMMV* captures size of an IPO firm using logarithm of market capitalization in ESM. *Auditor* is a dummy variable taking the value of "1" if an auditor belongs to a Big 2 auditors in Taiwan. *AuditCommittee* is a dummy variable taking the value of "1" if an IPO firm forms a pre-IPO audit committee. *TECH* is a dummy variable taking the value of "1" for IPOs in high-tech industries. *Year FE* captures year fixed effects. Coefficient estimates are presented with t-statistics in parentheses. Heteroskedasticity consistent standard errors are used. ***, ** and * represent the significance levels at 1%, 5% and 10%, respectively.

the substitution model dominates.[8] Our results suggest that managers are conservative in setting offer prices unless the subscription levels are extremely high. For the sample without an audit committee, the outcome model dominates when subscription levels are below 27, and the substitution model dominates when subscription levels are above 27.

Tables 5, 6, and 7 report the effect of D&O insurance on IPO pricing for the entire sample. In Table 8, we further examine the effect for the subsample of IPOs with D&O insurance before issuance to assess if D&O insurance coverage limit matters. Panels A, B, and C of Table 8 report the effect of D&O insurance coverage limit on the price range discount, final offer price discount, and initial return, respectively. Consistent with Tables 5, 6, and 7, Table 8 presents that D&O insurance coverage limit is positively related to the IPO price discount and initial return. Moreover, retail subscription mitigates the positive effect of D&O insurance coverage limit on IPO pricing, and the presence of an audit committee reinforces the positive effect of D&O insurance coverage limit on IPO pricing. Table 8 confirms the significance of D&O insurance coverage limit on IPO pricing.

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[8] These results are based on regression (2) of Table 6. Detailed calculations are available from the authors upon request.

**Table 6**
Second-stage regression analyses of discount of final offer price.

| | Dependent variable: *Discount* | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Intercept* | 0.019 | −0.005 | 0.013 | −0.010 | 0.011 | −0.027 |
| | (0.31) | (−0.09) | (0.23) | (−0.08) | (0.19) | (−0.39) |
| *D&O_Dummy_hat* | 0.019* | 0.027* | | | | |
| | (1.93) | (1.81) | | | | |
| *D&O_Asset_hat* | | | 0.150** | 0.064* | | |
| | | | (2.04) | (1.94) | | |
| *D&O_MV_hat* | | | | | 0.108* | 0.059* |
| | | | | | (1.87) | (1.74) |
| *Subscription* | 0.002*** | 0.002*** | 0.002*** | 0.002*** | 0.002*** | 0.002*** |
| | (11.99) | (11.66) | (12.08) | (5.34) | (12.09) | (10.04) |
| *D&O_Dummy_hat* Subscription* | | −0.001*** | | | | |
| | | (−3.10) | | | | |
| *D&O_Asset_hat* Subscription* | | | | −0.002** | | |
| | | | | (−1.96) | | |
| *D&O_MV_hat* Subscription* | | | | | | −0.002*** |
| | | | | | | (−2.69) |
| *ESMstd* | 1.048*** | 1.052*** | 1.035** | 0.748* | 1.046*** | 1.004** |
| | (2.96) | (3.02) | (2.48) | (1.94) | (2.91) | (2.41) |
| *RD* | −0.355 | −0.340 | −0.442 | −2.023 | −0.427 | −0.860 |
| | (−1.38) | (−1.34) | (−0.14) | (−0.30) | (−0.62) | (−1.05) |
| *ROA* | −0.193** | −0.188** | −0.199 | −0.464 | −0.198 | −0.277* |
| | (−2.27) | (−2.26) | (−0.37) | (−0.40) | (−1.41) | (−1.68) |
| *Underwriter* | −0.087 | −0.075 | −0.094 | −0.207 | −0.092 | −0.126 |
| | (−1.17) | (−1.02) | (−0.42) | (−0.43) | (−1.09) | (−1.27) |
| *VentureCapital* | −0.003 | −0.000 | −0.006 | −0.048 | −0.005 | −0.014 |
| | (−0.19) | (−0.03) | (−0.06) | (−0.24) | (−0.24) | (−0.51) |
| *Ownership* | −0.047 | −0.034 | −0.059 | −0.191 | −0.059 | −0.090 |
| | (−1.35) | (−0.99) | (−0.21) | (−0.31) | (−0.78) | (−1.01) |
| *lnESMMV* | 0.024*** | 0.024*** | 0.026** | 0.040** | 0.026*** | 0.032*** |
| | (3.59) | (3.68) | (2.44) | (2.38) | (2.69) | (2.84) |
| *Auditor* | 0.002 | −0.000 | 0.003 | −0.004 | 0.003 | −0.001 |
| | (0.16) | (−0.00) | (0.16) | (−0.11) | (0.21) | (−0.09) |
| *AuditCommittee* | −0.025* | −0.016* | −0.026* | −0.144* | −0.027* | −0.084* |
| | (−1.93) | (−1.78) | (−1.94) | (−1.84) | (−1.75) | (−1.93) |
| *D&O_Dummy_hat*AuditCommittee* | | 0.014** | | | | |
| | | (2.38) | | | | |
| *D&O_Asset_hat*AuditCommittee* | | | | 0.018** | | |
| | | | | (2.19) | | |
| *D&O_MV_hat* AuditCommittee* | | | | | | 0.028** |
| | | | | | | (2.57) |
| *TECH* | 0.001 | 0.003 | 0.002 | −0.023 | 0.002 | −0.005 |
| | (0.07) | (0.15) | (0.05) | (−0.20) | (0.12) | (−0.21) |
| *Year FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| $Pr > F$ | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| $R^2$ | 0.5364 | 0.5545 | 0.5388 | 0.5462 | 0.5387 | 0.5474 |

In Table 6, we report the second-stage regression analyses using discount of final offer price as dependent variable (*Discount*). *D&O_Dummy_hat*, *D&O_Asset_hat*, and *D&O_MV_hat* are the fitted value from first-stage regressions in Table 3. *Subscription* is the ratio of number of shares subscribed to the number of shares offered. *ESMstd* captures IPO uncertainty measured by standard deviation of daily stock returns in ESM. *RD* is R&D expenditure measured by R&D expenses to lagged assets before issuance. *ROA* is net income to lagged assets before issuance. *Underwriter* captures underwriter reputation measured by market share of the lead underwriter. *VentueCapital* is a dummy variable taking the value of "1" for venture-backed IPOs. *Ownership* is the ownership of directors and officers before issuance. *lnESMMV* captures size of an IPO firm using logarithm of market capitalization in ESM. *Auditor* is a dummy variable taking the value of "1" if an auditor belongs to a Big 2 auditors in Taiwan. *AuditCommittee* is a dummy variable taking the value of "1" if an IPO firm forms a pre-IPO audit committee. *TECH* is a dummy variable taking the value of "1" for IPOs in high-tech industries. *Year FE* captures year fixed effects. Coefficient estimates are presented with t-statistics in parentheses. Heteroskedasticity consistent standard errors are used. ***, ** and * represent the significance levels at 1%, 5% and 10%, respectively.

### 4.4. Long-run performance

IPOs experience poor long-run performance after issuance. A positive initial return with a poor long-run performance indicates that a higher price in the early aftermarket price leads to a lower long-run performance. Tables 7 and 8 indicate that D&O insurance is positively associated with IPO initial return. Therefore, we expect that D&O insurance will further impact the long-run performance of IPOs.

Table 9 presents that the long-run performance of the IPO firm is negatively related to D&O insurance, initial return, and the

**Table 7**
Second-stage regression analyses of initial return.

| | Dependent variable: *InitialReturn* | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Intercept* | −0.602** | −0.695** | −0.563 | −0.640** | −0.558** | −0.694** |
| | (−2.07) | (−2.39) | (−1.58) | (−2.14) | (−1.99) | (−2.34) |
| *D&O_Dummy_hat* | 0.130* | 0.020* | | | | |
| | (1.86) | (1.87) | | | | |
| *D&O_Asset_hat* | | | 0.405* | 0.216* | | |
| | | | (1.88) | (1.91) | | |
| *D&O_MV_hat* | | | | | 0.224** | 0.135** |
| | | | | | (2.07) | (2.42) |
| *Subscription* | 0.006*** | 0.007*** | 0.006*** | 0.007*** | 0.006*** | 0.007*** |
| | (9.31) | (8.97) | (7.23) | (8.21) | (9.27) | (8.62) |
| *D&O_Dummy_hat* Subscription* | | −0.002** | | | | |
| | | (−2.43) | | | | |
| *D&O_Asset_hat* Subscription* | | | | −0.008* | | |
| | | | | (−1.89) | | |
| *D&O_MV_hat* Subscription* | | | | | | −0.007** |
| | | | | | | (−2.26) |
| *ESMstd* | 7.900*** | 7.931*** | 8.481* | 7.572** | 7.852*** | 7.703*** |
| | (4.66) | (4.70) | (1.95) | (2.08) | (4.52) | (4.28) |
| *RD* | −0.793 | −0.735 | 2.293 | −2.690 | −0.821 | −2.287 |
| | (−0.64) | (−0.60) | (0.12) | (−0.17) | (−0.25) | (−0.65) |
| *ROA* | −0.561 | −0.542 | −0.091 | −0.927 | −0.621 | −0.890 |
| | (−1.38) | (−1.35) | (−0.03) | (−0.33) | (−0.92) | (−1.25) |
| *Underwriter* | −0.172 | −0.122 | 0.041 | −0.311 | −0.171 | −0.277 |
| | (−0.48) | (−0.34) | (0.03) | (−0.27) | (−0.42) | (−0.65) |
| *VentureCapital* | 0.004 | 0.013 | 0.100 | −0.035 | 0.008 | −0.020 |
| | (0.06) | (0.20) | (0.18) | (−0.07) | (0.07) | (−0.18) |
| *Ownership* | −0.099 | −0.050 | 0.200 | −0.215 | −0.075 | −0.176 |
| | (−0.59) | (−0.30) | (0.12) | (−0.15) | (−0.21) | (−0.46) |
| *lnESMMV* | 0.074** | 0.075** | 0.043** | 0.090** | 0.069* | 0.090* |
| | (2.30) | (2.33) | (2.25) | (1.83) | (1.90) | (1.86) |
| *Auditor* | 0.012 | 0.003 | 0.017 | −0.007 | 0.004 | −0.011 |
| | (0.19) | (0.05) | (0.15) | (−0.07) | (0.06) | (−0.17) |
| *AuditCommittee* | −0.062* | −0.121* | −0.224* | −0.143** | −0.035* | −0.154* |
| | (−1.88) | (−1.89) | (−1.79) | (−2.14) | (−1.84) | (−1.92) |
| *D&O_Dummy_hat*AuditCommittee* | | 0.090** | | | | |
| | | (2.51) | | | | |
| *D&O_Asset_hat*AuditCommittee* | | | | 0.105** | | |
| | | | | (2.53) | | |
| *D&O_MV_hat*AuditCommittee* | | | | | | 0.091** |
| | | | | | | (2.54) |
| *TECH* | 0.084 | 0.089 | 0.117 | 0.038 | 0.068 | 0.044 |
| | (1.02) | (1.08) | (0.37) | (0.14) | (0.74) | (0.46) |
| *Year FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| $Pr > F$ | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| $R^2$ | 0.3685 | 0.3824 | 0.3606 | 0.3750 | 0.3671 | 0.3725 |

In Table 7, we report the second-stage regression analyses using initial return as dependent variable (*InitialReturn*). *D&O_Dummy_hat*, *D&O_Asset_hat*, and *D&O_MV_hat* are the fitted value from first-stage regressions in Table 3. *Subscription* is the ratio of number of shares subscribed to the number of shares offered. *ESMstd* captures IPO uncertainty measured by standard deviation of daily stock returns in ESM. *RD* is R&D expenditure measured by R&D expenses to lagged assets before issuance. *ROA* is net income to lagged assets before issuance. *Underwriter* captures underwriter reputation measured by market share of the lead underwriter. *VentueCapital* is a dummy variable taking the value of "1" for venture-backed IPOs. *Ownership* is the ownership of directors and officers before issuance. *lnESMMV* captures size of an IPO firm using logarithm of market capitalization in ESM. *Auditor* is a dummy variable taking the value of "1" if an auditor belongs to a Big 2 auditors in Taiwan. *AuditCommittee* is a dummy variable taking the value of "1" if an IPO firm forms a pre-IPO audit committee. *TECH* is a dummy variable taking the value of "1" for IPOs in high-tech industries. *Year FE* captures year fixed effects. Coefficient estimates are presented with t-statistics in parentheses. Heteroskedasticity consistent standard errors are used. ***, ** and * represent the significance levels at 1%, 5% and 10%, respectively.

interaction between D&O insurance and initial return. The negative relation between D&O insurance coverage variables and long-run performance of IPOs suggest that managers tend to use D&O insurance opportunistically and time their IPOs such that public valuation of their shares exceed their private valuation.

IPOs that experience positive initial return will suffer loss in the long run. Market overreacts to underpricing at issuance in the early aftermarket. Consequently, the higher the initial return, the lower the one-year stock return after issuance. The negative interaction term between D&O insurance and initial return indicates that D&O insurance reinforces the negative relation between initial return and post-issuance long-run performance.

**Table 8**
Second-stage regression analyses of pricing for IPOs with D&O insurance.

Panel A: *RangeDiscount* as Dependent variable

|  | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| *Intercept* | 0.060 | 0.065 | 0.047 | 0.056 |
|  | (0.56) | (0.61) | (0.44) | (0.52) |
| *D&O_Asset_hat* | 0.191** | 0.091* |  |  |
|  | (2.34) | (1.93) |  |  |
| *D&O_MV_hat* |  |  | 0.161*** | 0.078* |
|  |  |  | (2.61) | (1.74) |
| *ESMstd* | 0.402 | 0.467 | 0.420 | 0.487 |
|  | (0.62) | (0.73) | (0.65) | (0.77) |
| *RD* | 0.018 | −0.014 | 0.013 | −0.013 |
|  | (0.05) | (−0.04) | (0.03) | (−0.03) |
| *ROA* | −0.047 | −0.059 | −0.049 | −0.067 |
|  | (−0.40) | (−0.51) | (−0.42) | (−0.58) |
| *Underwriter* | −0.108 | −0.139 | −0.105 | −0.145 |
|  | (−0.79) | (−1.02) | (−0.78) | (−1.07) |
| *VentureCapital* | 0.001 | 0.005 | 0.001 | 0.006 |
|  | (0.05) | (0.22) | (0.05) | (0.26) |
| *Ownership* | 0.154** | 0.146** | 0.147** | 0.141** |
|  | (2.53) | (2.41) | (2.41) | (2.33) |
| *lnESMMV* | 0.018 | 0.019 | 0.019 | 0.020 |
|  | (1.43) | (1.52) | (1.54) | (1.62) |
| *Auditor* | 0.017 | 0.019 | 0.017 | 0.018 |
|  | (0.80) | (0.88) | (0.78) | (0.84) |
| *AuditCommittee* | −0.053* | −0.084** | −0.055* | −0.093*** |
|  | (−1.74) | (−2.41) | (−1.81) | (−2.59) |
| *D&O_Asset_hat*AuditCommittee* |  | 0.284* |  |  |
|  |  | (1.78) |  |  |
| *D&O_MV_hat* AuditCommittee* |  |  |  | 0.234* |
|  |  |  |  | (1.92) |
| *TECH* | −0.010 | −0.012 | −0.010 | −0.013 |
|  | (−0.33) | (−0.41) | (−0.33) | (−0.44) |
| *Year FE* | Yes | Yes | Yes | Yes |
| *Pr > F* | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| *R²* | 0.4795 | 0.4924 | 0.4846 | 0.4994 |

Panel B: *Discount* as dependent variable

|  | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| *Intercept* | −0.018 | −0.041 | −0.022 | −0.064 |
|  | (−0.20) | (−0.47) | (−0.26) | (−0.73) |
| *D&O_Asset_hat* | 0.126* | 0.155* |  |  |
|  | (1.94) | (1.76) |  |  |
| *D&O_MV_hat* |  |  | 0.099** | 0.144* |
|  |  |  | (1.99) | (1.84) |
| *Subscription* | 0.001*** | 0.001*** | 0.001*** | 0.001*** |
|  | (5.84) | (4.73) | (5.73) | (5.27) |
| *D&O_Asset_hat*Subscription* |  | −0.002* |  |  |
|  |  | (−1.83) |  |  |
| *D&O_MV_hat* Subscription* |  |  |  | −0.002** |
|  |  |  |  | (−2.12) |
| *ESMstd* | 0.576 | 0.618 | 0.586 | 0.645 |
|  | (1.13) | (1.22) | (1.15) | (1.29) |
| *RD* | −0.184 | −0.184 | −0.173 | −0.190 |
|  | (−0.61) | (−0.61) | (−0.58) | (−0.64) |
| *ROA* | −0.148 | −0.145 | −0.147 | −0.155* |
|  | (−1.58) | (−1.55) | (−1.57) | (−1.69) |
| *Underwriter* | −0.027 | −0.041 | −0.025 | −0.044 |
|  | (−0.25) | (−0.37) | (−0.23) | (−0.41) |
| *VentureCapital* | 0.003 | 0.009 | 0.003 | 0.009 |
|  | (0.15) | (0.49) | (0.19) | (0.53) |
| *Ownership* | 0.054 | 0.061 | 0.052 | 0.068 |
|  | (1.06) | (1.20) | (1.03) | (1.34) |
| *lnESMMV* | 0.025** | 0.027*** | 0.025** | 0.029*** |
|  | (2.51) | (2.74) | (2.55) | (2.95) |
| *Auditor* | 0.019 | 0.017 | 0.019 | 0.014 |
|  | (1.12) | (0.99) | (1.10) | (0.84) |
| *AuditCommittee* | −0.034* | −0.060** | −0.036* | −0.070** |
|  | (−1.73) | (−2.13) | (−1.87) | (−2.45) |

(*continued on next page*)

**Table 8** (*continued*)

| Panel A: *RangeDiscount* as Dependent variable | | | | |
| --- | --- | --- | --- | --- |
| | (1) | (2) | (3) | (4) |
| D&O_Asset_hat*AuditCommittee | | 0.266* | | |
| | | (1.94) | | |
| D&O_MV_hat* AuditCommittee | | | | 0.239** |
| | | | | (2.40) |
| TECH | −0.003 | −0.007 | −0.003 | −0.005 |
| | (−0.13) | (−0.30) | (−0.12) | (−0.24) |
| Year FE | Yes | Yes | Yes | Yes |
| Pr > F | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| $R^2$ | 0.6009 | 0.6138 | 0.6015 | 0.6262 |
| Panel C: *InitialReturn* as dependent variable | | | | |
| | (1) | (2) | (3) | (4) |
| Intercept | −0.559 | −0.564 | −0.572 | −0.675* |
| | (−1.49) | (−1.46) | (−1.52) | (−1.74) |
| D&O_Asset_hat | 0.369* | 0.219* | | |
| | (1.91) | (1.87) | | |
| D&O_MV_hat | | | 0.287* | 0.358** |
| | | | (1.93) | (2.04) |
| Subscription | 0.004*** | 0.004*** | 0.004*** | 0.005*** |
| | (4.60) | (3.06) | (4.52) | (3.77) |
| D&O_Asset_hat*Subscription | | −0.002** | | |
| | | (−2.22) | | |
| D&O_MV_hat* Subscription | | | | −0.006** |
| | | | | (−2.24) |
| ESMstd | 4.535** | 4.680** | 4.562** | 4.751** |
| | (2.06) | (2.11) | (2.07) | (2.16) |
| RD | −0.016 | −0.066 | 0.018 | −0.036 |
| | (−0.01) | (−0.05) | (0.01) | (−0.03) |
| ROA | −0.322 | −0.338 | −0.318 | −0.348 |
| | (−0.79) | (−0.83) | (−0.78) | (−0.86) |
| Underwriter | 0.031 | −0.037 | 0.038 | −0.035 |
| | (0.07) | (−0.08) | (0.08) | (−0.07) |
| VentureCapital | 0.049 | 0.060 | 0.050 | 0.068 |
| | (0.62) | (0.75) | (0.64) | (0.87) |
| Ownership | 0.316 | 0.311 | 0.312 | 0.349 |
| | (1.44) | (1.39) | (1.43) | (1.58) |
| lnESMMV | 0.062 | 0.065 | 0.064 | 0.073* |
| | (1.45) | (1.50) | (1.48) | (1.69) |
| Auditor | −0.004 | −0.004 | −0.005 | −0.017 |
| | (−0.06) | (−0.05) | (−0.07) | (−0.22) |
| AuditCommittee | −0.078* | −0.151* | −0.081* | −0.189* |
| | (−1.74) | (−1.84) | (−1.77) | (−1.71) |
| D&O_Asset_hat*AuditCommittee | | 0.687** | | |
| | | (2.14) | | |
| D&O_MV_hat*AuditCommittee | | | | 0.742* |
| | | | | (1.90) |
| TECH | 0.075 | 0.069 | 0.076 | 0.068 |
| | (0.76) | (0.69) | (0.76) | (0.68) |
| Year FE | Yes | Yes | Yes | Yes |
| Pr > F | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| $R^2$ | 0.4594 | 0.4653 | 0.4596 | 0.4748 |

In Table 8, we report the second-stage regression analyses using discount of mid-point of price range, discount of final offer price, and initial return as dependent variables (*RangeDiscount*, *Discount*, and *InitialReturn*) for IPOs with D&O insurance. *D&O_Asset_hat* and *D&O_MV_hat* are the fitted value from first-stage regressions in Table 3. *ESMstd* captures IPO uncertainty measured by standard deviation of daily stock returns in ESM. *RD* is R&D expenditure measured by R&D expenses to lagged assets before issuance. *ROA* is net income to lagged assets before issuance. *Underwriter* captures underwriter reputation measured by market share of the lead underwriter. *VentueCapital* is a dummy variable taking the value of "1" for venture-backed IPOs. *Ownership* is the ownership of directors and officers before issuance. *lnESMMV* captures size of an IPO firm using logarithm of market capitalization in ESM. *Auditor* is a dummy variable taking the value of "1" if an auditor belongs to a Big 2 auditors in Taiwan. *AuditCommittee* is a dummy variable taking the value of "1" if an IPO firm forms a pre-IPO audit committee. *TECH* is a dummy variable taking the value of "1" for IPOs in high-tech industries. *Year FE* captures year fixed effects. Coefficient estimates are presented with t-statistics in parentheses. Heteroskedasticity consistent standard errors are used. ***, ** and * represent the significance levels at 1%, 5% and 10%, respectively.

## 5. D&O insurance coverage after issuance

Before going public, private firms' D&O policies might contain an exclusion concerning public securities exposures after issuance. For most IPOs, the private D&O policy is limited to the misconducts occurring prior to the launch of the IPOs. Coverage for the

**Table 9**

Second-stage regression analyses of year-one return after issuance.

| | Dependent variable: *Ret250* | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Intercept* | −0.177 | −0.207 | −0.184 | −0.211 | −0.176 | −0.186 |
| | (−1.26) | (−1.36) | (−1.38) | (−1.39) | (−1.30) | (−1.22) |
| *D&O_Dummy_hat* | −0.077* | −0.039* | | | | |
| | (−1.84) | (−1.65) | | | | |
| *D&O_Asset_hat* | | | −0.889** | −0.676* | | |
| | | | (−2.07) | (−1.79) | | |
| *D&O_MV_hat* | | | | | −0.672* | −0.592* |
| | | | | | (−1.77) | (−1.67) |
| *InitialReturn* | −0.724*** | −0.635*** | −0.724*** | −0.660*** | −0.714*** | −0.693*** |
| | (−6.12) | (−2.92) | (−6.18) | (−4.87) | (−6.04) | (−5.23) |
| *D&O_Dummy_hat* * *InitialReturn* | | −0.104* | | | | |
| | | (−1.70) | | | | |
| *D&O_Asset_hat*InitialReturn* | | | | −0.436* | | |
| | | | | (−1.76) | | |
| *D&O_MV_hat*InitialReturn* | | | | | | −0.132** |
| | | | | | | (−2.29) |
| *Market_Book1* | 0.090*** | 0.090*** | 0.092*** | 0.091*** | 0.089*** | 0.088*** |
| | (2.73) | (2.72) | (2.75) | (2.73) | (2.70) | (2.68) |
| *ROA1* | 1.392** | 1.381** | 1.388** | 1.374** | 1.360** | 1.354** |
| | (2.00) | (1.98) | (2.01) | (2.01) | (1.99) | (2.00) |
| *STD1* | −0.001 | −0.001 | 0.000 | 0.001 | −0.000 | 0.000 |
| | (−0.17) | (−0.12) | (0.07) | (0.19) | (−0.05) | (0.00) |
| *TECH* | −0.025 | −0.032 | −0.036 | −0.040 | −0.038 | −0.040 |
| | (−0.27) | (−0.35) | (−0.40) | (−0.44) | (−0.42) | (−0.44) |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| $Pr > F$ | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 |
| $R^2$ | 0.3158 | 0.3162 | 0.3233 | 0.3242 | 0.3206 | 0.3207 |

In Table 9, we report the second-stage regression analyses using one-year long-run performance as dependent variable (*Ret250*). *D&O_Asset_hat* and *D&O_MV_hat* are the fitted value from first-stage regressions in Table 3. *InitialReturn* captures the initial return from final offer price to day 1 price in the aftermarket. *Market_Book1* is market-to-book ratio year one after issuance. *ROA1* is net income to lagged assets year one after issuance. *STD1* is the standard deviation of daily stock return during year one after issuance. *TECH* is a dummy variable taking the value of "1" for IPOs in high-tech industries. *Year FE* captures year fixed effects. Coefficient estimates are presented with t-statistics in parentheses. Heteroskedasticity consistent standard errors are used. ***, ** and * represent the significance levels at 1%, 5% and 10%, respectively.

misconducts occurring after IPO issuance would be included under newly purchased D&O insurance policy after issuance.

Table 1 indicates that IPO firms purchase higher D&O insurance after issuance than that before issuance. We further examine D&O insurance purchased after issuance, and the results are presented in Table 10, which indicate that directors' and officers' ownership, audit committee, and stock volatility after issuance are the determinants of D&O coverage after issuance. The higher the ownership of directors and officers, the more powerful are the directors and officers. Accordingly, they urge firms to raise D&O coverage limit to protect themselves. The audit committee is still an essential determinant of D&O coverage. Finally, stock volatility after issuance also increases the D&O coverage limit. Stock volatility implies the idiosyncratic risk of the stock. Investors suffer investment risk from stock volatility. Investors, especially retail investors, are more likely to sue the firms once they suffer losses on their stock investment. The higher the stock volatility, the higher the potential lawsuit risk. Accordingly, IPO firms raise the D&O insurance coverage limit even without the potential lawsuit liability on IPO pricing due to the volatility of the IPO stock after issuance.

## 6. Conclusion

This study examines the effect of D&O insurance on IPO price setting. IPO firms are subject to lawsuit risk due to the mispricing of the offerings at issuance. Tinic (1988) argues that IPOs are underpriced to avoid potential lawsuit. On the one hand, moral hazard implies that directors and officers engage in aggressive pricing decisions because they are protected under D&O insurance. On the other hand, directors and officers are risk averse and conservative and are reluctant to take aggressive pricing decision even when covered by D&O insurance. We propose the outcome and substitute models of D&O insurance to examine the IPO price setting decision.

Our empirical results suggest that when retail demand is not considered, D&O insurance is a complement to the risk-avoidance behaviors of the directors and officers of Taiwanese IPO firms, thereby supporting the outcome model of D&O insurance. Directors and officers are conservative in setting IPO prices even under D&O insurance. IPO firms can adjust the offer price after observing retail subscription. We determine that IPO firms are conservative in taking pricing decisions under D&O insurance when observing weak feedback from the public and that IPO firms under D&O insurance are aggressive in pricing when observing strong feedback. After observing the feedback from the public, a low retail demand supports the outcome model of D&O insurance and a high retail

**Table 10**

Regression analyses of D&O insurance coverage after issuance.

|  | D&O_Dummy1 | D&O_Asset1 | D&O_MV1 |
|---|---|---|---|
|  | (1) | (2) | (3) |
| Intercept | −1.336 | 0.151*** | 0.228*** |
|  | (−0.94) | (2.64) | (3.68) |
| InitialReturn | −0.064 | −0.018 | −0.001 |
|  | (−0.11) | (−0.92) | (−0.05) |
| Discount | −0.430 | 0.064 | 0.051 |
|  | (−0.22) | (0.99) | (0.71) |
| Market_Book1 | 0.001 | 0.005 | 0.003 |
|  | (0.02) | (1.61) | (0.75) |
| ROA1 | 0.312 | −0.051 | −0.080 |
|  | (0.16) | (−0.65) | (−0.94) |
| Ownership1 | 0.714** | 0.103*** | 0.103*** |
|  | (2.36) | (3.15) | (2.92) |
| Auditor | 0.590 | 0.003 | 0.006 |
|  | (1.15) | (0.24) | (0.47) |
| AuditCommittee | 1.099** | 0.038** | 0.059*** |
|  | (2.31) | (2.33) | (3.30) |
| TECH | 0.850* | 0.007 | 0.006 |
|  | (1.65) | (0.49) | (0.43) |
| RD1 | −2.980 | 0.320 | 0.238 |
|  | (−0.52) | (1.39) | (0.95) |
| lnMV1 | −0.094* | −0.021*** | −0.029*** |
|  | (−1.85) | (−3.07) | (−3.84) |
| STD1 | 0.036* | 0.002*** | 0.002** |
|  | (1.77) | (2.81) | (2.05) |
| Year FE | Yes | Yes | Yes |
| Pr > ChiSq/Pr > F | 0.01 | 0.0001 | 0.0001 |
| Pseudo $R^2/R^2$ | 0.1285 | 0.1799 | 0.1804 |

In Table 10, we report the first-stage logistic regression in Regression 1 and OLS regression analyses in Regressions 2 and 3 using D&O insurance coverage of IPO firms year one after issuance as dependent variables. D&O_Dummy1 is a dummy variable taking the value of "1" if the firm purchases D&O insurance during the year after issuance. D&O_Asset1 and D&O_MV1 are logarithm of (1 + D&O coverage limit during the year after issuance scaled by lagged assets and market value of equity, respectively). InitialReturn captures the initial return from final offer price to day 1 price in the aftermarket. Market_Book1 is market-to-book ratio year one after issuance. ROA1 is net income to lagged assets year one after issuance. Ownership1 is ownership of directors and officers year one after issuance. Auditor is a dummy variable taking the value of "1" if an auditor belongs to a Big 2 auditors in Taiwan. AuditCommittee is a dummy variable taking the value of "1" if an IPO firm forms a pre-IPO audit committee. TECH is a dummy variable taking the value of "1" for IPOs in high-tech industries. RD1 is R&D expenditure measured by R&D expenses to lagged assets year one after issuance. lnMV1 is the market value of equity of an IPO firm at the end of year one after issuance. STD1 is the standard deviation of daily stock return during year one after issuance. Year FE captures year fixed effects. Coefficient estimates are presented with t-statistics in parentheses. Heteroskedasticity consistent standard errors are used. ***, ** and * represent the significance levels at 1%, 5% and 10%, respectively.

demand supports the substitute model of D&O insurance. After issuance, IPO firms purchase higher D&O coverage when directors and officers hold higher ownership, have an audit committee, and/or face higher stock volatility.

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