Hedging Affecting Firm Value via Financing and Investments: Evidence from Property Insurance Use

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Abstract

The effect of corporate risk management on firm value has gained significant research attention in recent years but prior studies have invariably focused on the effects of derivatives use due to the lack of data on alternative corporate risk management activities. We provide evidence on the value effects of alternative risk management by examining corporate purchase of property insurance – a commonly used pure hedge of asset-loss risks. Using an insurance dataset from China, we find evidence that there is an inverted U-shape effect of the extent of property insurance use on firm value measured by several versions of Tobin's Q. Therefore, the use of property insurance up to a certain degree has a positive effect on firm value, however, over-insurance appears detrimental to firm value. Given that the inflection points occur at relatively high levels of the observed insurance spending, insurance use appears beneficial to the majority of our sample firms. The estimated average hedging premium is about 1.5%. We show that one avenue for insurance to create value in China is that it helps firms secure valuable new debt financing and enhance investment.

JEL classification: G22.

Keywords: Corporate Risk Management; Hedging; Insurance; Firm Value; China.

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Hedging and Firm Value: Evidence from Property Insurance Use

1. Introduction

Risk management theories suggest while risk management (e.g., hedging via using derivatives and insurance) at the firm level is potentially costly,[1] in a world with frictions (e.g., bankruptcy costs, agency costs, taxes), such activities may be value increasing through the reduction of various costs.[2] While much of the empirical literature has focused on the determinants of corporate hedging, the overall value effect of corporate risk management has not received enough attention until recently. So far, the literature on hedging and firm value has invariably focused on hedging via derivatives trading and has reported evidence broadly consistent with the notion that derivatives hedging (particularly on firm input factors) is value increasing (e.g., Allayannis and Weston, 2001; Graham and Rogers, 2002; Nelson, Moffitt and Affleck-Graves, 2005; Adam and Fernando, 2006; Carter, Rogers and Simkins, 2006; Lin, Pantzalis and Park, 2007; Mackay and Moeller, 2007; Bartram, Brown and Fehle, 2009).[3] As a result, little is known about the value effect of alternative means of hedging (e.g., via insurance) despite their prevalence (Petersen and Thiagarajan,

[1] Using derivatives involves significant set-up and running costs. Insurance premium rates are not actuarially fair due to the charge of a loading factor that covers insurers' operational expenses and/or provides profit margin. Vaughan (1997) reports that the loading is typically one third of total premiums in property insurance. Throughout the paper, we refer to risk management via derivatives and insurance use as hedging.

[2] The costs examined include expected costs of financial distress (Mayers and Smith, 1982; Smith and Stulz, 1985), contracting cost between the firm and its stakeholders (e.g., managers and other employees) (Mayers and Smith, 1982), tax savings in firms facing a convex tax schedule (Smith and Stulz, 1985) or savings due to a higher interest tax shield afforded by an expanded debt capcity (Leland, 1998), financing cost (e.g., Froot, Scharfstein and Stein, 1993), and agency cost of debt (Mayers and Smith, 1982; MacMinn, 1987), among others.

[3] Some studies report inconsistent evidence. For example, after comparing the magnitude of the risk exposure hedged through derivatives with firm size and cash flows in a random sample of U.S. firms, Guay and Kothari (2003) argue that corporate derivatives use is too small to have a noticeable effect on firm value. More recently, using a sample from U.S. oil and gas producers, Jin and Jorion (2006) document that while (output) hedging reduces the stock price sensitivity to oil and gas prices, it has no discernible impact on firm value.

2000). This study contributes to our understanding of the effect of risk management on firm value using a unique corporate property insurance dataset from China.[4]

Corporate insurance offers an interesting setting in which to analyze the value of corporate risk management activities for two reasons. First, insurance is the primary way of managing pure risks (e.g., property and liability damage) and corporate spending on insurance is economically significant in many countries (Mayers and Smith, 1982; Yamori, 1999; MacMinn and Garven, 2000; Regan and Hur, 2007).[5] In addition, many large industrial corporations can gain access to commercial reinsurance through setting up captive insurance operations that are more cost effective than directly purchasing commercial insurance in recent years.[6] Therefore, whether insurance purchases affect firm value is an important but unanswered question (due to the paucity of firm-level insurance data; in contrast, data on corporate derivatives are routinely reported probably because derivative trading can be risky if derivatives are used for speculation). Indeed, Mayers and Smith (1990, p.20) opine that " . . . insurance purchases affect the firm's current *market* value through changing tax liabilities, contracting costs, or incentives with respect to real investment decisions for either the corporation or its claimholders". While several studies (Mayers and

[4] The definition of property insurance covers indemnity for losses in physical assets (e.g. fixed assets and inventory) due to fire, theft and environmental perils (e.g., floods, storm damage and earthquakes). Undeveloped property (mainly the right of land use) is treated as intangible assets in China and is not insurable. Lost business income due to business interruption caused by asset losses may also be covered if business interruption insurance is separately purchased in addition to property insurance coverage. Property insurance policy is normally valid for one year and renewable afterwards subject to mutual agreements. The purchase of property insurance in China is voluntary.

[5] For example, MacMinn and Garven (2000) report that corporate property-liability insurance premiums typically exceed dividend payments by an order of 30-40%.

[6] A captive insurance company is an insurance subsidiary (often incorporated in tax favorable offshore domiciles) of a non-insurance parent company and is solely for the purpose of providing insurance to the parent. A captive insurance company can pass a part of the risk assumed from the parent to the international reinsurance market. Skipper (1998, p. 660) reports that over 90 percent of the top 500 companies in the US and over 80 percent of the top 200 companies in the UK have established captive insurance operations.

Smith, 1990; Yamori, 1999; Hoyt and Khang, 2000; Zou, Adams and Buckle, 2003; Zou and Adams, 2006; 2008; Regan and Hur, 2007) have examined the determinants of corporate insurance in different jurisdictions, no prior study has investigated the effect of insurance purchases on firm value and this study thus attempts to fill this void.

Second, in testing the value effect of corporate risk management, insurance may represent a cleaner setting than derivatives use given that many firms also use derivatives for selective hedging (e.g., because managers think that they have unique market insights) (see Bodnar, Hayt and Marston, 1998; Adam and Fernando, 2006; Géczy, Minton, and Schrand, 2007). Géczy et al. (2007) also report that investors are often unable to ascertain the activities of frequent speculators based on corporate disclosures. As insurance cannot be used for speculation, it provides a cleaner setting for testing the value effect of risk management (Adams, Hardwick and Zou, 2008).

In addition to data availability, China is interesting for another reason. Commercial property insurance is a major commercial risk management tool for companies in China that lack risk management options and in-house risk management expertise. Corporate risk management theories posit a close linkage between debt and insurance. Chinese firms rely heavily on indirect debt financing (e.g., bank loans), as both equity and bond issues are tightly regulated in China (Sun and Tong, 2003).[7] This situation means that debt financing (and insurance) is an important factor in management decision-making in the Chinese corporate sector and sometimes

[7] Firms applying for equity issues (both initial public and seasoned offerings) have to go through a profitability-oriented screening process. For example, during our sample period, a firm eligible for a rights issue must have reported a three-year average return on equity (ROE) ≥6%.

crucially determines firms' growth. Indeed, Zou and Adams (2008) report that firms may take out property insurance in order to secure bank loans and/or to lower the cost of debt in China. They find that property insurance helps expand a firm's debt capacity, which may translate into gains in firm value through providing valuable funding for real investments and/or tax savings.

We find evidence that there is an inverted U-shape effect of the extent of property insurance use on firm value measured by several versions of Tobin's Q. Therefore, the use of property insurance up to a certain extent has a positive effect on firm value, however, over-insurance appears detrimental to firm value. Given that inflection occurs above the 99th percentile of the observed insurance spending, insurance use appears beneficial to the majority of our sample firms. These results are robust to accounting for the endogeneity of insurance. We show that one avenue for insurance to create value in China is that it helps firms secure valuable new debt financing and enhance investment. The estimated average hedging premium is about 1.5% and is lower than the 5% reported in foreign currency hedging in Allayannis and Weston (2001) and about 10% in fuel hedging in Carter et al. (2006). Our study represents a useful extension to the literature on the value of corporate risk management. In addition, as the first study of its kind, it provides a reference point for future investigations of insurance use on firm value.

The rest of the paper is structured as follows. Section 2 discusses the linkage between property insurance and firm value. Section 3 describes the research design. Section 4 discusses the results. Section 5 identifies a specific avenue through which insurance adds value, and the paper concludes in Section 6.

2. The Effects of Property Insurance Use on Firm Value

In a seminal paper, Mayers and Smith (1982) first argue that insurance is an integral part of corporate financing activities and they theorize that the benefits of corporate insurance include the saving in contracting costs between a firm and its claimholders (e.g., managers and employees) due to shifting the risk to insurance companies that have comparative advantages in risk bearing, lowered expected costs of financial distress, efficient real services provided by the insurance company (e.g., claims administration, loss adjustment, and advice on loss prevention activities), helping control various incentive conflicts and bond real investment decisions, the potential tax savings (e.g., in presence of tax convexity), among others. Drawing upon their and others' work, below we discuss the value effects of corporate insurance that are likely to be important in the Chinese setting.

First, property insurance helps lower the insured firm's chance of financial distress. Although listed firms in China are seldom liquidated[8], there are still significant indirect costs of financial distress. Purnanandam (2008) contends that a financially distressed firm may violate its debt covenants and so may incur deadweight losses in the form of financial penalties, accelerated debt-repayment, operational inflexibility and managerial time and efforts spent on negotiations with the lenders. Zou and Adams (2008) further argue that in China the costs of financial distress for listed companies may also arise from being disqualified from issuing

[8] As the corporate demand for listing shares in China is high but the issue of shares is tightly regulated, financially distressed and poorly performing listed companies often are able to have their blocks of controlling ownership transferred to more efficient corporate investors through negotiated purchases. The government often takes a supporting attitude towards such deals for the purpose of reducing layoffs and maintaining social stability. Asset swaps, debt restructuring and other forms of company reorganization often follow the block transfer of ownership. Consequently, the liquidation of the distressed listed firm is usually avoided (Chen, Firth, Xin and Xu, 2008).

equity, restricted trading of the company's stock (should a firm report a loss for two consecutive years), delisting (should a firm report a loss for three consecutive years), and the loss of key customers and business suppliers. As a result, a firm with appropriate insurance may have lower expected costs of financial distress that can be triggered by a major accidental property loss. In addition, such properly insured firms may secure more business and/or enjoy more favorable business terms when dealing with its major business partners. This is because such a firm is more likely to maintain normal operations and deliver on its business promises.

Second, insurance may help coordinate a firm's financing and real investment decisions. Froot et al. (1993) show that if external financing is costly (e.g., because of market imperfection and information asymmetry), hedging would enable a firm to have sufficient and less costly internal fund to take advantage of attractive investment opportunities in bad states.[9] Two necessary conditions are implicit in this reasoning: first, external financing is costly; and second, the firm can identify attractive investment opportunities in the bad states. Carter et al. (2006) show that hedging of fuel cost in the airline industry is a good example of such setting. Both conditions are nicely met in the case of property insurance (MacMinn and Garven, 2000). First, insurance enables firms to secure post-loss financing (claims payments) at an ex-ante predetermined cost (i.e., insurance premium), thereby avoiding the need to rely on external financing that can be very costly or impossible following a major accidental asset loss. Second, a major accidental asset loss invariably interrupts a firm's normal

[9] As we discuss later (on p.9), Tufano (1998) extends the work of Froot et al. (1993) and show that once owner-manager agency problems are introduced, there may be agency cost of risk management and corporate hedging may not be necessarily value-adding for shareholders.

business operation, and the reinvestment in the damaged properties often represents a positive-net-present-value (NPV) project. Doherty (1997) further argues that since insurance claim payments provide funds for the reinvestment of damaged assets, internal funds can be freed up for taking up other valuable investment opportunities (if any). Therefore, corporate insurance can provide cash flow hedging and mitigate the underinvestment problem in the manner predicted by Froot et al. (1993).[10]

Third, property insurance can directly facilitate corporate borrowing. Property insurance (on the assets serving as collateral) lowers the credit risk faced by banks and other corporate lenders (particularly in a nascent market like China where a good credit system is absent).[11] Mayers and Smith (1982) and MacMinn (1987), among others, show that the presence of property insurance in debt covenants allows debtholders' payoffs to become relatively independent of project selection and so limits the ability of the borrowing firm to shift business risk onto debtholders. As a result, insurance can help mitigate the borrower's assets substitution incentives and thereby lower the lender's risk. Zou and Adams (2008) tests the simultaneous

[10] Mayers and Smith (1987) analyze a more specific underinvestment problem – i.e., following a major accidental loss, the firm and its shareholders may be reluctant to reinvest into damaged assets to prevent debtholders from capturing most of the gains from such reinvestment. They show that a property insurance contract can mitigate such an underinvestment problem. As in China the state as a major shareholder of many firms is unlikely to step away even after a major accidental loss, this type of underinvestment problem is likely to be of the second order.

[11] Zou and Adams (2008) also argue that the presence of large blocks of state ownership may induce moral hazards among state-owned borrowers (e.g., in terms of the reluctance for managers to commit to loan repayment schedules given the low chance of legally enforced liquidation for SOEs). As a result, state-owned banks face even higher credit risks than their counterparts in the West and they therefore have enhanced incentives to take ex-ante measures to control for ex-post credit risks after the drastic market-based banking reform in the 1990s (see Zou and Adams (2008) for a review of the banking reform in China). While the bank may require insurance as a condition of the loan, the level of insurance is invariably negotiable between the bank and the borrowing firm. The firm may trade off the costs of insurance premiums against savings in interest rate and other conditions of the debt contract (e.g., flexibility). In other words, both the level of insurance and the decision to accept a particular bank's loan terms reside with the firm's manager and thus a choice variable of the firm. This possibility is reinforced by market competition for creditworthy clients among banks in China. Indeed, publicly listed companies typically represent better-than-average firms in China and so may have bargaining power in loan decisions.

linkages between debt capacity, cost of debt and corporate property insurance in China. They find that a higher cost of debt appears to motivate the use of more property insurance, and the extent of property insurance helps expand the insured firms' debt capacity and marginally lower their borrowing costs. This is important given that Chinese firms generally rely on indirect debt financing (e.g., bank loans) to provide fund for investment because equity financing and the issuance of bonds are tightly controlled by the government. Therefore, property insurance may help a firm secure debt financing for investment in China. Our (later) empirical results suggest that insurance helps increase new debt financing and capital investment. A related benefit is that the expanded debt capacity may afford the borrowing firm a larger interest tax shield (Leland, 1998; Graham and Rogers, 2002). Moreover, a borrowing firm can further benefit from insurance if the lender agrees to charge it a lower interest rate. Zou and Adams (2008) find moderate evidence on this.[12]

However, several authors (e.g., Tufano, 1996; Jin and Jorion, 2006) note that corporate risk management activities may be motivated by the objective of maximizing managers' utility function, particularly when they have non-diversified financial and human capital that is tied to the firm's wealth. If so, corporate insurance may not be value-increasing for shareholders. This is plausible in China where managers often

[12] We note that property insurance may benefit firms (particularly small firms with limited risk management expertise) through insurers' "free" and "quality-bonded" safety inspections and loss control service. In addition, the purchase of property insurance may facilitate the adoption of managerial incentive compensation schemes by helping filter out the adverse influence of incidental property/liability risks (that are normally beyond the control of managers) on firm performance. As a result, not only managers' risk-bearing can be lowered, but also the observability of their efforts and productivity can be improved (DeMarzo and Duffie, 1991; Han, 1996; Meulbroek, 2001; Guay and Kothari, 2003). The level of managerial ownership in China is generally low (on average below 1% of the total number of shares outstanding) and stock options are still at the experiment stage; however, cash bonus schemes are common. Our above analysis suggests that the effect of corporate insurance on firm value could be larger for firms adopting incentive-based compensation schemes (e.g., a cash bonus scheme), other things being equal. However, this possibility is not tested because data on the use of cash bonus scheme are not available from public sources in China.

have non-diversified personal portfolios because they mainly derive income and other benefits from the company employing them; the lack of a developed managerial labor market also reduces company managers' mobility (Sun and Tong, 2003).

In addition, Tufano (1998) extends the work of Froot et al. (1993) to a setting when the owner-manager agency costs are introduced. He argues that while external financing is costly, it provides valuable monitoring and discipline on the investment decisions made by managers. Corporate risk management may help entrenched managers secure funding for their negative-NPV "pet" projects (from which they can derive private benefits) and by-pass the scrutiny of external monitors (e.g., corporate lenders). In other words, there may be agency cost of risk management and corporate hedging may not be necessarily value-adding for shareholders. Zou and Adams (2008) also argue that SOE managers who are often politically connected could have incentives to insure company assets because an uninsured major loss may be counted as functional incompetence and/or a neglect of duty, which will have an adverse effect on their (political) career prospects. Whether the benefits of property insurance use outweigh the associated costs and its effect on firm value is investigated in the paper.

3. Empirical Analysis: Property Insurance Use and Firm Value

3.1. Data

Corporate disclosure rules in China require listed firms to itemize major financial statement items in the notes to financial statements in annual reports and some firms voluntarily report insurance expenditure under "amortized expense items". A sample disclosure is given in Appendix 1. This means that investors can readily identify and

assess the information regarding insurance purchases if a firm has insurance and discloses the purchase in annual reports.

In common with prior studies (Hoyt and Khang, 2000; Allayannis and Weston, 2001; Zou and Adams, 2006; Regan and Hur, 2007), we first impose the following selecting criteria in constructing the sample:

a) A firm should not be in the financial services sector (i.e., banks, insurance and securities companies) because they account and report under different rules and tend to have a distinct capital structure.

b) A firm should not have experienced material reorganizations in the sample period. Company reorganizations in China typically involve asset swaps, debt transfer and/or divestitures among associated companies. Such activities can dramatically change a firm's asset base, capital structure and often lead to industry changes, thereby causing incomparability and rendering empirical results meaningless.[13]

We manually checked the annual reports of firms meeting the above criteria a) and b) from 1997 through 2003, which represents the longest period for which full-text annual reports of Chinese listed firms were available at the time the study was carried out, and identified 2,016 firms/years reporting property insurance expenditure. 215 firms/years having zero-insurance are further identified by a supplementary simple telephone and email survey of all firms that did not disclose property insurance use in annual reports but meeting criteria a) and b) discussed

[13] The materiality of asset reorganization is determined by applying the official criteria laid down by the China Securities Regulatory Commission (CSRC) – i.e., more than 30 percent change in the value of tangible assets.

above for the sample period.[14] These 2,231 firms/years constitute the basis of our empirical analysis.

Company-specific share price data are extracted from *DataStream* and accounting information other than insurance spending and capitalized interest (that are hand collected) is obtained from *CSMAR* (developed by Shenzhen GTA Ltd.) and *WIND database* (developed by Shanghai Wind Ltd).

3.2. Models and Variables

3.2.1. Models

Prior studies on derivatives hedging (e.g., Allayannis and Weston, 2001; Lin et al., 2007) typically examine the effect of the incidence of hedging on firm value.[15] In contrast, our examination focuses on the impact of the extent of property insurance use on firm value for three reasons. First, the extent of property insurance provides richer information than a yes/no variable on insurance use. Second, unlike derivatives trading that involves significant set-up and running costs, the purchase of property insurance per se is easy so that it normally does not involve significant administration cost at least for a single contract (Mayers and Smith, 1990). Therefore, while the incidence of derivatives trading provides a reasonable proxy for a firm's hedging activities via derivatives, the incidence of insurance unlikely matters much for firm value. Third, the proportion of sample firms/years carrying no property insurance is less than 10% in our sample. As a result, we cannot provide a powerful test of the

[14] The survey asked the secretary of the board of director or his/her designated representative responsible for information disclosures whether or not the firm purchased property insurance in a sample year. The main purpose of the survey was to identify a sample of firms/years without property insurance; besides, considering that various political, social and cultural constraints in China make field-based data collection difficult via phone and email, the survey only asked whether property insurance was purchased in a year.

[15] Carter et al. (2006) use both a dummy and continuous measure of hedging and find only the continuous one exhibits a positive and significant relation with firm value.

effect of the incidence of insurance on firm value. To test the effect of property insurance use on firm value, we adopt the following model:

$$\text{Firm Value}_{it} = f\{\text{INS, Control Variables of Firm Value}\} + \alpha_i + \beta_t + \varepsilon_{it} \quad (1)$$

INS is a firm's (amortized) annual spending on property insurance scaled by the prior year-end book value of tangible assets (e.g., fixed assets and inventory). While our measurement of INS is consistent with prior studies (e.g., Hoyt and Khang, 2000; Regan and Hur, 2007; Zou and Adams, 2008), we note that it does not directly reflect the extent of asset coverage. Because insurance premiums may be affected by other factors (e.g., deductibles, the risk profile of the assets concerned), INS is a noisy measure of the proportion of assets covered by insurance (Aunon-Nerin and Ehling, 2008).[16] This, however, represents an unavoidable limitation of our data. α_i are firm-specific dummies used to control for omitted firm-specific factors that are likely to affect a firm's market value. β_t are used to capture time-related market- and economy-wide factors common to all sample firms. ε_{it} is the error term.

We use market value measures instead of accounting performance measures because market measures are forward-looking and have the potential to capture all sources of risk and return information relevant to the firm. If corporate insurance can help lower a firm's various sorts of costs, its benefit should be ultimately reflected in forward-looking market value measures (Mayers and Smith, 1990). In contrast, accounting performance measures (e.g., return on equity) are ex-post indicators of firm value and they are also subject to frequent manipulation in China (Chen and Yuan, 2004).

[16] We thank an anonymous reviewer for suggesting this point.

As data on replacement value of assets are not available in China, Tobin's Q is computed in the manner of Chung and Pruitt (1994). When debt is not traded, its book value is used. When a firm has multiple classes of tradable shares, the market value of each share class is computed using the total number of shares outstanding in that class multiplied by the corresponding year-end share price. Shares held by the government and legal persons in China (that account for about two-thirds of total shares in issue) are not publicly tradable in our sample period. We compute the market value of non-publicly-tradable shares in two ways. First, we use the price of tradable A-shares as the price of these non-publicly-tradable shares. A similar approach is followed in Sun and Tong (2003) and Villalonga and Raphael (2006). This approach, however, may overstate the value of non-publicly-tradable shares (Villalonga and Raphael, 2006). To address this problem, we follow Zou et al. (2003) and compute the market value of non-publicly-tradable shares as the number of such shares multiplied by net assets per share. The rationale is that in China, such non-publicly-tradable shares in practice are often transferred at net assets per share in private negotiated purchases (Chen et al., 2008).

One notable difficulty in analyzing the relation between hedging (property insurance in our case) and firm value is the potential endogeneity of hedging with respect to firm value. We address the potential endogeneity issue in several ways. First, endogeneity may arise from omitted variables (e.g., industry effects) that affect both firm value and corporate insurance, we therefore adopt a panel data estimation of Equation (1) by introducing firm-specific dummies (see Campa and Kedia, 2002). Second, following Daines (2001), Chen et al. (2008), and Coles, Daniel and Naveen

(2007), we also industry adjust Tobin's Q to remove the industry effect. Specifically, we adjust Tobin's Q by subtracting the respective industry median from a firm's raw Q in the same year. Industry medians are calculated on the basis of the two-digit primary industry code prescribed by the 2001 CSRC industry classification.[17]

If Tobin's Q also proxies for firms' growth opportunities, Q may in turn affect corporate purchase of insurance and so the coefficient estimate of INS is biased. To mitigate this possibility, we control for firms' growth opportunities in the model (see Section 3.2.2.). We also explicitly use an instrumental-variable approach to address the endogeneity of insurance purchase.

3.2.2. Control Variables of Firm Value

Following prior studies (e.g., Allayannis and Weston, 2001; Sun and Tong, 2003), we control for several factors that may affect firm value.

Firm size: Firm size may have a negative impact on firm value because large firms are expected to suffer from more acute agency problems since information asymmetry and incentive conflicts between contracting constituents tend to increase as firms become bigger (Sun and Tong, 2003). Chen et al. (2008) also note that in China large firms may attract more bureaucratic intervention and hence could be less efficient than small firms. On the other hand, large firms in China may obtain more government support and have better access to financing. Therefore, we do not provide an ex-ante prediction on the effect of firm size. Firm size is measured by the natural logarithm of the book value of total assets.

[17] We do not make industry adjustment using a pure-play firm's Q (as in Allayannis and Weston, 2001) because segmental reporting is inadequate in China. The 2001 CSRC industry classification is modeled on the SIC code in the U.S.

Leverage: Leverage may affect firm value through interest costs, providing tax shields, and magnifying business operating risk. Depending on the operating situation of the firm, leverage may make firm performance better or worse. In addition, debtholders may help monitor managerial inertia, thereby improving firm value. Leverage is measured by the book value of long- and short-term debt ÷ total assets.

Growth opportunities: Stocks of firms with more growth opportunities are more likely to receive a higher valuation than the stocks of firms with fewer growth opportunities. Controlling for the effect of growth opportunities is also necessary as firms with more growth opportunities are more likely to purchase insurance in order to secure funding for investment and lower the chance of financial distress. As in Graham and Rogers (2002) and Jin and Jorion (2006), we measure growth opportunities as the ratio of capital expenditures to total assets.

State ownership: listed firms in China typically have a high level of state ownership due to the government's piecemeal privatization strategy. In China, lackluster financial performance of many state-owned firms is often reported to be due to the severe owner-manager agency conflicts (e.g., Sun and Tong, 2003) and/or the incompetent management by politically connected managers and directors (Fan, Wong and Zhang, 2007). We expect the proportion of state ownership to have a negative impact on firm value.

Profitability: Firm profitability is expected to have a positive impact on the valuation of the firm. Chen and Yuan (2004) report that earnings management via one-time items (e.g., investment income) is prevalent among Chinese listed firms. As

a result, the market is likely to attach more importance to a firm's profitability of core operating activities in valuation. We therefore include the operating profit to assets ratio as a control variable.

Access to financial markets: When a firm faces financial constraints, its managers may have added incentives to carefully undertake positive-NPV projects and thereby may end up with a high firm value. As in Allayannis and Weston (2001), we proxy access to financial markets by a dividend dummy that equals 1 if a firm paid a dividend in a year (implying that the firm has no financial constraints). The dividend dummy is expected to be negatively related to firm value.

Industry diversification: A large body of the literature suggests that diversified firms receive a discount in valuation (e.g., see Lang and Stulz, 1994). However, some recent studies (e.g., Campa and Kedia, 2002) accounting for the potential sample selection bias and endogeneity issues in firm diversification find a much smaller or insignificant discount. Nevertheless, we include a diversification indicator variable that equals 1 for firms engaging in more than one industry as a further control and expect it to be negatively related to firm value.

4. Results

4.1. Sample Characteristics and Correlation Analysis

Table 1 provides the descriptive statistics of the variables used. The proportion of sample firms/years carrying no property insurance is less than 10% of the total number of observations, indicating that property insurance use is common among Chinese listed firms. The median of the property insurance spending to tangible assets

ratio is about 0.1%. When we calculate the mean of the insurance spending to sales ratio, it is 0.22% and about half of the reported 0.4% in U.S. and Canadian firms (surveyed in 1999) (MacMinn and Garven, 2000). Therefore, while in China corporate purchase of property insurance is common, the level of spending is only moderate compared to Western firms. In order to gain a rough idea of the economic significance of such insurance spending, we divide the median insurance intensity by 0.3% to derive the approximate percentage of sum insured relative to beginning-of-period tangible assets and the proportion covered is about 33% - an economically significant figure.[18]

In terms of ownership, the average shareholdings of the state and incumbent managers are 31% and 0.07%, respectively – similar to the figures reported in the prior studies (e.g., Zou and Adams, 2006). The mean value of the natural logarithm of total assets is 12.56 for our sample of firms.

The descriptive statistics also suggest that raw Qs tend to be skewed to the right because of the presence of some large values of Q. Following Allayannis and Weston (2001) and Jin and Jorion (2006), we use the natural logarithm of Q (i.e., LnQ) in subsequent analyses when raw Q (i.e., non-industry-adjusted) is used.

[Insert Table 1 about here]

Table 2 presents the Pearson correlation coefficients between Qs, property insurance, and other covariates. According to the results from the columns under Qs, there seems to be a positive and significant correlation between the extent of

[18] Property insurance premium rates vary according to the nature of the business and the region in which a firm is located. 0.3% is roughly the mean of the premium rates charged by PICC (a major insurance provider in China) on an average industrial business during the sample period.

insurance use (INS) and Qs. As these simple correlation coefficients could be spurious, we do not place emphasis on them. Also note that different versions of Qs are reasonably correlated. A look at the correlation coefficients between explanatory variables (not tabulated for brevity) and the variance inflation factors of each variable in the regression models reported later reveals no evidence of multicollinearity.

[Insert Table 2 about here]

4.2. Multivariate Results

4.2.1 Results from the Baseline Regression

To isolate the effect of the extent of insurance use (INS) on firm value, we run regression models where Qs are used as dependent variables. We use a random-effects panel estimation because some variables (e.g., state ownership, dividend and diversification indicator) tend to have limited within-firm variations and so a fixed-effects estimation that removes within-group variations can pose estimation problems (Zhou, 2001).[19] Furthermore, Petersen (2008) shows that when residuals are correlated, a random-effects model estimated by generalized least squares (GLS) produces more efficient estimates than OLS estimates (even if the OLS model includes firm dummies). We also use standard errors clustered at the firm level that are robust to both cross-sectional heteroskedasticity and within-firm serial correlation in computing *p*-values in all the regression models. The baseline regression results are reported in Table 3.

[Insert Table 3 about here]

[19] However, in unreported tests, our result on the effect of extent of insurance use on firm value is robust to a fixed-effects estimation, but we find the results on the variables that may have limited within-firm variations tend to differ between the fixed-effects and random-effects estimation.

As shown in Table 3, the coefficient estimate for INS is positive and statistically significant at the 0.01 level (two-tailed) in all the four models, suggesting that a higher level of property insurance use is associated with a higher firm valuation. Note when industry-adjusted Qs are used as the dependent variable, we also industry-adjust the continuous explanatory variables (including INS).

Among the control variables, as expected, state ownership is found to be negatively related to Qs, consistent with the inefficiencies of SOEs. The same is also reported in Sun and Tong (2003). The negative and statistically significant coefficient estimate for the dividend payout indicator is consistent with the notion that firms facing financial constraints may carefully invest in positive NPV-projects, thereby ending up with a high firm value. Moreover, the negatively significant coefficient estimate of leverage suggests that firms with high leverage appear to have a lower valuation than other firms. There is also evidence that the operating profit to assets ratio is positively related to firm value, but the result is not robust to different versions of Q.

4.2.2. Non-linearity of the Insurance-Firm Value Relation

As discussed, our measure of the extent of insurance use is based on insurance premiums rather than on the proportion of assets covered. Since firms may obtain the same amount of coverage by choosing different levels of deductibles and paying different insurance premiums (other things being equal), the existence of deductibles might introduce non-linearity into our measure of insurance use (based on insurance

premiums) and firm value.[20] Modeling the non-linearity in the relationship between insurance use and firm value is also necessary given that property insurance contract is, in nature, an indemnity contract. In other words, any ex-post claim payments will be capped at the minimum of actual loss and the sum insured even if an asset is over-insured. Therefore, over-insurance and repeat insurance of an asset would incur an extra cost but bring about no benefit to a company. This reasoning thus suggests that the relation between the extent of insurance use and firm value is likely to be inverted U-shape. To test for this possibility, we include the square term of INS into the model, and the results are reported in Table 4. When INS is industry-adjusted in models using industry-adjusted Qs, INS^2 is computed using industry-adjusted INS.

[Insert Table 4 about here]

Table 4 shows that the coefficient estimate of INS^2 is negative and statistically significant at the 0.05 level or better (two-tailed) in all the models. On the other hand, the coefficient of INS is still positive and statistically significant. Therefore, there is an inverted-U shape relation between the extent of insurance use and firm value. The inflection point occurs when INS takes 2.25~3.03% depending on how Q is measured. This result, to our knowledge, is the first evidence on the non-linear effect of insurance use on firm value. Given that inflection occurs above the 99th percentile of the observed insurance spending, insurance use appears beneficial to the majority of our sample firms.

Since prior studies on derivatives hedging typically estimate a hedging premium, we also estimate one for comparison. Since not all shares in China are publicly listed, we focus on the regression coefficient of INS in Model 2 (that uses LnQ1) for a direct

[20] We thank an anonymous referee for suggesting this.

comparison with the 5% hedging premium for industrial firms reported in Allayannis and Weston (2001) and 7%-10% for U.S. airlines reported in Carter et al. (2006). Using the mean extent of insurance use for firms/years with non-zero insurance (0.180), the estimated hedging premium in our sample is 1.49% (-0.014×0.180×0.180+0.085×0.18), which is considerably lower than the derivative hedging premium reported by prior studies.[21] To our knowledge, this is the first report of insurance hedging premium in the literature.

4.2.3.Robustness Check: Results from the Instrumented Variable Estimation

As discussed earlier, if Tobin's Q also proxies for growth opportunities, Q may in turn affect the use of insurance since growth firms are expected to be more likely to engage in risk management to mitigate the underinvestment problem (though our inclusion of capital expenditure-to-assets ratio should mitigate such a possibility). In this section, we adopt an instrument variable approach as a robustness check on the results from the baseline regressions.

4.2.3.1. Instrument variables for insurance

Specifically, INS is instrumented by Equation (2) first, its fitted value is then incorporated as an explanatory variable into Equation (1).

$$INS_{it} = f\{\text{Instrument Variables, Control Variables}\} + \alpha_i + \beta_t + \varphi_{it} \qquad (2)$$

Where, α_i are firm-specific dummies used to control for omitted firm-specific factors that are likely to affect a firm's use of insurance. β_t are used to capture time-related market- and economy-wide factors common to all sample firms. φ_{it} is the

[21] If using the regression coefficients from Model 1 that uses LnQ0, the hedging premium is about 3.5%.

error term. We use four instrument candidates that are of varying strength for corporate insurance - namely, a dummy for whether a firm belongs to an industry that faces inherently high accidental risks, a dummy for the existence of accidental loss in prior year, a firm's average interest cost of borrowing, and (lagged) fiscal subsidy to sales ratio. [22]

First, businesses including the manufacturing of chemicals, plastics and rubber, oil and gas extraction/refining, coal mining and metallurgical engineering are prone to accidental losses (hereafter termed as "high property risk firms"). Therefore, a dummy that equals 1 for firms operating in these high property risk industries serves a natural instrument for the purchase of insurance and there is no a priori relation between this dummy and firm value.

Second, the purchase of property insurance may be closely related to managers' perception of the chance of accidental events (e.g., fire, work-related accidents). When there was an accidental loss in prior year, managers are more likely to purchase property insurance to protect the firm against future accidental losses (Regan and Hur, 2007). We search annual reports for the occurrence of accidental losses in prior year and include a dummy (1 denoting there was a prior accidental loss) as an instrument. The dummy variable does not capture the level of a firm's future expected cash flows and therefore it is not expected to relate to Tobin's Q.

Zou and Adams (2008) show that firms with a higher cost of borrowing tend to use more property insurance to facilitate borrowing in China, however, as a priori,

[22] Using the four instrument candidates for INS, we run Durbin-Wu-Hausman tests and the results suggest that INS can be regarded as exogenous only when adjusted Q1 is used; in contrast, the results from Schaffer-Stillman C-tests suggest that the endogenity of INS is a problem when LnQ0 and adjusted Q0 are used.

there is no direct evidence suggesting that the cost of debt is systematically related to firm value. For example, firms with a higher cost of borrowing may be poorly-performing firms and may have a lower valuation than other firms. Alternatively, because such firms face financial constraints, managers are more likely to only take on positive-NPV projects and end up with a high valuation. As in Zou and Adams (2008), we measure average borrowing cost as (interest expense charged to the income statement + capitalized interests) ÷ book value of total debt.[23] Therefore, we use a firm's average interest cost of borrowing as a third instrument.

The last instrument candidate is the (lagged) fiscal subsidy to sales ratio. In China, state-owned firms may sometimes obtain subsidy from the government in the form of tax rebates and/or direct fiscal assistance. Zou and Adams (2008) find that fiscal subsidies may induce "charity hazard" and so discourage SOE managers from insuring asset-loss risks. Forward-looking Tobin's Q is not expected to correlate with the fiscal subsidy in prior year. Lagged fiscal subsidy is defined as total annual subsidy received from government agencies in prior year scaled by sales income in prior year. We also include other predetermined variables (e.g., diversification indicator) that appear in the firm value regression models as additional instruments of insurance.

4.2.3.2. Control variables for insurance

Following the risk management literature (e.g., Mayers and Smith, 1982; Graham and Rogers, 2002; Zou and Adams, 2006; 2008), we also control for firm size (measured as the natural logarithm of book value of assets), lagged leverage, tangible

[23] Ideally, we should use the lagged cost of borrowing, but this will result in many missing values.

assets to assets ratio, growth opportunities, managerial ownership (measured as the natural logarithm of (1 + market value of managerial shares)), the proportion of state ownership, and lagged quick ratio (computed as (current assets ─ inventory) ÷ current liabilities).

Firms that are small and those that have higher leverage, more tangible assets, or more growth opportunities are expected to have a higher demand for insurance than other firms. To control for the possibility that the relation between leverage and property insurance is conditional on a firm's tangible assets, we interact leverage and tangible asset intensity. We "center" both variables by subtracting their mean from the original variable before constructing the interaction term in order to avoid muliticollinearity between the interaction term and the component variables (see Jaccard, Turrisi and Wan, 1990).

The effect of state ownership on insurance demand is ambiguous. On the one hand, state ownership may discourage the purchase of property insurance because SOEs may have a "deeper pocket" or they have more acute owner-manager agency problems that arise from the vague ownership than other firms (Zou et al., 2003). On the other hand, politically connected SOE managers could be motivated to insure company assets to avoid being blamed for a neglect of duty (Zou and Adams, 2008).

We also control for the effect of corporate governance in examining the hedging-firm value relation because hedging decisions can be induced by agency incentives of managers and may reflect the choice of good corporate governance (Allayannis et al., 2003; Lookman, 2005). Our existing ownership variables (state and managerial ownership) have partially captured the effect of corporate governance. We

include two additional governance variables – a dummy variable for firms issuing H-shares or B-shares and a dummy variable denoting CEO-board Chairman duality. H-shares are listed in overseas bourses and B-shares are intended primarily for foreign investors to trade in domestic markets. Since both H- and B-share firms need to be audited by international auditors in accordance with the international accounting standards and H-share firms also need to comply with the listing rules and governance standards in overseas bourses, these firms tend to have more developed systems of corporate governance than other firms (Bai, Liu, Lu, Song and Zhang, 2004). On the one hand, good corporate governance may encourage corporate risk management activities; on the other hand, it may better monitor the hedging activities that are pursued primarily for managers' self interest (Tufano, 1998). We therefore do not provide an ex-ante prediction on the effects of these governance variables.

4.2.3.3. Results from the first-stage Tobit regression

Equation (2) is estimated using a random-effects Tobit regression to reflect the existence of zero-insurance observations and the panel data nature. Except for the industry dummies of particular interest (e.g., the high property risk firm dummy), the results on other industry and year dummies are not tabulated for brevity.[24]

The results reported in Panel A of Table 5 show that firms' extent of property insurance use is positively related to the high property risk firm dummy, average interest cost of borrowing and state ownership, but negatively related to the fiscal subsidy to sales ratio, firm size, and tangible asset intensity. As in Zou and Adams

[24] Since there are missing values in CEO-Chairman duality dummy in some observations, we recoded the missing value to zero and include a missing value indicator in the model so that we do not lose those observations with missing values.

(2008), the negative and statistically significant coefficient of the tangible assets to assets ratio suggests that firms with more tangible assets do not insure assets proportionately. It is plausible that the marginal benefit of increasing property insurance may be declining once a certain level of coverage is obtained. In addition, as in Zou and Adams (2006), we find that the coefficient estimate of market value of managerial ownership is positive and moderately significant, suggesting managerial risk aversion has an impact on corporate insurance decisions. Finally, the coefficient of the diversification indicator is negative and statistically significant, implying that diversified firms tend to purchase less insurance than focused firms, other things being equal.

Note that three instruments of INS (i.e., the high property risk firm dummy, average interest cost of borrowing and the fiscal subsidy to sales ratio) have a statistically significant coefficient estimate as predicted. A Wald test of their joint significance generated a Chi-square statistic of 29.07 (d.f. = 4), which is statistically significant at the 0.01 level and thereby confirms the validity of these instruments. We also report the summary statistics of the fitted extent of insurance use (INS*) in Table 1 for a comparison, and find INS and INS* have a correlation of 0.49 (note to Table 2).

[Insert Table 5 about here]

4.2.3.4. The Impact of (Fitted) Property Insurance Use on Firm Value

Table 5 Panel B reports the second-stage regression of firm value on the fitted extent of insurance use (INS*). The results on INS* and other factors affecting firm value are quite similar to those reported in Table 3. For the new governance variables

entering the firm value regression, there is some evidence that firms with managers rewarded by a higher market value of company stocks and firms combining the CEO and Board Chairman positions exhibit a lower valuation than other firms. Therefore, the low level of managerial ownership in China does not seem to provide incentives for managers to maximize firm value. The coefficient estimate of the H-share or B-share firm dummy is negative and significant in three out of the four models, which could be due to the fact that H-share and B-share markets tend to have a lower average price-to-earnings ratio.

We also include the square term of INS* in the model to examine any non-linearity in the effect of INS* and the results are reported in Table 6. The coefficient estimate for INS* is always positive and significant and the coefficient estimate of the square term is negative in all the four models (though insignificant when fitted INS* is also industry-adjusted in Columns (3) and (4)). However, if we do not industry adjust fitted INS* in Columns (3) and (4), the estimated coefficient of $(INS^*)^2$ is -4.186 and -1.162, respectively, both significant at the 0.01 level (two-tailed).[25] The linear term INS* has a coefficient of 6.053 and 1.825 in Columns (3) and (4), respectively – both significant at the 0.01 level (two-tailed). Therefore, the inflection point occurs when INS* takes a value of 0.72~0.79%, depending on the model specification. Since the fitted INS* roughly ranges from 0~1%, the inflection occurs at a high level of insurance. Overall, our key results are quite robust and do not seem to be severely affected by the endogeneity problem of insurance with respect to

[25] Gompers, Ishii and Metrick (2003) does not industry adjust independent variables when the dependent variable is industry adjusted; in contrast, Daines (2001) and Coles et al. (2007) do.

Tobin's Q. As such, the following analyses are based on the original extent of insurance use (INS).

[Insert Table 6 about here]

5. Value Increasing Avenues of Insurance

Previously we find that property insurance use tends to increase firm value (before its effect inflects at a very high level of insurance). This section aims to identify some channels through which insurance adds value. Since debt financing plays a pivotal role in enabling firms to take up good investment projects and realize growth opportunities in China, we examine the effect of insurance on firm value via its effect on corporate financing and investment.[26]

5.1. The Effect of Insurance on New Debt Financing

One potential benefit of property insurance is that it facilitates firms' access to new debt financing. While Zou and Adams's (2008) finding that a greater extent of insurance use leads to a higher total debt ratio is consistent with the conjecture, we provide direct evidence using data on new debt financing. Specifically, we regress the new debt financing in year t+1 on INS in year t, controlling for other factors. We calculate new debt financing in year t+1 as (total liabilities in year t+1 minus total

[26] In order to examine the potential interaction between insurance, debt financing and investment and their joint effects on firm value, we follow Carter et al. (2006) and experiment several model specifications with interaction terms: (1) adding the interaction term between INS in year t and new debt financing in year t to the models in Table 3; (2) adding the interaction term between INS in year t and capital expenditure ratio to total assets ratio in year t to the models in Table 3; and (3) adding both interaction terms in (1) and (2) to the models in Table 3. In unreported results, the coefficients of these interaction terms are never statistically significant and INS still has a positive and significant effect on firm value. These results suggest that the effect of insurance on corporate financing and/or investment may not be instantaneous. This time difference may be because that in many cases firms voluntarily insure its assets first as a bonding mechanism and then seek bank loan. The time difference may also reflect the time needed by the bank to make the loan decision. We thank an anonymous referee for suggesting these interaction terms.

liabilities in year t)/total assets in year t. Graham (1996a) argues that this measure of new financing is better than the first difference in debt ratio, as when there is no change in total liabilities but there is a change in total assets, our measure of new debt financing still correctly measures the zero change (while the first difference in debt ratio does not). The results are reported in Table 7.

In Column (1), we control for proxies for the risk of financial distress (firm size, quick ratio, and total leverage in year t), a measure of a firm's marginal tax rate defined in the manner of Graham (1996b), tangible asset intensity, growth opportunities, non-interest tax shield (i.e., SG&A expense ratio), profitability of main business, and state ownership. As the results show, the coefficient of INS is positive and statistically significant at the 0.05 level (one-tailed), supporting the notion that the existence of insurance in year t helps a firm obtain new debt financing in year t+1.

Among the control variables, we find that firms with a higher "before-planning" marginal tax rate in year t tend to use more debt in year t+1, a result supporting the tax effects of interest payments and it is also consistent with the results of Graham (1996b). The negative and statistically significant coefficient of leverage suggests that a high-leverage firm has a limited capacity to further increase its debt ratio. Neither the static trade-off model of capital structure nor the pecking order hypothesis is fully supported by the results on other control variables. For example, we find that firms with more growth opportunities and less tangible assets appear to use more debt financing in the following year (results *prima facie* consistent with the POH) and more profitable firms are able to further increase its debt financing (a result ostensibly

corroborating the static trade-off model). An alternative explanation of the negative relation between tangible asset intensity and new debt financing is that high tangible asset intensity has already been associated with high leverage ratio in China and so the further room to lever up is limited.

In Column (2), we estimate a model in changes. Note that the dependent variable is an incremental concept and so is our independent variable INS, given that a property insurance contract is typically valid for one year and so must be renewed each year. More importantly, it is the *level* of property insurance that matters in debt financing decisions rather than the change in property insurance. Following Graham (1996a), marginal tax rate is also measured in levels. We omit leverage from Model 2 and measure all other variables in changes. Now the sample size is reduced to 2,131 observations because of missing values in changes. The newly obtained results on the effect of insurance and marginal tax rate are similar to those from Model 1. In addition, firms with increasing capital expenditure over the year before appear to use more new debt financing and firms with improving quick ratio use more new debt financing.

[Insert Table 7 about here]

In order to test whether firms facing a higher marginal tax rate purchase more insurance to expand debt capacity, we follow Graham and Rogers (2002) and include an interaction term INS×MTR in Column 1 of Table 7. We find the coefficient of the interaction term positive but insignificant in unreported result, suggesting our "insurance increases debt" result is not due to incentive to save tax via interest

payments. In contrast, Graham and Rogers (2002) find that tax incentives are behind their "(derivatives) hedging causes debt" result.

Nevertheless, to better understand the tax benefit associated with enhanced debt capacity, we estimate the potential tax savings in Table 8. Following Graham and Rogers (2002), the portion of debt ratio change is computed using the regression coefficient of INS in Column 1 of Table 7 multiplied by a firm's extent of insurance (INS). Column 2 is computed by multiplying figures in Column 1 by the book value of total assets in year t and marginal tax rate. Note this estimate of tax saving is a simple upper-bound estimate of tax benefit as it assumes that the incremental new debt is perpetual and it does not consider the increased cost of financial distress. Column 3 is derived by dividing Column 2 by the firm's market value that is used in calculating Q1. Table 8 shows that the annual mean tax saving associated with expanded debt capacity is about 2.21 million yuan, representing only 0.09% of firm value. This confirms that direct tax saving associated with more debt financing is a minor part (about 6%) of increase in firm value caused by insurance (the calculated hedging premium using LnQ1 is about 1.49%).

[Insert Table 8 about here]

5.2. The Effect of Insurance on Capital Expenditure in Year t+1

Property insurance may affect corporate investment through the mitigation of the underinvestment problem and providing more funds for investment via an expanded debt capacity in China. This section examines the effect of insurance use in year t on capital expenditure in year t+1. Following Carter et al. (2006) and Nini, Smith and

Sufi (2009), we control for the effects of cash flow to sales ratio and lagged Tobin's Q. The results are reported in Table 9. Columns 1-4 of Table 9 show that the extent of insurance in year t increases the capital expenditure in year t+1. In Columns 5-8, we add new debt financing in year t+1 to control for the effect of expanded debt capacity on investment, the coefficients of insurance in year t are still positive and significant. This suggests that the effect of property insurance use on investment goes beyond the effect of more funds available for investment as a result of expanded debt capacity in China. This result is consistent with the underinvestment problem mitigation argument of insurance; alternatively, given the coverage of insurance, firms can free up more funds for investment that would otherwise be held for contingent use (see Doherty, 1997).

[Insert Table 9 about here]

5.3 The Effect of New Financing and Capital Expenditure on Firm Value

We have shown that insurance helps increase new debt use and capital expenditure in year t+1. This section examines whether the increased new debt use and capital expenditure in year t+1 is associated with a higher firm value at the end of year t. If the market can reasonably anticipate the new debt financing that a firm is likely to obtain in the next year based on its insurance policy, growth opportunities, and current capital structure, the effect of new debt financing and associated new investment may be incorporated into the current firm valuation.

Table 10 shows that new debt financing and capital expenditure in year t+1 tend to be positively associated with Tobin's Qs in year t, suggesting their effects have

been priced in. This result also highlights the importance of new debt financing to firm value in an environment where access to alternative sources of financing (e.g., equity) is tightly regulated. In contrast, the (existing) leverage has a negative effect on Tobin's Q. Also note that our results on INS and its square term are qualitatively unaffected. This suggests that the benefit of insurance is not limited to the facilitation of a firm's new debt financing and investment. Indeed, other possible benefits of insurance include the lowered cost of financial distress, insurer's real service in loss control, improved business terms afforded by a more secure financial condition when dealing with key suppliers, mitigated managerial incentives to pass up positive-NPV safety projects by the monitoring of the insurer, etc. Therefore, we have indirectly shown that one avenue for insurance to be beneficial is that insurance facilitates new debt financing and investment that benefits the firm.

[Insert Table 10 about here]

Finally, as another robustness check, we follow Carter et al. (2006) and adopt a multi-stage sequential modeling: (1) at time 0 the insurance decision is made; (2) at time 1, new debt is used and new investment is made; (3) the firm's next insurance decision is made at time 1 and firm value of time 1 is observed. Specifically, we estimate the following models:

$$\text{New debt financing in year}_t = f(\text{insurance}_{t-1}, \text{control variables}) + \varepsilon_1 \quad (3)$$

$$\text{Capital expenditure in year}_t = f(\text{fitted new debt financing}_t, \text{control variables}) + \varepsilon_2 \quad (4)$$

$$\text{Firm value}_t = f(\text{fitted capital expenditure}_t, \text{insurance}_t, \text{control variables}) + \varepsilon_3 \quad (5)$$

The above model setup captures both the effect of insurance in year t-1 and year t on firm value in year t. The control variables for Equation (3) include the ones used in Column 1 of Table 7 (lagged by one period). The control variables for Equation (4) are cash flow to sales ratio, lagged Tobin's Q and year dummies. The above model setup reduces the number of sample observations to 1,472 (as opposed to over 2,200 observations previously) because one year of observations is lost. However, this reduced sample serves as a further robustness check of our previous results.

In unreported first-stage result, lagged INS has a coefficient of 0.051 that is statistically significant at the 0.05 level.[27] In unreported second-stage results, the coefficient of the fitted new debt financing is always positive and statistically significant at the 0.01 level. The results from the final stage models are reported in Table 11. The fitted capital expenditure-to-total assets ratio in year t exhibits a positive and significant effect on firm value in three out of the four models. This supports that insurance (in year t-1) increases debt use and enhances investment (in year t), thereby increasing firm value. In addition, insurance in year t still has a positive and significant effect on firm value. Its square term has a negative coefficient (albeit insignificant in two out of the four models). Consistent with our previous findings, the inflection points occur at a relatively high level of insurance.

6. Conclusion

[27] Using the estimated regression coefficient of lagged INS, the estimated mean increase in debt ratio is 0.94%, the mean annual tax saving attributable to more debt financing is 2.84 million yuan and this saving contributes 0.12% to firm value (in the manner of computing Q1). These figures are slightly higher than the ones reported in Table 8.

The effect of corporate risk management on firm value has attracted significant research interest in recent years, but prior studies have focused on the effects of derivatives hedging. This study represents the first step towards understanding the value effect of alternative means of hedging (property insurance). The effect of insurance is interesting because it is a commonly used pure hedge of asset-loss risks. We test the impact of the extent of property insurance on firm value using a unique insurance dataset from China where firms rely on indirect debt financing (e.g., bank loans) and property insurance plays an important role in debt financing.

We find evidence that there is an inverted U-shape effect of the extent of property insurance use on firm value measured by several versions of Tobin's Q. Therefore, the use of property insurance up to a certain extent has a positive effect on firm value, however, over-insurance appears detrimental. Given that the inflection only occurs at very high level of insurance use, insurance use appears beneficial for our most sample firms/years. We also show that one avenue for insurance to create value for shareholders in China is that it helps firms secure valuable new debt financing and enhances corporate investment. We acknowledge that our measure of the extent of insurance use (by insurance premiums) may be noisy and so the results should be interpreted with caution.

As the first study of its kind, our study represents a useful extension to the literature on the value of corporate risk management. Future studies would benefit from investigating this issue in developed economies (e.g., the U.S.) when the firm-level insurance data become available to assess the generality of our results.

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Appendix 1
Sample Disclosure of Property Insurance Use

Liaotong Chemical (stock code 000059) (2003) (all figures in RMB yuan)

Item 7 Amortized Expenses

	Balance as of Dec. 31, 2002	New addition in 2003	Amortization in 2003	Balance as of Dec. 31, 2003
Property insurance premium	3,750,920.13	8,538,909.50	*8,552,621.32*	3,737,208.31
Material cost	633,227.75	446,235.12	895,202.60	184,260.27
Vehicle rental	568,000.00	--	568,000.00	--
Reimbursed electricity bill	996,300.00	--	996,300.00	--
Others	--	22,900.00	19,628.58	3,271.42
Total	5,948,447.88	9,008,044.62	11,031,752.5	3,924,740.00

Extracted from p.28 of the 2003 Annual Report of Liaotong Chemical
The premium figure in italics is used in calculating the extent of insurance use.

Appendix 2
Variable Definitions

	Variables	Definition
1	Extent of insurance use (INS)	Annual (amortized) corporate spending on property insurance scaled by the prior year-end book value of tangible assets (e.g., fixed assets and inventory) * 100
2	Fitted extent of insurance use (INS*)	Extent of insurance use fitted by a random-effects Tobit model with instrument variables (i.e., prior accidental loss dummy, high property risk firm dummy, interest cost of borrowing and lagged fiscal subsidy to sales ratio) and other control variables
3	Prior accidental loss dummy	1 = if a firm had accidental property losses reported in prior year's annual reports and 0 for otherwise
4	High property risk firms dummy	1 = if a firm manufactures chemicals, plastics or rubber, or engages in oil and gas exploration & refining, coal mining or metallurgical engineering
5	Interest cost of borrowing	(Interest charges in income statement + interest capitalized in the current year in balance sheet) ÷ total liabilities (winsorized at the top 0.5% level)
6	Fiscal subsidy to sales ratio (lagged)	Total annual subsidies received from the government ÷sales income (measured in one-period lag)
7	Leverage (lagged)	Debt-to-assets ratio, total liabilities ÷total assets (measured in one-period lag)
8	Ln(book value of assets)	Natural logarithm of book values of total assets (in RMB 10,000)
9	Capital expenditure-to-assets ratio	Annual capital expenditure ÷ total assets
10	Ln(1+market value of managerial shares)	Natural logarithm of (1 + total number of managerial shareholdings × monthly average A-share price in the year concerned) (market value is in RMB)
11	Tangible assets to assets ratio	(Fixed assets + inventory) ÷ total assets
12	Proportion of state shareholdings	Total number of state-held shares ÷ total shares outstanding
13	Quick ratio (lagged)	(Current assets – inventory) ÷ current liabilities (measured in one-period lag and winsorized at the top 1% level)
14	Tobin's Q0	(Market value of tradable shares + tradable A-share price × number of non-tradable state and legal-person shares + market value of debt) ÷ book value of total assets (book value of debt is used if debt is not traded)
15	Tobin's Q1	(Market value of tradable shares + net assets per share × number of non-tradable state and

		legal-person shares + market value of debt) ÷ book value of total assets. Net assets per share is the base transaction price of non-publicly-tradable shares in block transfer of control rights.
16	Ln Q0	Natural logarithm of Tobin's Q0
17	Ln Q1	Natural logarithm of Tobin's Q1
18	Adjusted Q0	Tobin's Q0 – the median Q0 in the year and industry as determined by two-digit CSRC industry code.
19	Adjusted Q1	Tobin's Q1 – the median Q1 in the year and industry as determined by two-digit CSRC industry code.
20	Dividend payout indicator	A proxy for firms' access to financial markets, 1 = a firm paid a dividend in a year and 0 for otherwise (and hence 0 denotes the firm has financing constraints)
21	Industry diversification indicator	1 = if a firm engages in more than one industry and 0 for otherwise
22	Operating profit to assets ratio	Operating profit ÷prior year-end total assets
23	H-share or B-share firm dummy	1 = if a firm has overseas listed H-shares or domestically listed B-shares for foreign investors and 0 for otherwise
24	CEO/Chairman duality	1= CEO and board chairman held by the same person and 0 for otherwise
25	New debt financing in year t+1	(total liabilities in year t+1 minus total liabilities in year t)/total assets in year t in the spirit of Graham (1996) (winsorized at the top and bottom 1%)
26	Marginal tax rate	A trichotomous variable recommended in Graham (1996b) (= top tax statutory rate if both taxable income > 0 and prior NOL = 0; = 0 if taxable income <= 0 and prior NOL > 0; = half of the top annual statutory tax rate otherwise). Top statutory tax rate is equal to 15% before 2001 and is equal to 33% from 2001 onward
27	SG&A expense ratio	Sales expenses, general and administrative expenses (including depreciation but excluding interest) ÷ sales income
28	Cash flow to sales ratio	(EBIT – tax + Depreciation + Amortization expense) ÷ sales

Table 1
Summary of Descriptive Statistics

Variables	Mean	Median	S.D.	Min	Max	N
Extent of insurance use (INS)	0.162	0.094	0.257	0.000	4.461	2231
Fitted extent of insurance use (INS*)	0.201	0.197	0.120	0.000	0.999	2230
Prior accidental loss dummy	0.017	0.000	0.128	0.000	1.000	2231
High property risk firm dummy	0.230	0.000	0.421	0.000	1.000	2231
Interest cost of borrowing	0.034	0.033	0.019	0.000	0.105	2231
Fiscal subsidy to sales ratio (lagged)	0.013	0.000	0.106	0.000	2.532	2230
Leverage (lagged)	0.446	0.448	0.165	0.023	0.999	2230
Ln(book value of assets)	12.561	11.774	2.763	9.382	23.448	2231
Capital expenditure-to-assets ratio	0.064	0.040	0.072	0.000	0.749	2231
Proportion of managerial shareholdings	0.0007	0.0002	0.006	0.000	0.170	2231
Ln(1+market value of managerial shares)	10.951	13.033	5.324	0.000	20.016	2231
Tangible assets to assets ratio	0.502	0.497	0.162	0.016	0.999	2231
Proportion of state shareholdings	0.302	0.305	0.257	0.000	0.886	2231
Quick ratio (lagged)	1.302	1.019	0.997	0.023	6.250	2231
Tobin's Q0	2.858	2.467	1.459	1.050	13.688	2227
Tobin's Q1	1.621	1.485	0.521	0.826	4.905	2227
Ln Q0	1.293	1.243	0.325	0.718	2.687	2227
Ln Q1	0.947	0.910	0.176	0.602	1.776	2227
Industry-median-adjusted Q0	0.217	-0.046	1.278	-2.764	10.383	2227
Industry-median-adjusted Q1	0.030	-0.049	0.473	-1.853	3.321	2227
Dividend payout indicator	0.530	1.000	0.499	0.000	1.000	2231
Diversification indicator	0.587	1.000	0.493	0.000	1.000	2231
Operating return on assets	0.028	0.035	0.065	-0.642	0.279	2231
H-share or B-share firm dummy	0.110	0.000	0.313	0.000	1.000	2231
CEO-Chairman duality dummy	0.192	0.000	0.394	0.000	1.000	2212
New debt financing in year t+1	0.087	0.053	0.171	-0.270	0.792	2228
Marginal tax rate	0.196	0.150	0.102	0.000	0.330	2228
SG&A expense ratio	0.174	0.129	0.150	0.032	0.809	2230
Cash flow to sales ratio	0.115	0.120	0.185	-0.821	0.570	2220

Table 1 provides descriptive statistics for the variables used in the analysis. Industry-adjusted Q is obtained by subtracting the median Q in the year and industry (as determined by two-digit CSRC industry code) from the raw Q. Other variables are self-explanatory and defined in Appendix 2. The book value of total assets is expressed in RMB 10,000 and the market value of managerial shares is in RMB.

Table 2
Pearson Correlation Coefficients

	Ln Q0	Ln Q1	Adjusted Q0	Adjusted Q1
Extent of insurance use (INS)	0.09***	0.07***	0.07***	0.05**
Fitted extent of insurance use (INS*)	0.21***	0.20***	0.19***	0.18***
Log (book value of assets)	-0.11***	-0.12***	-0.07***	-0.07***
Leverage (lagged)	-0.21***	-0.19***	-0.20***	-0.19***
Proportion of state shareholding	-0.07***	-0.14***	-0.07***	-0.12***
Capital expenditure-to-total assets ratio	-0.02	-0.01	0.01	0.01
Dividend indicator	0.01	-0.01	-0.03	-0.03
Diversification indicator	-0.03	0.02	0.01	0.06***
Operating profit to assets	0.11***	0.07***	0.07***	0.03
Ln Q1	0.86***			
Industry-adjusted Q0	0.81***	0.72***		
Industry-adjusted Q1	0.68***	0.85***	0.81***	
Log(1+market value of managerial shares)	0.01	0.01	-0.03	-0.01
H-share or B-share firm dummy	-0.07***	-0.27***	-0.09***	-0.26***
CEO-Chairman duality dummy	0.01	0.03	-0.01	0.01

Table 2 presents the Pearson correlation coefficients between the dependent and independent variables in the firm value regression models. Q0 and Q1 are computed Tobin's Q. In computing Q0, the price of non-publicly-tradable shares is proxied by the price of tradable A-shares, while in computing Q1, the price of non-publicly-tradable shares is proxied by net assets per share. Industry-adjusted Q0 (Q1) are Q0 (Q1) subtracting the median Q0 (Q1) in the year and industry as determined by two-digit CSRC industry code. The Pearson correlation between INS and fitted INS* is 0.490, statistically significant at the 0.01 level. *, **, ***: statistically significant at the 0.10, 0.05 and 0.01 level (two-tailed), respectively.

To save space, correlation coefficients between independent variables are not tabulated. We also compute the variance inflation factor (vif) of each variable appearing in each model and find no evidence of multicollinearity.

Table 3

Baseline Regression: The Effect of Property Insurance Use on Firm Value

Variables	Exp. Sign	Ln Q0	Ln Q1	Adjusted Q0	Adjusted Q1
		(1)	(2)	(3)	(4)
Extent of insurance use (INS)	+/-	0.117***	0.052***	0.522***	0.167***
		[0.000]	[0.001]	[0.000]	[0.000]
Ln(book value of assets)	+/-	-0.005	-0.004*	-0.015	-0.003
		[0.184]	[0.092]	[0.340]	[0.651]
Leverage (lagged)	+/-	-0.119**	-0.084***	-0.533**	-0.246***
		[0.016]	[0.003]	[0.029]	[0.006]
Proportion of state ownership	-	-0.135***	-0.114***	-0.461***	-0.242***
		[0.000]	[0.000]	[0.002]	[0.000]
Capital expenditure-to-total assets ratio	+	0.028	0.006	0.108	0.048
		[0.375]	[0.451]	[0.425]	[0.392]
Dividend payout indicator	-	-0.024**	-0.011**	-0.123***	-0.026*
		[0.012]	[0.032]	[0.009]	[0.080]
Diversification indicator	-	0.011	0.011	0.019	0.037*
		[0.389]	[0.108]	[0.749]	[0.092]
Operating profit to assets	+	0.265**	0.062	0.982*	0.024
		[0.035]	[0.205]	[0.087]	[0.460]
Year dummies		Yes	Yes	Yes	Yes
Adjusted R^2		0.291	0.272	0.040	0.065
Number of Obs		2226	2226	2226	2226

Table 3 shows the random-effects panel regression results of Tobin's Q on the extent of property insurance use (INS) and other determinants of firm value. Q0 and Q1 are computed Tobin's Q. In computing Q0, the price of non-publicly-tradable shares is proxied by the price of tradable A-shares, while in computing Q1, the price of non-publicly-tradable shares is proxied by net assets per share. Industry-adjusted Q0 (Q1) are Q0 (Q1) subtracting the median Q0 (Q1) in the year and industry as determined by two-digit CSRC industry code. When industry-adjusted Q is used as the dependent variable, continuous independent variables are also industry-adjusted. *p*-values are one-tailed when uni-directional variables have predicted signs and two-tailed for otherwise. *, **, ***: statistically significant at the 0.10, 0.05 and 0.01 level, respectively. Robust standard errors clustered at the firm level that allow for within-firm serial correlation are used in computing t-values (denoted in parentheses). All models include a constant, but its coefficient estimate is omitted for brevity.

Table 4 The Nonlinear Effect of Property Insurance Use on Firm Value

Variables	Exp. Sign	Ln Q0	Ln Q1	Adjusted Q0	Adjusted Q1
		(1)	(2)	(3)	(4)
The square term of INS	+/-	-0.036***	-0.014**	-0.182***	-0.048**
		[0.000]	[0.016]	[0.003]	[0.022]
Extent of insurance use (INS)	+/-	0.201***	0.085***	0.820***	0.245***
		[0.000]	[0.000]	[0.000]	[0.000]
Ln(book value of assets)	+/-	-0.004	-0.003	-0.012	-0.002
		[0.311]	[0.150]	[0.455]	[0.755]
Leverage (lagged)	+/-	-0.116**	-0.083***	-0.540**	-0.248***
		[0.019]	[0.004]	[0.027]	[0.006]
Proportion of state ownership	-	-0.134***	-0.113***	-0.462***	-0.242***
		[0.000]	[0.000]	[0.001]	[0.000]
Capital expenditure-to-total assets ratio	+	0.040	0.011	0.154	0.061
		[0.323]	[0.425]	[0.392]	[0.366]
Dividend payout indicator	-	-0.025**	-0.011**	-0.121***	-0.025*
		[0.012]	[0.031]	[0.010]	[0.084]
Diversification indicator	-	0.012	0.011*	0.019	0.037*
		[0.352]	[0.099]	[0.743]	[0.092]
Operating profit to assets	+	0.265**	0.062	0.963*	0.019
		[0.035]	[0.205]	[0.092]	[0.419]
Year dummies		Yes	Yes	Yes	Yes
Adjusted R^2		0.290	0.271	0.044	0.064
Number of Obs		2226	2226	2226	2226
Inflection point (where, INS=)		2.79	3.03	2.25	2.55

Table 4 shows the random-effects panel regression results of Tobin's Q on the extent of property insurance use (INS), its square term, and other determinants of firm value. Q0 and Q1 are computed Tobin's Q. In computing Q0, the price of non-publicly-tradable shares is proxied by the price of tradable A-shares, while in computing Q1, the price of non-publicly-tradable shares is proxied by net assets per share. Industry-adjusted Q0 (Q1) are Q0 (Q1) subtracting the median Q0 (Q1) in the year and industry as determined by two-digit CSRC industry code. When industry-adjusted Q is used as the dependent variable, continuous independent variables are also industry-adjusted. *p*-values are one-tailed when uni-directional variables have predicted signs and two-tailed for otherwise. *, **, ***: statistically significant at the 0.10, 0.05 and 0.01 level, respectively. Robust standard errors clustered at the firm level that allow for within-firm serial correlation are used in computing t-values (denoted in parentheses). All models include a constant, but its coefficient estimate is omitted for brevity.

Table 5 IV Regression: The Effect of Property Insurance Use on Firm Value

Panel A: First-stage regression (random-effects Tobit model, Y=INS)

Variables	Exp. Sign	Coefficient Estimate	Marginal Effects
Instruments for INS			
High property risk firm dummy	+	0.104***	0.071
		[0.000]	
Prior accidental loss dummy	+	-0.009	-0.005
		[0.785]	
Interest cost of borrowing	+	0.646**	0.413
		[0.021]	
Fiscal subsidy to sales ratio (lagged)	-	-0.269***	-0.172
		[0.000]	
Control variables for INS			
Leverage (lagged)	+	0.019	0.012
		[0.349]	
Ln(book value of assets)	-	-0.091***	-0.058
		[0.000]	
Capital expenditure-to-assets ratio	+	0.073	0.046
		[0.147]	
Ln(1+market value of managerial shares)	+/-	0.003*	0.002
		[0.055]	
Tangible assets to assets ratio	+	-0.397***	-0.254
		[0.000]	
Proportion of state shareholding	+/-	0.062**	0.040
		[0.047]	
Quick ratio (lagged)	+/-	0.007	0.005
		[0.323]	
Leverage × Tangible assets to assets ratio	+	0.166	0.106
		[0.201]	
H-share or B-share firm dummy	+/-	0.043	0.029
		[0.156]	
CEO-Chairman duality dummy	+/-	0.016	0.011
		[0.198]	
Missing CEO-Chairman duality indicator	+/-	-1.415	-0.160
		[0.950]	
Other predetermined variables from the firm value model			
Dividend payout indicator	+/-	0.003	0.002
		[0.806]	
Diversification indicator	-	-0.023**	-0.015
		[0.026]	
Operating profit to assets	+/-	0.037	0.024
		[0.650]	
Year and other industry dummies		Yes	
Number of Obs (number of left-censored obs)		2230 (215)	
Log likelihood		347.18	
Wald test of the joint significance of instruments (χ^2)		29.07***	

Panel B: Second-stage regression of firm value on the fitted extent of property insurance use

Variables	Exp. Sign	Ln Q0	Ln Q1	Adjusted Q0	Adjusted Q1
		(1)	(2)	(3)	(4)
Fitted extent of insurance use (INS*)	+/-	0.765***	0.347***	3.528***	1.087***
		[0.000]	[0.000]	[0.000]	[0.000]
Ln(book value of total assets)	+/-	0.012**	0.005*	0.057**	0.021***
		[0.032]	[0.052]	[0.014]	[0.006]
Leverage (lagged)	+/-	-0.109**	-0.074***	-0.515**	-0.221**
		[0.024]	[0.007]	[0.030]	[0.011]
Proportion of state shareholdings	-	-0.147***	-0.118***	-0.505***	-0.251***
		[0.000]	[0.000]	[0.000]	[0.000]
Capital expenditure-to-assets ratio	+	0.033	0.001	0.253	0.077
		[0.347]	[0.496]	[0.320]	[0.324]
Dividend payout indicator	-	-0.025***	-0.011**	-0.127***	-0.027*
		[0.010]	[0.025]	[0.007]	[0.069]
Diversification indicator	-	0.022*	0.017**	0.061	0.053**
		[0.075]	[0.011]	[0.279]	[0.011]
Operating profit to assets	+	0.266**	0.041	1.024*	-0.017
		[0.032]	[0.290]	[0.075]	[0.943]
Ln(1+market value of managerial shares)	+/-	-0.003***	-0.001	-0.012*	-0.001
		[0.010]	[0.637]	[0.052]	[0.999]
H-share or B-share firm dummy	+/-	-0.04	-0.132***	-0.215*	-0.341***
		[0.199]	[0.000]	[0.066]	[0.000]
CEO-Chairman duality dummy	-	-0.027**	-0.006	-0.121**	-0.029
		[0.035]	[0.220]	[0.034]	[0.116]
Missing CEO-Chairman duality indicator	+/-	0.100	0.042	0.385	0.104
		[0.289]	[0.296]	[0.355]	[0.443]
Year dummies		Yes	Yes	Yes	Yes
Adjusted R^2		0.331	0.359	0.117	0.168
Number of Obs		2226	2226	2226	2226

Table 5 shows the random-effects panel regression results of firm value on the extent of insurance use (INS) using the instrument variable method. Panel A presents the first-stage random-effects Tobit regression of INS on the instrument variables (high property risk firm dummy, prior accidental loss dummy, interest cost of borrowing, and the fiscal subsidy to sales ratio) and the predetermined control variables included in the second-stage regression of firm value. Panel B shows the results from the regression of firm value on the fitted extent of insurance use (INS*). When industry-adjusted Q is used as the dependent variable, continuous independent variables are also industry-adjusted. Standard errors (clustered at the firm level) that are robust to both cross-sectional heteroskedasticity and within-firm serial correlation are used in computing *p*-values (denoted in the parentheses). *p*-values are one-tailed when uni-directional variables have predicted signs and two-tailed for otherwise. *, **, ***: statistically significant at the 0.10, 0.05 and 0.01 level, respectively. The coefficients of the constant are omitted for brevity.

Table 6 IV Regression: The Non-linear Effect of Property Insurance Use on Firm Value

Variables	Exp. Sign	Ln Q0	Ln Q1	Adjusted Q0	Adjusted Q1
		(1)	(2)	(3)	(4)
The square term of INS*	+/-	-1.091***	-0.497***	-0.092	-0.360
		[0.000]	[0.001]	[0.968]	[0.526]
Fitted extent of insurance use (INS*)	+/-	1.568***	0.713***	3.548***	1.150***
		[0.000]	[0.000]	[0.000]	[0.000]
Ln(book value of total assets)	+/-	0.025***	0.011***	0.058**	0.024***
		[0.000]	[0.001]	[0.023]	[0.004]
Leverage (lagged)	+/-	-0.109**	-0.073***	-0.518**	-0.221**
		[0.023]	[0.008]	[0.030]	[0.011]
Proportion of state shareholdings	-	-0.156***	-0.121***	-0.506***	-0.253***
		[0.000]	[0.000]	[0.000]	[0.000]
Capital expenditure-to-assets ratio	+	0.057	0.011	0.253	0.077
		[0.250]	[0.410]	[0.320]	[0.323]
Dividend payout indicator	-	-0.026***	-0.012**	-0.128***	-0.027*
		[0.008]	[0.021]	[0.007]	[0.068]
Diversification indicator	-	0.025**	0.018***	0.061	0.052**
		[0.038]	[0.005]	[0.276]	[0.012]
Operating profit to assets	+	0.256**	0.036	1.023*	-0.021
		[0.036]	[0.312]	[0.075]	[0.928]
Ln(1+market value of managerial shares)	+/-	-0.003***	-0.001	-0.012*	-0.001
		[0.006]	[0.577]	[0.052]	[0.986]
H-share or B-share firm dummy	+/-	-0.042	-0.133***	-0.216*	-0.341***
		[0.172]	[0.000]	[0.066]	[0.000]
CEO-Chairman duality dummy	-	-0.031**	-0.008	-0.121*	-0.030
		[0.018]	[0.164]	[0.034]	[0.111]
Missing CEO-Chairman duality indicator	+/-	0.1	0.042	0.386	0.107
		[0.305]	[0.307]	[0.354]	[0.433]
Year dummies		Yes	Yes	Yes	Yes
Adjusted R^2		0.348	0.370	0.117	0.168
Number of Obs		2226	2226	2226	2226
Inflection point (where, INS*=)		0.72	0.72	0.72 Note 2	0.79 Note 2

1. Table 6 shows the (second-stage) results from the regression of firm value on the fitted extent of insurance use (INS*) and its square term. INS* is fitted by a first-stage random-effects Tobit regression of INS on the instrument variables (high property risk firm dummy, prior accidental loss dummy, interest cost of borrowing, and the fiscal subsidy to sales ratio) and the predetermined control variables included in the second-stage regression of firm value. When industry-adjusted Q is used as the dependent variable, continuous independent variables are also industry-adjusted. Standard errors (clustered at the firm level) that are robust to both cross-sectional heteroskedasticity and within-firm serial correlation are used in computing *p*-values (denoted in the parentheses). *p*-values are one-tailed when uni-directional variables have predicted signs and two-tailed for otherwise. *, **, ***: statistically significant at the 0.10, 0.05 and 0.01 level, respectively. The coefficients of the constant are omitted for brevity.

2. In Column (3) and (4), if the fitted INS* is not industry-adjusted, its square term is negatively significant at the 0.01 level (two-tailed), and at the inflection point, fitted INS* takes 0.72 and 0.79, respectively.

Table 7 The Effect of Property Insurance Use on New Debt Financing

Variables	Expected Sign	(1)	(2)
Extent of insurance use (INS)	+	0.0399**	0.0397**
		[0.028]	[0.016]
Quick ratio	+/-	-0.007	
		[0.121]	
Leverage	-	-0.101***	
		[0.004]	
Marginal tax rate	+	0.136**	0.320***
		[0.020]	[0.000]
Ln(book value of assets)	+/-	-0.002	
		[0.325]	
Tangible assets to assets ratio	+/-	-0.070**	
		[0.037]	
Proportion of state shareholding	+/-	-0.027*	
		[0.088]	
Capital expenditure-to-assets ratio	+	0.220***	
		[0.000]	
SG&A expense to sales ratio	-	-0.008	
		[0.421]	
Operating profit to assets	+/-	0.240**	
		[0.011]	
Δ Quick ratio	+/-		0.008*
			[0.095]
Δ Ln(book value of assets)	+/-		0.003
			[0.277]
Δ Tangible assets to assets ratio	+/-		0.012
			[0.674]
Δ SG&A expense to sales ratio	+/-		-0.035
			[0.495]
Δ Capital expenditure-to-assets ratio	+/-		0.110**
			[0.020]
Δ Proportion of state shareholding	+/-		-0.040
			[0.231]
Δ Operating profit to assets	+/-		0.120
			[0.225]
Industry dummies		Yes	No
Year dummies		Yes	Yes
Adjusted R^2		0.065	0.044
Number of Obs		2227	2131

Table 7 shows the random-effects panel regression results of new debt financing in year t+1 on the extent of insurance use (INS) in year t. New debt financing is defined as (total liabilities in year t+1 minus total liabilities in year t)/total assets in year t in the spirit of Graham (1996). Standard errors (clustered at the firm level) that are robust to both cross-sectional heteroskedasticity and within-firm serial correlation are used in computing *p*-values (denoted in the parentheses). *p*-values are one-tailed when uni-directional variables have predicted signs and two-tailed for otherwise. *, **, ***: statistically significant at the 0.10, 0.05 and 0.01 level, respectively. The coefficients of the constant are omitted for brevity.

Table 8 Quantifying Tax Advantage of Increased New Debt in Year t+1 Due to Insurance

	Portion of debt ratio attributable to insurance to increase new debt	Dollars of tax savings from increased debt use (million yuan)	Tax savings from increased debt use to a firm's market value
Mean	0.72%	2.21	0.09%
Median	0.44%	0.83	0.05%
S.D.	1.06%	7.90	0.15%
Min	0.002%	0.00	0.00
Max	17.80%	287.25	2.55%
N	2016	2015	2015

Table 8 quantifies the tax savings of increased use of debt in year t+1 that arises from insurance in year t. The portion of debt ratio change is computed using the regression coefficient of INS in Column 1 of Table 7 multiplied by a firm's extent of insurance. Column 2 is computed by multiplying Column 1 by the book value of total assets in year t and marginal tax rate. Column 3 is derived by dividing Column 2 by the firm's market value that is used in calculating Q1.

Table 9 The Effect of Property Insurance Use on Capital Expenditure in Year t+1

Variables		Capital expenditure-to-total assets ratio in year t+1							
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Extent of insurance use (INS)	+	0.017**	0.018**	0.017**	0.019**	0.015**	0.017**	0.016**	0.017**
		[0.043]	[0.032]	[0.036]	[0.028]	[0.046]	[0.034]	[0.040]	[0.031]
Cash flow to sales	+	0.050***	0.051***	0.051***	0.051***	0.046***	0.046***	0.046***	0.046***
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
LnQ0	+	0.032***				0.025***			
		[0.000]				[0.001]			
LnQ1	+		0.040***				0.027**		
			[0.002]				[0.018]		
Adjusted Q0	+			0.006***				0.005***	
				[0.001]				[0.006]	
Adjusted Q1	+				0.011***				0.008**
					[0.004]				[0.035]
New debt financing in year t+1	+					0.050***	0.052***	0.051***	0.052***
						[0.000]	[0.000]	[0.000]	[0.000]
Year dummies		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2		0.081	0.086	0.086	0.088	0.117	0.120	0.120	0.122
Number of Obs		2216	2216	2216	2216	2216	2216	2216	2216

Table 9 shows the random-effects panel regression results of new capital expenditure in year t+1 on the extent of insurance use (INS) in year t. Standard errors (clustered at the firm level) that are robust to both cross-sectional heteroskedasticity and within-firm serial correlation are used in computing *p*-values (denoted in the parentheses). *p*-values are one-tailed when uni-directional variables have predicted signs and two-tailed for otherwise. *, **, ***: statistically significant at the 0.10, 0.05 and 0.01 level, respectively. The coefficients of the constant are omitted for brevity. Several observations were lost due to missing values.

Table 10 The Effects of New Debt Financing and New Investment on Firm Value

Variables	Exp. Sign	Ln Q0	Ln Q1	Adjusted Q0	Adjusted Q1
		(1)	(2)	(3)	(4)
The square term of INS	+/-	-0.030***	-0.011*	-0.158***	-0.040**
		[0.002]	[0.057]	[0.005]	[0.045]
Extent of insurance use (INS)	+/-	0.172***	0.070***	0.720***	0.213***
		[0.000]	[0.002]	[0.000]	[0.000]
New debt financing in year t+1	+/-	0.169***	0.097***	0.754***	0.293***
		[0.000]	[0.000]	[0.000]	[0.000]
Capital expenditure-to-total assets ratio in year t+1	+	0.322***	0.103**	1.569***	0.236*
		[0.000]	[0.032]	[0.010]	[0.090]
Ln(book value of assets)	+/-	-0.004	-0.003	-0.011	-0.002
		[0.341]	[0.165]	[0.478]	[0.788]
Leverage (lagged)	+/-	-0.080*	-0.065**	-0.407*	-0.199**
		[0.098]	[0.020]	[0.085]	[0.023]
Proportion of state ownership	-	-0.125***	-0.109***	-0.424***	-0.232***
		[0.000]	[0.000]	[0.007]	[0.000]
Capital expenditure-to-total assets ratio in year t	+	0.015	-0.001	-0.002	0.019
		[0.425]	[0.989]	[0.446]	[0.215]
Dividend payout indicator	-	-0.024***	-0.010**	-0.121**	-0.024*
		[0.012]	[0.037]	[0.011]	[0.098]
Diversification indicator	-	0.010	0.010	0.016	0.034
		[0.406]	[0.135]	[0.786]	[0.119]
Operating profit to assets	+	0.138	0.003	0.359	-0.144
		[0.113]	[0.482]	[0.303]	[0.538]
Year dummies		Yes	Yes	Yes	Yes
Adjusted R^2		0.289	0.277	0.050	0.072
Number of Obs		2226	2226	2226	2226
Inflection point (where, INS=)		2.87	3.18	2.28	2.66

Table 10 shows the random-effects panel regression results of Tobin's Q on new debt financing in year t+1, (new) capital expenditure in year t+1, the extent of property insurance use (INS), its square term, and other determinants of firm value. Q0 and Q1 are computed Tobin's Q. New debt financing is defined as (total liabilities in year t+1 minus total liabilities in year t)/total assets in year t in the spirit of Graham (1996). In computing Q0, the price of non-publicly-tradable shares is proxied by the price of tradable A-shares, while in computing Q1, the price of non-publicly-tradable shares is proxied by net assets per share. Industry-adjusted Q0 (Q1) are Q0 (Q1) subtracting the median Q0 (Q1) in the year and industry as determined by two-digit CSRC industry code. When industry-adjusted Q is used as the dependent variable, continuous independent variables are also industry-adjusted. *p*-values are one-tailed when uni-directional variables have predicted signs and two-tailed for otherwise. *, **, ***: statistically significant at the 0.10, 0.05 and 0.01 level (two-tailed), respectively. Robust standard errors clustered at the firm level that allow for within-firm serial correlation are used in computing t-values (denoted in parentheses). All models include a constant, but its coefficient estimate is omitted for brevity.

Table 11 The Effects of Insurance Use on Firm Value (Sequential Modeling)

Variables	Exp. Sign	Ln Q0	Ln Q1	Adjusted Q0	Adjusted Q1
		(1)	(2)	(3)	(4)
The square term of INS	+/-	-0.020*	-0.007	-0.106*	-0.029
		[0.073]	[0.288]	[0.093]	[0.202]
Extent of insurance use (INS)	+/-	0.129***	0.054*	0.515**	0.167**
		[0.007]	[0.070]	[0.012]	[0.026]
Ln(book value of assets)	+/-	-0.005	-0.003	-0.022	-0.004
		[0.146]	[0.107]	[0.127]	[0.521]
Leverage (lagged)	+/-	-0.098	-0.080**	-0.652**	-0.290**
		[0.123]	[0.032]	[0.027]	[0.012]
Proportion of state ownership	-	-0.033	-0.069***	-0.162	-0.148***
		[0.190]	[0.000]	[0.134]	[0.007]
Fitted capital expenditure-to-total assets ratio* in year t	+	5.174***	1.217**	15.783***	0.908
		[0.000]	[0.014]	[0.000]	[0.312]
Dividend payout indicator	-	-0.031***	-0.013**	-0.131**	-0.028*
		[0.008]	[0.028]	[0.016]	[0.100]
Diversification indicator	-	0.012	0.007	0.053	0.021
		[0.343]	[0.289]	[0.360]	[0.333]
Operating profit to assets	+	-0.579***	-0.150	-1.713**	-0.164
		[0.001]	[0.123]	[0.032]	[0.600]
Year dummies		Yes	Yes	Yes	Yes
Adjusted R^2		0.374	0.281	0.126	0.070
Number of Obs		1472	1472	1472	1472
Inflection point (where, INS=)		3.23	-	2.43	-

Table 11 shows the final-stage results from a sequential modeling. In the first stage, new debt in year t is estimated by the extent of insurance use in year t-1 and other (lagged) control variables used in Table 7 Column 1. In the second stage, capital expenditure-to-total assets ratio in year t is fitted by a model including the fitted new debt in year t (in the first stage), cash flow-to-sales ratio, and one of the four versions of lagged Tobin's Q. The fitted capital expenditure-to-total assets ratio in year t is then used in the current table. All models are estimated using random-effects panel regression with robust standard errors clustered at the firm level . Q0 and Q1 are computed Tobin's Q. In computing Q0, the price of non-publicly-tradable shares is proxied by the price of tradable A-shares, while in computing Q1, the price of non-publicly-tradable shares is proxied by net assets per share. Industry-adjusted Q0 (Q1) are Q0 (Q1) subtracting the median Q0 (Q1) in the year and industry as determined by two-digit CSRC industry code. When industry-adjusted Q is used as the dependent variable, continuous independent variables are also industry-adjusted. *p*-values are one-tailed when uni-directional variables have predicted signs and two-tailed for otherwise. *, **, ***: statistically significant at the 0.10, 0.05 and 0.01 level (two-tailed), respectively. All models include a constant, but its coefficient estimate is omitted for brevity.