

The corporate purchase of property insurance: Chinese evidence

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Abstract

Using a panel data set (1997–1999) for 235 publicly listed companies in the People's Republic of China (PRC), this study tests empirically whether the purchase of property insurance mitigates principal-agent (agency) incentive conflicts. In contrast to prior studies, we first estimate a probit insurance participation decision model and then a fixed-effects insurance volume decision model (with Heckman's sample selection correction) in order to shed light on the determinants of both property insurance participation and volume decisions. Our results suggest that a major motivation for the corporate purchase of insurance in China appears to be the mitigation of agency conflicts. Additionally, various ownerships seem to have different impacts on the corporate purchase of insurance in China. Moreover, the results show that the same factor can have different impacts on the insurance participation and volume decisions, and that binding financial conditions may be a key factor accounting for such observed differences.

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1. Introduction

One of the recurrent puzzles in the finance literature is why risk neutral corporations, particularly those large publicly listed corporations (PLCs) with a diffuse ownership structure, purchase insurance on actuarially unfair terms.¹ This is because shareholders of such companies are expected to diversify firm-specific (unsystematic) risks more cost-effectively by holding balanced portfolios of investments (e.g., see [Main, 1982](#); [Mayers and Smith, 1982](#)). [Mayers and Smith \(1982\)](#) conclude that risk aversion by shareholders/owners cannot by itself satisfactorily explain the large amounts of insurance purchased by corporations in many parts of the world. As such, researchers (e.g., [Mayers and Smith, 1982, 1986](#); [Smith, 1986](#)) have used financial economics-based theories (e.g., agency theory) to suggest factors other than owners' risk aversion that could explain motivations for the corporate purchase of insurance. For example, it is argued that insurance helps to mitigate agency problems (e.g., asset substitution and underinvestment) that arise from the shareholder–debtholder and/or owner–management incentive conflicts, thereby adding value for shareholders (e.g., see [Mayers and Smith, 1987](#); [Doherty, 2000](#)).

Three prior studies (i.e., [Mayers and Smith, 1990](#); [Yamori, 1999](#); [Hoyt and Khang, 2000](#)) have investigated the corporate insurance decision. [Mayers and Smith \(1990\)](#) examined reinsurance purchases for a sample of United States (US)-based property/casualty (P & C) insurance companies because such data are systematically reported in insurers' statutory returns. They find that firms' size, default risk, ownership and geographical concentration are major influential factors of the amount of reinsurance used by P & C insurance companies. However, due to data limitations, many factors (e.g., growth opportunities and tax) are absent from their analysis and some variables specific to the insurance industry (e.g., geographical concentration) could not be readily generalized to industrial firms. [Yamori \(1999\)](#), taking advantage of the corporate disclosure of insurance purchases before the 1986 financial reporting reforms in Japan, examined the purchase of property insurance by 504 Japanese industrial companies. He reported that only firm size and industry regulatory status appear to be important determinants of the corporate purchase of insurance. Again, some potentially important determinants of insurance purchases (e.g., growth opportunities and managerial ownership) were absent from [Yamori's \(1999\)](#) study. Collecting data from 187 US-based industrial companies for the year 1989, [Hoyt and Khang \(2000\)](#) was the first study that attempted to test a full set of determinants of the corporate purchase of property insurance. Their results suggest that leverage, firm size, growth opportunities, managerial ownership and regulatory status have significant impact on the volume of property insurance purchased.

Despite these contributions, [Yamori \(1999, p. 24\)](#) reports that "... [prior] hypotheses have not been substantially tested by actual data ... [thus] knowledge regarding whether previous theoretical predictions are valid is very limited." This situation is potentially understandable given the difficulty of obtaining insurance usage data at the firm level. On the other hand, [Haushalter \(2000\)](#) suggests that the factors affecting oil and gas firms

¹ For example, insurance premiums contain an element (loading) to cover insurers' expenses and profits as well as the present value of the expected loss.

to *participate* in risk management programs (like derivatives hedging) can be different from the determinants of the *extent* to which firms engage in risk management. However, this contention may or may not apply to corporate risk management via insurance given that insurance and derivatives are quite different in nature.² Therefore, in order to better understand why and how firms routinely manage their property risks via insurance we need to separately examine the determinants of the propensity to purchase insurance (hereafter as the participation decision) and the amount of insurance purchased (hereafter as the volume decision). However, the three prior studies only examine the determinants of the volume decision in corporate insurance. Accordingly, in this paper we empirically address the following question: what are the determinants of the insurance participation and volume decisions? We address this question in the context of the non-statutory purchase of property (assets-based) insurance in the Chinese corporate sector.^{3,4}

Our results suggest that the decision to use property insurance by Chinese PLCs is positively related to leverage and physical assets intensity, but negatively related to State ownership, tax rate and the existence of tax-loss carry-forwards. Corporate insurance propensity also tends to vary according to geographical location and industry sectors. In contrast, the volume of property insurance purchased (conditional on the firm deciding to purchase insurance) is positively related to managerial ownership, foreign ownership and growth options, but inversely related to size and physical assets intensity. We also observe that the relation between managerial ownership and the property insurance decisions of Chinese companies is influenced by leverage and size. Moreover, consistent with Haushalter (2000), we find that the same factors (e.g., leverage and physical asset intensity) can have different impacts on the insurance participation and volume decisions. An exploratory test performed in this study suggests that binding financial conditions may be one of the reasons that account for such observed differences (see Section 5.3.1).

Our study contributes to the literature in three major ways. First, unlike previous research, we employ a two-stage analytical approach. This approach is essential for properly

² For example, derivatives are suitable for hedging speculative risks (e.g., price fluctuation risk) while insurance only deals with pure risks. In addition, economies of scale are well pronounced in using derivatives because of the high set-up costs, but less important in the use of insurance (e.g., see Mayers and Smith, 1990).

³ We focus on commercial property insurance because other forms of loss control (e.g., through the use of derivatives) are largely undeveloped in the PRC (Karmel, 1996). Moreover, commercial insurance is generally cheaper for firms in emerging economies like China than other risk management activities (such as derivatives trading) that have high fixed costs of establishment and operation (e.g., see Mayers and Smith, 1990). As in prior studies (e.g., Hoyt and Khang, 2000), only property insurance is covered in this study, whilst liability insurance is excluded for two reasons. First, third party liability insurance in auto insurance is compulsory and the corporate purchase of other liability insurance is still very minor (less than 5 percent of the total general insurance premium, see CIRC, 2000). Second, Hoyt and Khang (2000) report that the levels of liability-based premiums are unlikely to correspond closely with currently measurable firm-specific factors (e.g., size).

⁴ Our definition of property insurance covers indemnity for losses arising from fire, theft and environmental perils (e.g., floods, storm damage and earthquakes). In China corporate spending on property insurance in the PRC includes premiums paid for the insurance of fixed assets (excluding land), inventories and other tangible assets (e.g., office fittings). Land is state-owned in China and so not subject to private damages (tort) claims (e.g., arising from pollution). Additionally, intangible assets (e.g., brands) are not currently insurable in the PRC due mainly to the relatively unsophisticated nature of the Chinese insurance market. However, this is deemed not to be a problem in this current study as tangible assets are normally required collaterals in debt covenants.

addressing the question of the determinants of the participation and volume insurance purchasing decisions outlined above. Second, our study is the first to adopt a panel data research design in order to achieve a robust estimate of the determinants of both property insurance participation and volume decisions. This design enables us to overcome some data/methodological limitations encountered in prior studies (e.g., Hoyt and Khang, 2000) that have used single year cross-sectional data. Specifically, we are able to effectively control for omitted/unobserved individual heterogeneity (e.g., risk profile and/or industry grouping) that can influence corporate insurance decisions. Third, our study is the first to investigate the determinants of the corporate purchase of property insurance in the emergent and partially privatized Chinese corporate sector—a sector that is unique and very different (e.g., in terms of its corporate ownership structure) from that of many other countries (see Section 2) (e.g., see Gul, 1999). As a result, our research offers some interesting insights into the determinants of corporate insurance decisions that are not provided by prior studies. For example, we show that the various ownerships that are unique to Chinese PLCs tend to have different impacts on corporate insurance decisions. Specifically, in contrast to the negative impact of managerial ownership on the volume of property insurance that is reported in the US (e.g., Hoyt and Khang, 2000), in China we find a positive impact on the volume of property insurance purchased. Our results also suggest that the presence of State ownership may reduce the likelihood that managers will insure asset-loss risks, while foreign ownership tends to encourage the corporate purchase of property insurance in China.

The rest of the paper is structured as follows. Section 2 provides institutional background on the Chinese corporate sector. Section 3 develops research hypotheses. Section 4 describes the research design, including the sources of data, the measurement of variables and the models employed. Section 5 discusses the results, while Section 6 concludes the paper.

2. Institutional background

The corporate demand for insurance in the PRC is to a large degree driven by the ongoing market-based reforms in the corporate sector that began in 1978 (e.g., see Ma et al., 1998). On the one hand, market reforms have granted the managers of Chinese companies much discretion over business decisions (including commercial insurance purchases) (Tam, 2000). On the other hand, market reforms, like the public flotation of State-owned enterprises (SOE), have considerably weakened corporate affiliations with government departments and introduced multiple stakeholders (e.g., private individuals, foreign and institutional investors) into the Chinese corporate sector. As a result, the public accountability of Chinese managers has been enhanced such that they now have greater market-based incentives to consider external (commercial) risk management options (e.g., property insurance) (Ma et al., 1998). The general lack of risk management expertise and limited risk management alternatives (e.g., with regard to the use of financial derivatives) in the PRC has further encouraged managers to transfer their downside business risks (like potentially severe property losses) into the commercial insurance market (e.g., see Karmel, 1996).

At the end of 1999 there were 976 companies listed on China's two main stock exchanges—Shanghai (SHSE) and Shenzhen (SZSE)—with slightly over half of these companies listed on the former bourse. By the end of 2000, the total market capitalization of these two bourses amounted to approximately RMB 4900 billion (roughly US\$ 590 billion) thus making China the most important emerging financial market in the world (Goldman Sachs, 2001). The value of corporate insurance purchases is also growing rapidly in the PRC in line with the development of domestic financial markets and corporate sector reforms, particularly in property lines. For example, in 1999 PRC-based companies accounted for annual property insurance premiums of roughly RMB 30 billion (US\$ 3.6 billion) (CIRC, 2000). The CIRC (2000) also reports that by the late 1990s, there were 25 suppliers of property insurance in China (including eight foreign insurers) offering some 300 different types of commercial insurance product. Shen (2000) reports that such growth in product lines and increased market competition among Chinese-based insurers has improved the level of insurance services to commercial (and private) consumers.⁵ The evolving Chinese insurance industry is thus an integral part of China's current economic development and the commitments required by its entry to the World Trade Organization (WTO) (Shen, 2000).

We believe that the PRC is well suited for the investigation of the corporate purchase of property insurance in three key aspects. First, as a result of the “gradualist” pace of market reforms pursued in China, the ownership structure of Chinese PLCs is unique in the world in terms of the substantive presence of State share ownership (Gul, 1999; OECD, 2000). Specifically, State ownership represents roughly one-third of total shares in issue and is present in about 90 percent of Chinese PLCs (China Securities Regulatory Commission Database, CSRC, 2000). This degree of State control in China is reported to be greater than in former command economies such as Eastern Europe as well as western developed countries (e.g., see Qian et al., 1999). Accordingly, the role of State ownership in affecting agency incentive conflicts and therefore, insurance decisions in the Chinese corporate sector should be of interest to policymakers and investors, and provide a context against which previous research (e.g., Vickers and Yarrow, 1998) can be compared. Second, Xu and Wang (1999) report that in the Chinese corporate sector there is a high level of information asymmetry between investors, creditors and managers. In addition, Chinese corporations have traditionally relied on debt financing (particularly bank loans), which accentuates the potential for agency conflicts between shareholders and debtholders (Tian, 2001).⁶ Leung and Young (2002) further report that accumulated non-performing debt and recent reforms in China's banking sector have led many lenders to tighten up credit rules and increase ex post monitoring of company managers' behavior. This feature can further induce the need for corporate purchase of property insurance on collateralized fixed assets.

⁵ Shen (2000) notes that increased competition has even encouraged the former state-owned insurer, the People's Insurance Company of China (PICC) (which has roughly 70 percent of the market) to become more responsive to competition and changing market trends—for example, in increasing the range of its products and improving quality standards.

⁶ This is true even when the controlling shareholder of a firm is the local government and the major corporate lender is a State (central government)-owned commercial bank. Agency incentive conflicts can occur because central and local government bodies/departments have divergent economic and political interests and objectives.

Therefore, we contend that agency problems in debt-reliant Chinese companies are potentially severe and as such, property insurance can play an important role in mitigating incentive conflicts among corporate stakeholders and add value for shareholders—for example, through reduced agency costs (see Section 3). Third, the CIRC closely regulates insurance premium rates;⁷ however, the corporate purchase of insurance per se is voluntary and not subject to external control.⁸ Because the effective premium rates remained unchanged over 1997–1999, the variations in annual corporate spending on property insurance are more likely to reflect managerial discretion over insurance purchases rather than confounding fluctuations in insurance prices and other external market conditions.⁹ In other words, annual total insurance premiums in China are likely to vary primarily because of company-specific differences in the volume of coverage.¹⁰ This regulatory feature thus enables us to conduct a more robust test of our hypotheses.

3. Hypotheses development

3.1. Hypotheses

This section puts forward four pairs of testable relevant hypotheses drawn from agency theory.

3.1.1. Leverage

Grace and Rebellio (1993) argue that the voluntary purchase of insurance helps to reduce the information asymmetry (agency) costs that debtholders face in screening borrowers' creditworthiness *ex ante*, monitoring contractual compliance and bonding investment decisions *ex post*. In this way, the decision to purchase insurance acts as an important signaling device regarding the quality of a firm's future financial condition and helps to mitigate debtholders' concerns about bankruptcy following an unanticipated severe loss. In a developing and risky market like China, bank/insurance managers (underwriters) are expected to have added incentives to closely monitor agency incentive conflicts and associated business

⁷ The CIRC not only sets the benchmark premium rates for the majority of corporate property insurance products, but also issues guidelines on risk rating and applicable classified premium rates (e.g., based on the type of business) (Shen, 2000). The Insurance Law also restricts the ability of insurers to realize competitive advantages by giving their customers premium rebates. As a result, insurance premium rates in China are expected to be influenced less by competitive market forces and differences in the risk-rating practices of underwriters than might be the case in some developed countries (e.g., the United Kingdom (UK) and US).

⁸ In China, property insurance prices are tightly regulated but at the same time the domestic insurance market is becoming increasingly competitive (Shen, 2000). Therefore, we assume that managers seeking property insurance will be able to secure the required amount of coverage in the market. As a result, companies not purchasing insurance are viewed as non-participants.

⁹ This institutional feature is important given that corporate spending on insurance is a function of both the degree of managerial discretion on amount of insurance purchased and insurance price.

¹⁰ To some degree, the level of annual premiums paid by Chinese companies may also vary because of differences in expected claims costs arising from (omitted) firm-specific effects (e.g., in terms of potential adverse selection/moral hazard problems). However, by using a fixed-effects panel design that allows the intercept to vary across firms, we are able to capture the potential influence of omitted variables.

risks of corporate borrowers (Leung and Young, 2002). Additionally, the more debt that a firm has in its capital structure the greater the likelihood that severe cash flow volatility will result in default on debt and increase the value of the default put option to shareholders.¹¹ Therefore, the level of property insurance is likely to be positively related to the amount of debt in a firm's capital structure. Consequently, we hypothesize that:

H1a. *Ceteris paribus*, companies with higher leverage are more likely to purchase property insurance than companies with lower leverage.

H1b. *Ceteris paribus*, companies with higher leverage are likely to purchase more property insurance than companies with lower leverage.

3.1.2. Growth opportunities

Smith and Watts (1992) argue that relative to entities with few growth opportunities, firms with greater growth options tend to be riskier as their managers are normally given more discretion over investment decisions. As a result, managerial decisions in firms with high growth prospects may be less transparent to outside parties (e.g., creditors) than other firms thus increasing agency costs (e.g., monitoring expenditures). Indeed, Chung and Charoenwong (1991) observe a positive linkage between equity risk and a firm's growth opportunities. Additionally, intangible growth options are only valuable when a firm is deemed to be a going concern and so their value will drop dramatically if the firm faces bankruptcy. This suggests that the expected costs of financial distress for firms with high growth opportunities are likely to be higher than for firms with low growth prospects (e.g., see Myers, 1984). Therefore, we expect that managers of high growth companies are likely to have greater incentives to purchase insurance than their counterparts in companies with poor growth prospects.

Froot et al. (1993), among others, predict a direct linkage between cash flow and investment in firms of high growth opportunities given market imperfections (e.g., information asymmetries between outside investors and managers about the quality of new projects). They argue that when firms' cash flows are low, costly external financing could force managers to scale down or forgo investment in positive net present value projects. Thus, the underinvestment incentive is likely to be particularly severe in firms with high growth options (Myers, 1977). Indeed, in their US study, Minton and Schrand (1999) find that corporate cash flow volatility is closely associated with a low rate of investment and high market cost of capital. The purchase of insurance can, however, reduce the incidence of a cash flow shortfall (following a major accidental loss) that could trigger a costly resort to the capital markets and/or a scaling-down in value-enhancing investment (Froot et al., 1993). Hence:

H2a. *Ceteris paribus*, companies with high growth opportunities are more likely to purchase property insurance than companies with low growth opportunities.

¹¹ Doherty (2000) reasons that with limited liability, shareholders in firms facing financial distress can exercise a default put option (i.e., default on outstanding debt) when the value of the firm falls below the present value of debt (as for example, in cases of acute financial distress).

H2b. *Ceteris paribus*, companies with high growth opportunities are likely to purchase more property insurance than companies with low growth opportunities.

3.1.3. State ownership

As mentioned above in Section 2, the Chinese State (local and national government) is a major shareholder retaining a controlling interest in roughly 30 percent of Chinese PLCs (OECD, 2000). Xu and Wang (1999) and Sun et al. (2002) observe that State ownership could exacerbate owner–management agency problems in State-controlled Chinese PLCs. This could occur because of the ambiguously defined meaning of public/State ownership in China and a lack of incentives for delegated State agencies (bureaucracies) to closely monitor managers in the companies that they oversee (Xu and Wang, 1999). Additionally, State ownership is traditionally viewed as contributing to, if not causing, corporate operational inefficiency (Vickers and Yarrow, 1998). Indeed, both Gul (1999) and Xu and Wang (1999) find evidence that in the PRC high levels of State ownership often result in limited investment opportunities and lackluster financial performance. Therefore, it is unlikely that an inefficient State shareholder will encourage the corporate purchase of property insurance as a way of mitigating owner–management conflicts. On the other hand, Tian (2001) recognizes that the existence of a large block of State shareholdings could have a positive influence on corporate value as the government can provide financial assistance (e.g., subsidies) and other benefits (e.g., business contacts). This suggests that where the State is a major shareholder, managerial incentives to purchase property insurance to manage asset-loss risks (and control agency conflicts) could be reduced because of the possible “charity (moral) hazard” effect of State support (Brown and Hoyt, 2000). Therefore, State shareholdings could substitute for the use of property insurance and thus:

H3a. *Ceteris paribus*, companies with low State shareholdings are more likely to purchase property insurance than companies with high State shareholdings.

H3b. *Ceteris paribus*, companies with low State shareholdings are likely to purchase more property insurance than companies with high State shareholdings.

3.1.4. Managerial ownership

The degree of managerial share ownership can also affect agency problems among shareholders, debtholders and managers and hence, the corporate purchase of property insurance (e.g., see Smith and Stulz, 1985).¹² There are two competing hypotheses concerning the influence of managerial ownership on the corporate purchase of insurance reported in the finance literature—the *managerial risk-aversion* and *incentive-alignment* hypotheses. For example, Smith and Stulz (1985) argue that as insider ownership increases managers are expected to become increasingly risk averse because they have a greater economic interest vested in the company. As a result, managers are likely to pursue risk management activities (e.g., via insurance) in order to reduce their (ill-diversified) wealth

¹² We focus on managerial ordinary (common) share ownership because equity-option plans are currently undeveloped in China (e.g., see Wei, 2000).

risk. Indeed, because managers have a self-interest in ensuring that the firm remains a going-concern (e.g., for job security reasons), they are less likely to exercise their default put option in the event of extreme financial distress than external (well-diversified) shareholders. This is particularly likely to be the case in China where company managers generally have lower levels of personal wealth and less diversified human capital outside of the firm that employs them than their counterparts in western developed countries (Wei, 2000). However, another line of argument advanced by Saunders et al. (1990) contends that shareholders' ownership rights position can be viewed as a call option on the assets of a firm, and the value of this call option can appreciate (depreciate) by increasing (decreasing) the risk of the underlying assets (e.g., through asset substitution). Therefore, as the managers' ownership in the firm increases, their economic interest is likely to become more closely aligned with those of shareholders, thereby creating managerial incentives to maximize the value of their call options by increasing the level of business risk. Previous studies (e.g., Cummins and Sommer, 1996; Hoyt and Khang, 2000; Chen et al., 2001) provide empirical support for this line of argument. Therefore:

H4a. *Ceteris paribus*, companies with low level of managerial ownership are more likely to purchase property insurance than companies with high level of managerial ownership.

H4b. *Ceteris paribus*, companies with low level of managerial ownership are likely to purchase more property insurance than companies with high level of managerial ownership.

3.2. Control variables

The corporate use of property insurance can also be influenced by other firm-specific factors. In this study, we control for the influences of firm size, foreign ownership, asset structure, tax position, three interaction effects, fiscal subsidies, geographical location and industry effects. Our motivation for selecting these variables is briefly as follows.

3.2.1. Firm size

We expect small companies will not only have a greater likelihood to purchase property insurance, but also buy relatively more insurance than large companies for three main reasons. First, the expected direct costs of financial distress are not usually proportional to size (e.g., see Warner, 1977). Second, small companies tend to gain more from insurers' real services (e.g., loss prevention) than large companies (Hoyt and Khang, 2000). Third, small entities are not normally well diversified and so they are particularly susceptible to downside business risks (Barnea et al., 1985). The findings of some prior studies (e.g., Hoyt and Khang, 2000) also support the inverse linkage between firm size and the amount of insurance purchased.

3.2.2. Foreign ownership

We expect foreign investors to require managers to engage in risk management (e.g., via property insurance) in order to control for the potentially acute business risks (notably exposures to asset loss) and other information asymmetries associated with investing in

the nascent (and uncertain) Chinese economy (e.g., see Tihanyi and Ellstrand, 1998).¹³ In contrast, managers in companies with little or no foreign investment may be under less pressure from shareholders to take out property insurance. Additionally, because most foreign investors are large institutional investors, they are likely to have incentives/capabilities to monitor the corporate insurance decisions of Chinese firms.

3.2.3. Asset structure

Cross-sectional differences in physical assets intensity (i.e., the proportion of tangible assets to total assets) may also influence the corporate purchase of property insurance. As such, physical assets intensity is controlled for despite the fact that no prior studies take account of this. We expect that companies with high physical assets intensity are likely to purchase relatively more property insurance than companies with a high proportion of (non-insurable) intangible assets, other things being equal.

3.2.4. Tax position

Smith and Stulz (1985) argue that risk management can reduce the expected tax liability in firms with a convex tax profile (e.g., by maximizing the value of existing tax shields). The convexity of effective corporate tax schedule often results from both statutory progressivity (e.g., in the US) and the presence of tax preference items (e.g., investment tax credits and tax-loss carry-forwards) (e.g., see Mayers and Smith, 1982).

China does not have a (statutory) progressive corporate income tax schedule. The tax code, however, allows a maximum of five-year carry-forwards of operating losses. Additionally, the tax code treats some types of companies (e.g., foreign-invested companies and government approved high-tech companies) favorably by allowing various tax exemptions or rebates. For example, a newly foreign-invested company is exempt from income tax for the first two operating years and is subject to a tax rate of 15 percent for three operating years thereafter. Therefore, the effective tax schedule of firms with tax-loss carry-forwards and/or tax credits can be convex. These companies are likely to purchase property insurance in order to reduce the downside variability of their taxable income (e.g., due to a major uninsured loss) and maximize the present value of their tax shields (e.g., Mayers and Smith, 1982). We therefore control for the effects of both tax-loss carry-forwards and tax concessions on the corporate purchase of property insurance.

3.2.5. Interaction effects

The corporate purchase of insurance can also be affected by interactions between some agency theory-based factors. For example, Downs and Sommer (1999) suggest that the linkage between managerial ownership and the corporate purchase of insurance can be influenced by leverage. Specifically, they argue that insider share ownership could moti-

¹³ Yung (2002) argues that given factors like the institutional constraints on international capital flows and information asymmetries, (foreign) investors may be prevented from optimally diversifying their international portfolios. Additionally, local underwriters may have a comparative advantage over foreign investors' risk management staff in identifying and assessing asset exposures in Chinese companies. As a result, foreign investors might choose a mixed insurance strategy, i.e., to insure some risks locally and others through their international group portfolios.

vate managers in companies with high leverage to engage in risk-taking activities (e.g., new ventures) rather than risk-averse pursuits (such as the purchase of insurance). In other words, the linkage between managerial ownership and corporate insurance purchases could be negative and its absolute magnitude could increase with the level of leverage. Therefore, we expect a multiplicative interaction term between managerial ownership and leverage to have a negative influence on the corporate purchase of property insurance.

Second, Hoyt and Khang (2000) argue that the relation between managerial ownership and corporate purchase of insurance could also be influenced by firm size. More specifically, they contend that for a given level of insider ownership, managers tend to be less risk averse in large companies. This is because managers of large companies are likely to be more effective in diversifying their human capital (and so ensuring job security). As a result, the linkage between managerial ownership and property insurance purchase could decrease in magnitude as firm size increases and hence we expect an inverse relation between the corporate use of property insurance in China and the interaction of managerial ownership and company size, all else equal.

Third, the capital structure literature (e.g., see Smith and Watts, 1992) generally records a negative relation between leverage and firms' growth options. This is because managers of firms with valuable growth opportunities are likely to choose lower leverage because equity financing mitigates a potentially costly underinvestment problem associated with risky debt. Therefore, leverage and growth options could interact with each other and exert a conjoint influence on the corporate purchase of insurance (e.g., see Hoyt and Khang, 2000). To account for this possibility, we also include a multiplicative interaction term between leverage and growth options. However, the expected direction of the interaction effect is not clearly predicted by existing theories.

3.2.6. Fiscal subsidies

As reported in Section 2, recent market reforms have reduced Chinese companies' affiliations with government; however, some companies may still receive fiscal subsidies (e.g., in the form of tax rebates on government-related undertakings). These fiscal benefits may induce "charity hazard" effects among company managers by encouraging them to rely on government financial assistance in the event of a major accidental loss event. In such circumstances, managers will have few incentives to take out commercial property insurance. This possibility is therefore controlled for in this study.

3.2.7. Geographical location

Industry commentators (e.g., Shi and Su, 2000) suggest that the risk management awareness of managers in China's economically more developed Eastern coastal regions is likely to be greater than that of managers in inland regions.¹⁴ This implies that managers of companies located in China's Eastern coast regions are more likely to use property insurance than their counterparts in companies operating elsewhere in the country. Additionally,

¹⁴ The Eastern Coastal region includes three autonomous cities (Beijing, Shanghai, Tianjin) and nine provinces (Hebei, Liaoning, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Guangxi and Hainan). The inland region comprises the provinces of Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, Hunan, Sichuan, Guizhou, Yunnan, Shanxi, Gansu, Qinghai, Ningxia and Xinjiang.

geographical location could to some extent capture differences in companies' expected systematic/unsystematic risks profile.¹⁵ However, the literature is not clear as to whether geographical factors will influence the financial extent of property insurance use. As such, geographical location is used as a selectivity bias identifier variable in our probit model.

3.2.8. Industry effects

Industry might also be a factor that influences the managerial decision to purchase insurance. For example, [Mayers and Smith \(1982\)](#) argue that companies operating in a regulated industry (e.g., utilities) tend to purchase more insurance than entities operating in a relatively unregulated industry (e.g., retailing). This might be because industry regulators have public reputation protection-based incentives to compel companies to take out insurance in order to mitigate business risks (e.g., bankruptcy) and thereafter, shift the transaction costs of hedging onto customers through market price increases. [Hoyt and Khang \(2000\)](#), however, argue that State-induced industry price controls might help to reduce company risks, thereby lowering managers' propensity to control potential losses through insurance. Indeed, in the PRC, some sectors—notably the utilities industries—are strictly regulated (e.g., in terms of product prices). In this study, we control for the potential influence of industry effects by using five industry dummies for service (mainly are retailers in our sample), real estate, utilities, conglomerate and manufacturing companies, respectively. This industry classification is currently adopted by the SHSE and SZSE in China.

4. Research design

4.1. Sample

From the 745 companies listed on the SHSE and SZSE at the end of 1997, we excluded 87 companies that experienced material asset reorganizations between 1997–1999 as such activity could distort the interpretation of our results.¹⁶ Additionally, six publicly listed financial companies (i.e., banks and investment companies) were not included in our sample because they account and report under different rules from other companies and are generally active in the trading of risk management products/services. Moreover, 17 companies with dual listing status on both the SHSE/SZSE and the Hong Kong Stock Exchange (HKSE) were also excluded in order to avoid the potentially confounding effects of institutional differences (e.g., with regard to legislation and degree of financial market development) on the empirical results. We then identified 96 companies disclosing annual property insurance spending in their annual financial reports during 1997–1999 and conducted a

¹⁵ For example, an environmental disaster (e.g., earthquake or flood) in the economically developed coastal areas of China (e.g., Shanghai or Beijing) could increase levels of systematic risk for Chinese companies and so have an adverse impact on the market cost of capital and the level of investors' returns.

¹⁶ In order to avoid the effect of structural changes before and after listing, each company in our sample had to be listed for two full accounting years during the research period (1997–1999). The most prevalent forms of corporate structural reorganization in China include asset swaps and divestitures among associated companies. The materiality of such asset reorganization was determined in this study by applying the official criteria laid down by the CSRC—i.e., more than 30 percent change in the value of tangible assets.

telephone-based survey of Financial Directors/Treasurers in the remaining 539 companies, which resulted in 146 responses.¹⁷ A further seven companies with missing annual accounting data had to be excluded, giving us a useable sample of 235 firms for 1997–1999 (approximately 32 percent of the population over the period of analysis). This enables us to compile an unbalanced panel data set of 668 company/year observations.¹⁸ The period 1997–1999 represents the earliest and latest years for which complete data necessary for this study were available. Company-specific non-insurance accounting data were obtained from the *Hong Kong & Macao Securities Information Database* (HKMSID). Data held on the HKMSID are derived from the audited annual financial statements of Chinese PLCs and so are assumed to be reliable.¹⁹ Share price data were sourced from the *Huaxia Yirong Securities Information System*. To eliminate variations due to annual price changes, all monetary values were adjusted by China's retail purchase index (RPI) (base year = 1997).

4.2. Variables

Two dependent variables (i.e., *INSCHO* and *INS*) are used in our study. *INSCHO* is a dummy variable taking the value of 1 for companies purchasing property insurance and 0 for otherwise. *INS* is a continuous measure of the extent of property insurance use, which is defined as the total corporate spending on property insurance in the current year scaled by the book value of insurable physical assets (e.g., buildings, plants, equipments, office fittings and inventories).

The explanatory variables used in this study are defined as follows. Leverage (*LEV*) is measured by total (long- and short-term) debt over the book value of equity. Tobin's *Q* is used in this study to capture the growth opportunities of firms (*GROW*). Tobin's *Q* is defined as the ratio of the sum of the book value of debt and market value of equity to the replacement cost of the firm's assets. To avoid the difficulty associated with computing replacement costs, the approximation of Tobin's *Q* recommended in Chung and Pruitt (1994) is used. That is, $Q = (MVE + PS + DEBT)/TA$, where *MVE* is the product of a firm's share price and the number of common shares in issue;²⁰ *PS* is the liquid value of a company's preferred equity; *DEBT* is the book value of long-term debt plus short term

¹⁷ A copy of the telephone survey instrument is available from the first author.

¹⁸ The panel comprises 203 cases in 1997, 234 cases in 1998 and 231 cases in 1999. Therefore, the disclosure of property insurance for a minority of firms in our sample is non-recurrent across years.

¹⁹ Graham (1996) reports that the audits of many Chinese PLCs, particularly those issuing shares to foreign investors, are usually performed by international auditing firms, such as Price Waterhouse Coopers and KPMG Peat Marwick. Also, Defond et al. (2000) observe the growing professional nature of external auditing in China in recent years. Thus, the data used in this study are considered to be reliable.

²⁰ While A-shares and B-shares are openly traded in China, some large blocks of company stocks held by the State and institutional investors (roughly 60 percent of total shares issued) cannot be freely transacted. Rather, they can be transferred through negotiation subject to approval from CSRC. The common practice is for such share interests to be transferred at prices based on the RMB value of net assets per share plus a margin for traders' profit and expenses. Therefore, the market value of the equity of Chinese publicly-listed companies can be substantially overstated using the figure of total shares in issue multiplied by the price of tradable A-shares and/or B-shares. In order to avoid this problem and as an improvement on Xu and Wang (1999), we calculate the market value of equity as the sum of market value of tradable A-shares and/or B-shares plus the product of non-tradable shares and year-end RMB value of net assets per share.

liabilities; and TA is the book value of total assets. Since Chinese companies rarely issue preference shares, the approximate Q is, in essence, equal to the market-to-book ratio of firm value.

As in Sun et al. (2002), State shareholdings ($STATE$) are measured as the fraction of the number of common (ordinary) shares held by the State relative to the total number of common shares in issue. Managerial ownership (MAN) is measured by the proportion of common shares held by company managers to the total number of common shares in issue.

Regarding our control variables, firm size ($SIZE$) is measured by the book value of total assets; foreign ownership ($FOWN$) is represented by the proportion of common shares held by foreign investors; asset structure ($STRUC$) is measured as the ratio of book value of physical assets to total assets; tax rate ($TAXRATE$) is approximated by the effective tax rate—the ratio of income tax to the taxable income in the current year. A dummy ($TAXLOSS$), with 1 indicating the presence of tax-loss carry-forwards and 0 for otherwise, is used to capture the effect of the tax convexity introduced by the existence of tax-loss carry-forwards.

To mitigate the potential multicollinearity problem arising from correlations between the multiplicative interaction terms (i.e., $LEVMAN$, $SIZEMAN$ and $LEVGrow$) and their component parts, we follow the “centering” transformation procedure recommended by Jaccard et al. (1990). This procedure involves “centering” corresponding variables by subtracting medians from them before constructing the multiplicative interaction terms. The centered form of the corresponding component variables is then used in the regression analysis. We find that such a transformation effectively reduces the correlation between the product term and the two component variables. Fiscal subsidies ($SUBSIDY$) are measured by the total subsidies received from local government in the current accounting year scaled by the annual operating profit. Geographical location ($GEOG$) is measured by a dummy variable that is coded as 1 for the Eastern coastal economic zone and 0 otherwise. Five industry dummies— $INDU_{1-5}$ —represent retailing, real estate, utilities, conglomerate, and manufacturing companies, respectively.²¹

4.3. Rank transformations

Our data are highly skewed and exhibit high kurtosis; however, the existence of zeros and negative values in the data set precludes us from taking log transformations to mitigate the problem of skewness (see Table 1, Section 5.1). Therefore, as in Lamm-Tennant and Starks (1993), Kane and Meade (1998) and Ireland and Lennox (2002), we take rank transformations of the metric variables and replace them with their rank equivalents in our analysis.²²

²¹ In our data set the numbers of firms from the retailing, real estate, utilities, conglomerate and manufacturing industry are 37, 11, 13, 29 and 145, respectively.

²² For the vector $[X_{t,1}, X_{t,2}, \dots, X_{t,n}]$ of variable X for year t , we replace each value of X_t with its corresponding rank (ranging from 1 to n in ascending sequence) divided by $n + 1$ (where n is the number of cases in year t). Observations are then aggregated and result in pooled data that are uniformly distributed between zero and one. Kane and Meade (1998) demonstrate that rank transformations have advantages of preserving comparative

4.4. Multivariate models

In the first stage of our multivariate analysis, a probit model is estimated to examine the determinants of a firm's property insurance participation decision. At the second stage, we employ a panel data (fixed-effects) model incorporating Heckman's (1979) two-step sample selection correction procedure to analyze firms' property insurance volume decisions. The rationale for this approach is twofold. First, separate analysis of property insurance participation and volume decisions could yield interesting insights into those factors that influence the ex ante and ex post managerial insurance decisions (e.g., see Haushalter, 2000). As such, a conventional ordinary least square (OLS) linear regression model and a single Tobit model are considered inappropriate for this purpose. Second, only firms purchasing property insurance are included in the second-stage analysis of volume decision. Therefore, potential sample selection bias in the volume decision model must be appropriately controlled for using the Heckman (1979) sample selection model (e.g., see Greene, 1999).

The probit insurance participation decision model used in this study is thus:

$$\begin{aligned}
 Y_{it}^* = & \beta_0 + \beta_1 LEV_{it} + \beta_2 GROW_{it} + \beta_3 STATE_{it} + \beta_4 MAN_{it} + \beta_5 SIZE_{it} + \beta_6 FOWN_{it} \\
 & + \beta_7 STRUC_{it} + \beta_8 TAXRATE_{it} + \beta_9 TAXLOSS_{it} + \beta_{10} LEVMAN_{it} \\
 & + \beta_{11} SIZEMAN_{it} + \beta_{12} LEVGROW_{it} + \beta_{13} SUBSIDY_{it} + \beta_{14} GEOG_{it} \\
 & + \beta_{15} INDU_1 + \beta_{16} INDU_2 + \beta_{17} INDU_3 + \beta_{18} INDU_4 + \beta_{19} YEAR_{97} \\
 & + \beta_{20} YEAR_{98} + \varepsilon_{it}.
 \end{aligned} \tag{1}$$

In (1), the latent dependent variable, Y_{it}^* , is not observable; its observable counterpart is $Y_{it}(INSCHO)$, which is equal to 1 if $Y_{it}^* > 0$, denoting a company purchasing property insurance; and 0 if $Y_{it}^* \leq 0$, denoting a company not purchasing property insurance. In (1), LEV_{it} , $GROW_{it}$, $STATE_{it}$, MAN_{it} , $SIZE_{it}$, $FOWN_{it}$, $STRUC_{it}$, $TAXRATE_{it}$, $TAXLOSS_{it}$, $LEVMAN_{it}$, $SIZEMAN_{it}$, $LEVGROW_{it}$, $SUBSIDY_{it}$, $GEOG_{it}$ and $INDU_{1-4}$ are explanatory variables defined in Sections 4.2 and 4.3. $YEAR_{97}$ and $YEAR_{98}$ are year dummies included to control for any time-related changes (e.g., insurance underwriting cycles and macroeconomic events); $\varepsilon_{it} \sim N(0, 1)$ is a disturbance term. Moreover, it is important to exclude some variables that only affect the participation decision from the second-stage model (Eq. (2)) in order to effectively control for potential effects of sample selection bias (Ireland and Lennox, 2002). As such, $GEOG_{it}$ fulfills this role in the present study.²³

Greene (1999) argues that a major advantage of using a panel data design is that it controls for omitted (unobservable) company-specific effects (e.g., differences in risk profiles and inter-company risk management expertise) and/or time-specific effects (e.g., insurance underwriting cycles). As such a panel data design helps to produce more informative and robust parameter estimates than a separate single period and/or simple pooled analysis.

information, avoiding arbitrary sample trimming and improving fit. As a result, rank transformations generally perform better than log or square root transformations in resolving the problem of skewed data.

²³ Our presumption here is that being located in the more financially developed Eastern coastal zone is likely to enhance company managers' exposure to, and familiarity with, the need for property insurance. However, geographical location per se is likely to be less important in determining of the actual level of insurance cover procured by individual managers.

Subject to the different assumptions made about the distribution of these effects, the main estimation techniques usually employed in panel data research are the fixed and random-effects (error components) models. The former model treats omitted firm-specific variables as constant over time and/or period-specific variables as invariant across companies. In contrast, the random-effects model treats both firm and period-specific factors as random.

To determine the most appropriate regression model for the insurance volume decision model, we follow a two-stage diagnostic procedure (see Table 3, panel B). First, we conduct Wald and Lagrange Multiplier (LM) tests to examine the relative efficiency of the heterogeneous fixed/random-effects estimation against the homogeneous pooled OLS model. The Wald F -statistic and the LM χ^2 value are statistically significant at the 0.01 level. This suggests that the fixed/random-effects models are more efficient than the pooled cross-sectional OLS model. Second, we perform a Hausman specification test, which is based on the differences between the coefficients estimated from the fixed or random-effects models, to determine which kind of panel model would be most appropriate in this study. The computed χ^2 statistic is statistically significant at the 0.01 level, indicating that the unobservable firm-specific effects (e.g., risk-profile) could be correlated with the explanatory variables in the model. In this case, fixed-effects model can derive consistent estimates but random-effects model cannot; therefore, a fixed-effects procedure is used in this study. The fixed-effects volume decision model with Heckman's sample selection correction that we employ is expressed as:

$$\begin{aligned} INS_{it} = & \alpha_0 + \alpha_i + \gamma_t + \beta_1 LEV_{it} + \beta_2 GROW_{it} + \beta_3 STATE_{it} + \beta_4 MAN_{it} + \beta_5 SIZE_{it} \\ & + \beta_6 FOWN_{it} + \beta_7 STRUC_{it} + \beta_8 TAXRATE_{it} + \beta_9 TAXLOSS_{it} \\ & + \beta_{10} LEVMAN_{it} + \beta_{11} SIZEMAN_{it} + \beta_{12} LEVGROW_{it} + \beta_{13} SUBSIDY \\ & + \beta_{14} \lambda_{it} + \delta_{it}. \end{aligned} \quad (2)$$

In (2), α_i represents the time-invariant firm-specific dummies that capture the unobservable differences among companies; and γ_t is the firm-invariant time-specific dummies that capture the time-related changes. In addition, λ_{it} is the inverse Mill's ratio generated by the first-step probit participation decision model that controls for possible sample selection bias in the volume decision model (where only companies purchasing insurance are included). Finally, α_0 is the intercept; δ_{it} is an error term that is assumed to have a zero mean and constant variance; and it is the company/year observations over the period 1997–1999. Other variables are defined as in Sections 4.2 and 4.3. It is worth noting that geographical location and industry-effect dummies are not included in the volume decision model for two reasons. First, these time-invariant dummies will cause multicollinearity problem with the fixed-effects. Second, as noted by Sun et al. (2002, p. 15), once firm-specific time-invariant effects are controlled for, possible variations due to industry effects can be alleviated.

5. Results

5.1. Descriptive and univariate results

Panel A of Table 1 gives the descriptive statistics. Clearly, many variables are highly skewed, exhibit high kurtosis or have zero/negative values. As such, our use of rank trans-

Table 1
PRC-based publicly-listed companies (668 observations), 1997–1999

A. Key descriptive statistics (SIZE is measured in million RMB)

Variables	Mean	Median	Std. Dev	Skewness	Kurtosis	Min	Max
INS	0.0026	0.001	0.004	3.789	19.940	0.000	0.033
LEV	1.027	0.851	0.719	1.311	5.153	0.019	4.337
GROW	2.001	1.720	0.957	2.172	9.364	0.858	8.518
STATE	0.297	0.299	0.257	0.189	1.677	0.000	0.886
MAN	0.0006	0.0003	0.0009	3.401	18.094	0.000	0.0071
SIZE	127.867	80.223	134.689	2.676	12.106	11.928	1034.0
FOWN	0.076	0.000	0.147	1.686	4.537	0.000	0.664
STRUC	0.505	0.503	0.159	−0.034	2.555	0.042	0.909
TAXRATE	0.322	0.146	4.652	25.836	668.999	−0.797	120.812
TAXLOSS	0.106	0.000	0.308	2.553	7.516	0.000	1.000
LEVMAN	0.000	0.000	0.0005	0.052	18.539	−0.0038	0.0028
SIZEMAN	0.000	0.000	0.0007	−1.096	36.503	−0.0076	0.0051
LEVGROW	−0.227	−0.040	0.632	−1.852	10.938	−4.437	2.499
SUBSIDY	0.098	0.000	0.445	9.825	116.049	−0.088	6.323
GEOG	0.634	0.000	0.482	−0.551	1.303	0.000	1.000
INDU ₁	0.617	1.000	0.487	−0.479	1.228	0.000	1.000
INDU ₂	0.159	0.000	0.366	1.864	4.472	0.000	1.000
INDU ₃	0.048	0.000	0.213	4.249	19.053	0.000	1.000
INDU ₄	0.055	0.000	0.228	3.902	16.223	0.000	1.000
INDU ₅	0.121	0.000	0.327	2.319	6.375	0.000	1.000

B. Comparison of sample firms with non-included firms (Mann–Whitney *U* test)

	Year	Sample		Non-included firms		z-statistic (two-tailed)
		No. of firms	Median	No. of firms	Median	
<i>Ln SIZE</i>	1997	203	11.180	542	11.080	1.304
	1998	234	11.310	651	11.280	0.471
	1999	231	11.400	745	11.380	0.308
<i>LEV</i>	1997	203	0.847	542	0.867	−0.291
	1998	234	0.836	651	0.825	0.144
	1999	231	0.859	745	0.844	0.156

	Sample mean (%)	Reported average level for all firms (%)	Source
<i>MAN</i>	0.06	< 0.1	Wei (2000)
<i>STATE</i>	29.7	33	Xu and Wang (1999)
<i>FOWN</i>	7.6	< 10	Xu and Wang (1999)

C. *INS* groups (*N* = 668)

Insuring proportion groups								
	0	0.000–0.005	0.005–0.010	0.010–0.015	0.015–0.020	0.020–0.025	0.025–0.030	0.030–0.035
Frequency	75	512	48	12	9	5	4	3
%	11.23	76.64	7.19	1.80	1.35	0.75	0.60	0.44

Table 1 (Continued)

D. Descriptive statistics: insurance users versus non-users ($N = 668$)

Variables	Predicted sign	Users ($n1 = 593$)		Non-users ($n2 = 75$)		t -stat
		Mean	Std. Dev.	Mean	Std. Dev.	
<i>LEV</i>	Users > Non-users	0.515	0.280	0.379	0.318	3.519***
<i>GROW</i>	Users > Non-users	0.490	0.288	0.580	0.277	-2.590***
<i>STATE</i>	Users < Non-users	0.504	0.284	0.471	0.275	0.982
<i>MAN</i>	Users < Non-users	0.497	0.283	0.523	0.319	-0.674
<i>SIZE</i>	Users < Non-users	0.510	0.287	0.414	0.279	2.756***
<i>FOWN</i>	Users > Non-users	0.502	0.217	0.482	0.199	0.817
<i>STRUC</i>	Users > Non-users	0.517	0.280	0.369	0.315	4.250***
<i>TAXRATE</i>	Users < Non-users	0.497	0.287	0.523	0.292	-0.751
<i>LEVMAN</i>	Users < Non-users	0.519	0.282	0.346	0.286	4.987***
<i>SIZEMAN</i>	Users < Non-users	0.505	0.283	0.457	0.318	1.239
<i>LEVGROW</i>	Indeterminate	0.507	0.285	0.442	0.300	1.834*
<i>SUBSIDY</i>	Users < Non-users	0.541	0.257	0.507	0.246	1.120

E. χ^2 tests of independence between industry dummies and insurance participation ($N = 668$)

Variables	χ^2 stat.	d.f.	p -value
<i>TAXLOSS</i>	5.746	1	0.017**
<i>GEOG</i>	3.853	1	0.050**
<i>INDU</i> ₁	0.453	1	0.501
<i>INDU</i> ₂	1.908	1	0.167
<i>INDU</i> ₃	0.320	1	0.572
<i>INDU</i> ₄	19.980	1	0.000***
<i>INDU</i> ₅	8.053	1	0.005***

Notes. (1) *INS* = extent of insurance use, defined as the annual corporate property insurance spending scaled by total insurable assets; *LEV* = leverage, defined as the ratio of total debt over the book value of equity; *GROW* = Tobin's Q , defined as the ratio of the sum of the book value of debt and market value of equity to the replacement cost of the firm's assets; *STATE* = State shareholdings, defined as the fraction of the number of State-held shares over the total shares in issue; *MAN* = managerial share ownership, defined as the proportion of common shares held by company managers; *SIZE* = company size—the book value of total assets; *FOWN* = foreign ownership, defined as the proportion of common shares held by foreign investors; *STRUC* = the percentage value of physical assets to total assets; *TAXRATE* = effective tax rate, measured by the ratio of corporate income tax to taxable income in the current year; *TAXLOSS* = tax-loss carry-forwards dummy, 1 = the existence of tax-loss carry-forwards in the beginning of an accounting year and 0 = otherwise; *LEVMAN* = multiplicative interaction term between *LEV* and *MAN*; *SIZEMAN* = multiplicative interaction term between *SIZE* and *MAN*; *LEVGROW* = multiplicative interaction term between *LEV* and *GROW*; *SUBSIDY* = government subsidies, measured by the total subsidies received from the local government scaled by the annual operating profit in the current accounting year; *GEOG* = geographical location—dummy variable, for coastal economic zones = 1, for inland economic zones = 0; *INDU*_{1–5} = industry dummies with 1 for service, real estate, utilities, conglomerate and manufacturing firms, respectively, and 0 otherwise. The rank-transformed equivalents of these variables are used. (2) Interaction terms are constructed in the manner prescribed by Jaccard et al. (1990). This involves “centering” each component variable first by deducting the median from each variable and then multiplying the two “centered” variables together to derive the multiplicative interaction term.

* Significant at the 0.10 level (two-tailed).

** Significant at the 0.05 level (two-tailed).

*** Significant at the 0.01 level (two-tailed).

formations appears to be justified. Panel C suggests that roughly 85 percent of the sampled companies purchased some amount of property insurance over the research period, while about 85 percent of them spent less than one percent of the book value of their physical assets on property insurance. This level of property insurance expenditure is low compared with the same figure (about 5 percent) of US firms reported in Hoyt and Khang (2000). Panel D reports the *t*-tests of the mean differences between property insurance users and non-users. As predicted, the users tend to have a higher leverage and a greater degree of physical assets intensity than non-users. However, the users are unexpectedly large companies with low Tobin's *Q* (*GROW*). Additionally, statistically significant differences in *LEVMAN* and *LEV**GROW* are found between the users and non-users. This finding suggests that leverage/managerial ownership and leverage/growth options could interact to influence the corporate property insurance decision. Otherwise, no significant differences in other variables are found between the users and non-users. Panel E presents the χ^2 tests of the independence between dummy independent variables and insurance participation decision. The results reveal that there are geographical and industrial differences (*INDU*₄ and *INDU*₅) in insuring behavior among our sample firms. Additionally, the existence of tax-loss carry-forwards appears to affect the managerial propensity to insure.

Table 2 presents the results of the correlation analysis. *LEV*, *STRUC* and *SIZE* are found to be positively related to *INSCHO*—though the finding of *SIZE* is inconsistent with our expectations. This observation suggests that large Chinese companies with higher leverage and a greater intensity of physical assets are more likely to insure than other companies. However, contrary to hypothesis H2a, *INSCHO* is negatively associated with *GROW* and positively correlated with *SUBSIDY*. Again, the statistically significant correlations between some interaction terms and *INSCHO* imply that these factors could interact to affect the property insurance participation decision. *GEOG* is also unexpectedly found to be negatively associated with *INSCHO*, suggesting that companies incorporated in economically more developed Eastern coastal regions are less likely to insure than inland-based companies. Additionally, manufacturers (*INDU*₅) appear to have a greater likelihood of insuring their assets, whilst conglomerates (*INDU*₄) tend to be less likely to insure their assets than other companies.

Turning to the volume of insurance use we find that as predicted, large companies appear to insure to a relatively lesser extent than small companies, though the former seems more likely to insure in the first place. Also, as expected, growth opportunities (*GROW*) is statistically significant and positively related to the volume of property insurance. However, inconsistent with our predictions, companies with a higher leverage and higher proportion of physical assets in their asset structure tend to buy less insurance than other companies. The correlation results regarding the impact of industry and geographical factors on the propensity and volume of property insurance are generally consistent with those of insurance participation. *TAXLOSS* is found to be unexpectedly and negatively associated with both the likelihood and extent of property insurance usage. This suggests that Chinese firms with tax-loss carry-forwards are less likely to insure and seem to purchase less property insurance than companies that do not have tax-loss carry-forwards. The seemingly different directional influences of some variables (e.g., leverage and firm size) on the property insurance participation and volume decisions further suggests that the determinants of these two

Table 2

PRC-based publicly-listed companies, 1997–1999—correlation matrix, variance inflation factors and condition indices

A. Correlation coefficients

	<i>INSCHO</i>	<i>INS</i>	<i>LEV</i>	<i>GROW</i>	<i>STATE</i>	<i>MAN</i>	<i>SIZE</i>	<i>FOWN</i>	<i>STRUC</i>	<i>TAXRATE</i>	<i>TAXLOSS</i>
<i>LEV</i>	0.149***	−0.076*	–								
<i>GROW</i>	−0.100**	0.105**	−0.406***	–							
<i>STATE</i>	0.035	0.004	0.013	−0.163***	–						
<i>MAN</i>	−0.029	0.021	−0.089**	0.297***	−0.164***	–					
<i>SIZE</i>	0.106***	−0.089**	0.301***	−0.455***	0.072**	−0.059	–				
<i>FOWN</i>	0.060	−0.006	0.066*	−0.304***	−0.118***	−0.111***	0.305***	–			
<i>STRUC</i>	0.163***	−0.117***	0.062	−0.156***	0.050	−0.038	0.070*	−0.021	–		
<i>TAXRATE</i>	−0.029	0.030	−0.080**	−0.029	0.134***	−0.044	0.113***	−0.109***	0.021	–	
<i>TAXLOSS</i>	−0.093**	−0.130***	0.148***	−0.104***	0.007	−0.129***	−0.029	0.108***	0.031	−0.217***	–
<i>LEVMAN</i>	0.190***	0.007	0.086**	−0.087**	0.131***	−0.011	0.054	−0.033	0.095**	0.032	−0.076*
<i>SIZEMAN</i>	0.053	−0.030	0.051	0.089**	−0.075*	0.023	0.002	0.014	−0.124***	−0.026	0.031
<i>LEV GROW</i>	0.071*	0.046	0.017	−0.087**	0.041	−0.060	0.008	−0.004	0.109***	−0.030	−0.041
<i>SUBSIDY</i>	0.080**	0.013	0.101***	−0.043	0.036	−0.003	0.115***	−0.091**	0.030	0.202***	−0.041
<i>GEOG</i>	−0.080**	−0.212***	0.131***	−0.173***	−0.197***	−0.019	0.273***	0.236***	0.101***	−0.103***	0.203***
<i>INDU</i> ₁	0.025	−0.051	0.012	−0.040	0.027	0.096**	−0.084**	−0.121***	0.239***	0.112***	−0.033
<i>INDU</i> ₂	−0.054	−0.204***	0.168***	−0.062	0.105***	0.071*	0.178***	0.030	0.087**	−0.001	0.123***
<i>INDU</i> ₃	0.023	0.060	−0.072*	0.013	0.007	0.002	0.013	−0.065*	−0.028	−0.037	−0.061***
<i>INDU</i> ₄	−0.171***	−0.126***	−0.034	0.093**	−0.158***	0.013	−0.093**	−0.051	−0.098**	−0.100***	0.043
<i>INDU</i> ₅	0.109***	0.176***	−0.026	−0.011	0.036	−0.114***	0.041	0.143***	−0.139***	0.001	−0.029

Table 2 (Continued)

	LEVMAN	SIZEMAN	LEVGrow	SUBSIDY	GEOG	INDU ₁	INDU ₂	INDU ₃	INDU ₄	INDU ₅
SIZEMAN	0.215***	–								
LEVGrow	0.247***	0.048	–							
SUBSIDY	–0.002	–0.058	–0.011	–						
GEOG	–0.039	–0.093**	–0.059	0.060	–					
INDU ₁	0.021	–0.081**	0.042	0.002	0.128***	–				
INDU ₂	0.110***	–0.002	0.027	–0.061	0.144***	–0.098**	–			
INDU ₃	0.026	0.034	0.057	0.043	0.069*	–0.104***	–0.054	–		
INDU ₄	–0.129***	–0.020	–0.113***	–0.029	–0.108***	–0.162***	–0.083**	–0.089**	–	
INDU ₅	0.011	0.059	0.006	–0.105***	–0.082**	–0.554***	–0.285***	–0.303***	–0.471***	–

Note. Reported correlations were computed using the Spearman rank test among the rank-transformed equivalents of corresponding variables (except for the non-metric variables). The number of cases involved in the calculation of correlation with *INS* is 593 observations; otherwise it is 668 observations.

- * Significant at the 0.10 level (two-tailed).
- ** Significant at the 0.05 level (two-tailed).
- *** Significant at the 0.01 level (two-tailed).

Table 2 (Continued)

B. Variance inflation factors and condition index

	Probit model	Volume model
<i>LEV</i>	1.360	1.332
<i>GROW</i>	1.886	1.843
<i>STATE</i>	1.232	1.149
<i>MAN</i>	1.182	1.145
<i>SIZE</i>	1.562	1.459
<i>FOWN</i>	1.600	1.484
<i>STRUC</i>	1.158	1.067
<i>TAXRATE</i>	1.155	1.129
<i>TAXLOSS</i>	1.197	1.136
<i>LEVMAN</i>	1.188	1.172
<i>SIZEMAN</i>	1.113	1.103
<i>LEVGROW</i>	1.106	1.094
<i>SUBSIDY</i>	1.077	1.052
<i>GEOG</i>	1.358	–
<i>INDU</i> ₁	1.208	–
<i>INDU</i> ₂	1.168	–
<i>INDU</i> ₃	1.106	–
<i>INDU</i> ₄	1.141	–
Largest condition index	9.947	9.439

Note. (1) See Table 1 notes. (2) Variance inflation factors and condition index in the probit and volume models are computed using 668 and 593 cases, respectively.

insurance decisions can be different and a two-stage analysis approach would therefore be necessary.

We also compute variance inflation factors (VIFs) and condition indices to test for the presence of multicollinearity (see Table 2, panel B). The calculated VIFs in both participation and volume models are all less than 2 and the (largest) condition indices in both models are less than 10. Therefore, multicollinearity does not appear to be a severe problem in this study (e.g., see Kennedy, 1998, p. 190).

5.2. Multivariate results

5.2.1. Participation decision model results

The parameter estimates of Eq. (1) are shown under Model (1) in Table 3. The coefficient for *LEV* is found to be positive and statistically significant. This supports the hypothesis H1a that companies with a high leverage are more likely to use property insurance than companies with less debt in their capital structure in order to mitigate the shareholder–debtholder incentive conflicts. Indeed, Ma et al. (1998) report that in China it is becoming increasingly common for major creditors (such as commercial banks) to request collateralized assets-related insurance coverage to give them ex ante protection against ex post potential losses.

Different from hypothesis H4a, *MAN* is found to have positive influence on a company's propensity to purchase property insurance (despite its insignificance). As noted earlier (Section 3.1), the linkage between managerial share ownership and the corporate insurance needs to be considered jointly with two interactive terms—*LEVMAN* and *SIZE-*

Table 3
 PRC-based publicly-listed companies, 1997–1999
 A. Multivariate results

Variable	Expected sign	INS CHO (1)	INS (2)	INS CHO (3)	INS (4)
<i>Intercept</i>	+/-	0.556 (0.602)	–	0.338 (0.552)	–
<i>LEV</i>	+	1.003*** (0.306)	0.024 (0.044)	1.054*** (0.310)	0.022 (0.042)
<i>GROW</i>	+	–0.053 (0.348)	0.075** (0.032)	–0.054 (0.343)	0.075** (0.032)
<i>STATE</i>	–	–0.190 (0.292)	0.031 (0.052)	–	–
<i>MAN</i>	–	0.211 (0.284)	0.172*** (0.043)	0.219 (0.286)	0.171*** (0.043)
<i>SIZE</i>	–	0.470 (0.313)	–0.301*** (0.057)	0.509 (0.317)	–0.306*** (0.058)
<i>FOWN</i>	+	0.121 (0.440)	0.508** (0.233)	0.091 (0.441)	0.495** (0.235)
<i>STRUC</i>	+	0.800*** (0.262)	–0.137*** (0.044)	0.788*** (0.264)	–0.137*** (0.043)
<i>TAXRATE</i>	–	–0.464* (0.269)	0.030 (0.021)	–0.472* (0.262)	0.018 (0.021)
<i>TAXLOSS</i>	+	–0.422* (0.230)	0.023 (0.024)	–0.435* (0.230)	0.030 (0.024)
<i>LEVMAN</i>	–	1.080*** (0.293)	–0.041 (0.034)	1.112*** (0.297)	–0.046 (0.033)
<i>SIZEMAN</i>	–	0.130 (0.257)	–0.068** (0.031)	0.163 (0.259)	–0.068** (0.030)
<i>LEVGROW</i>	+/-	–0.298 (0.281)	–0.031 (0.021)	–0.297 (0.282)	–0.030 (0.020)
<i>SUBSIDY</i>	–	–0.124 (0.139)	–0.0003 (0.0008)	–0.107 (0.141)	–0.0001 (0.0078)
<i>GEOG</i>	+	–0.332* (0.184)	–	–0.376** (0.182)	–
<i>INDU₁</i>	+/-	–0.174 (0.220)	–	–0.115 (0.223)	–
<i>INDU₂</i>	+/-	–0.845*** (0.331)	–	–0.852*** (0.329)	–
<i>INDU₃</i>	+/-	0.120 (0.357)	–	0.174 (0.361)	–
<i>INDU₄</i>	+/-	–0.651*** (0.198)	–	–0.661*** (0.198)	–
<i>YEAR₉₇</i>	+/-	–0.268 (0.175)	–0.014 (0.011)	–0.276 (0.176)	–0.013 (0.011)
<i>YEAR₉₈</i>	+/-	–0.058 (0.176)	–0.0008 (0.007)	–0.073 (0.177)	–0.0006 (0.0073)
<i>STATEDUM</i>	–	–	–	–0.322* (0.177)	0.039 (0.030)
λ	+/-	–	–0.101 (0.099)	–	–0.108 (0.090)
Pseudo- R^2/R^2	χ^2/F test	0.421***	0.869***	0.437***	0.870***

Table 3 (Continued)

B. Model diagnostics

	Test	d.f.	Statistic
Insurance participation decision model (based on Model (1))			
LM test of heteroskedasticity of probit model	χ^2	1	0.145
LR test of heteroskedasticity of probit model	χ^2	1	0.214
Insurance volume decision model (based on Model (2))			
Wald test for a pooled OLS model versus a fixed-effects model	F	212,365	16.872***
LM test for a pooled OLS model versus a random-effects model	χ^2	2	359.44***
Hausman test for a random-effects versus a fixed-effects model	χ^2	15	36.32***
White test of heteroskedasticity	χ^2	240	391.13***

Notes. (1). Model 1 and 2 are estimated using 668 and 593 cases, respectively. (2) Standard errors are reported in parentheses. In volume decision models, White's standard errors robust to unknown heteroskedasticity are reported. Intercept for a two-way fixed-effects model with White correction is not available.

* Significant at the 0.10 level (two-tailed).

** Significant at the 0.05 level (two-tailed).

*** Significant at the 0.01 level (two-tailed).

MAN. The former is positive and statistically significant, suggesting that for given levels of insider ownership, managerial propensity to purchase property insurance increases with leverage. This finding is consistent with the *managerial risk-aversion* hypothesis of Smith and Stulz (1985), but runs counter to the *incentive-alignment* hypothesis (e.g., see Downs and Sommer, 1999). It is plausible that when leverage increases, the risk of financial distress becomes higher, thus increasing the equity price risk of managers' shareholdings and potentially adversely affecting their job security. As a result, managers are more likely to purchase property insurance in highly indebted corporate states than would otherwise be the case when leverage is low. However, *SIZEMAN* is not statistically significant at conventional levels, thus we find no significant interaction between firm size and managerial share ownership on the property insurance participation decisions among our sample of Chinese firms.

As predicted, companies with a greater degree of physical assets intensity are more likely to purchase property insurance to manage asset-loss risk. Also, *TAXRATE* is found to be negative and statistically significant. This appears to provide some support for the view that companies with more tax credits (i.e., lower actual tax rate) are more likely to use property insurance in order to maximize the value of tax shields. Interestingly, the estimate of coefficient for *TAXLOSS* is unexpectedly negative and significant ($p \leq 0.10$). This suggests that the convexity of tax position arising from the tax-loss carry-forwards in fact discourages Chinese managers from purchasing property insurance. This might reflect the possibility that Chinese managers in (financially) poorly-performing companies might be under pressure (e.g., from shareholders) to curtail business expenses including insurance.

The insurance participation decision of Chinese managers also appears to vary according to geographical location and industrial sector. Different from expected, *GEOG* is found to be inversely related to the property insurance participation decision, implying that Chinese PLCs incorporated in inland regions have a greater propensity to use property insurance than their counterparts in coastal areas. One possible reason for this is that, compared with managers in companies located in the economically more developed Eastern

coastal regions, inland-based company managers might have few risk management alternatives to insurance and less expertise in risk management. Alternatively, in-land based companies may face a greater risk of asset loss—for example, due to generally poor loss prevention and/or inadequate safety systems. As a result, they tend to be more likely to rely on the usage of (potentially expensive) commercial insurance to manage asset-loss risk than other forms of risk management.

Turning to the results for the industry sectors, real estate ($INDU_2$) and conglomerate companies ($INDU_4$) appear less likely to purchase property insurance than companies from other industries. This is not surprising as a large proportion of the assets of Chinese real estate companies are (statutorily) uninsurable land. Additionally, conglomerate firms can achieve risk diversification through multi-line business operations and thus have less need for property insurance compared with other companies, all else equal.

Albeit correctly signed, *GROW*, *STATE*, *FOWN* and *SUBSIDY* are not found to have a statistically significant influence on the property insurance participation of Chinese firms. Furthermore, the two year dummies are not statistically significant, suggesting there have not been (material) time-related changes regarding the managerial decision to participate in commercial property insurance amongst our sample of Chinese PLCs.

The diagnostics presented under Model (1) include a χ^2 statistic for testing the null hypothesis that the regression coefficients (excluding the intercept) are jointly zero. The computed χ^2 statistic allows us to reject this null hypothesis. Two additional χ^2 statistics are calculated using the LM and likelihood ratio (LR) tests for heteroskedasticity (see panel B of Table 3). In both cases, the calculated χ^2 and associated p-values could not reject the null hypothesis, implying that heteroskedasticity is not a severe problem in the probit model.

5.2.2. Volume decision model results

The linkage between the volume of property insurance and firm-specific characteristics is examined by estimating a fixed-effects model with Heckman's sample selection correction. Only those sample companies that purchased property insurance are included in this model ($n = 593$). The results are presented in Table 3 under Model (2). In addition, the White's test is conducted to test for the presence of heteroskedasticity in Model (2). The computed χ^2 statistic is statistically significant at the 0.01 level, indicating the presence of heteroskedasticity in the volume decision model. Thus, White's heteroskedasticity consistent-standard errors are reported.

Contrary to hypothesis H1b, the coefficient of *LEV* is not statistically significant in the volume decision model. This suggests that some companies with a high leverage do not appear to purchase property insurance in proportion to the level of their outstanding debt. Therefore, it seems that though major creditors (e.g., commercial banks) may require collateralized assets to be insured, the level of insurance coverage does not appear to give them adequate ex ante protection against ex post asset losses.

STRUC is now unexpectedly negative and statistically significant. This finding suggests that Chinese companies do not purchase property insurance in amounts proportionate to the total (book) value of physical assets though companies with relatively more physical assets in their asset structure are more likely to buy property insurance in the first place.

This provides further evidence that Chinese companies may be under-insuring their asset-loss risk externally through (potentially costly) commercial insurance programs.

Consistent with hypothesis H2b, *GROW* is found to be positive and statistically significant. This result suggests that companies with high growth opportunities appear to use more property insurance in order to mitigate severe agency problems (e.g., the underinvestment incentive) arising from high growth opportunities between debtholders, shareholders and managers.

Contrary to hypothesis H4b, the coefficient for *MAN* is positive and statistically significant in the volume model. This finding suggests that managers with relatively high levels of (insider) share ownership are more likely to be engaged in managing asset risks via property insurance than their counterparts with relatively low levels of insider ownership. Again, this observation is compatible with Smith and Stulz's (1985) *managerial risk-aversion* hypothesis, but inconsistent with the *incentive-alignment* hypothesis. It is worth noting, however, that this result is contrary to the evidence documented in Hoyt and Khang (2000). Nonetheless, this is not necessarily surprising as the generally low levels of insider ownership in Chinese PLCs may not effectively align managerial interests with those of shareholders (Sun et al., 2002).

Consistent with Hoyt and Khang (2000), *SIZEMAN* is negative and statistically significant. This implies that the relation between managerial ownership and the volume of property insurance appears to decline as companies increase in size. This observation provides some support for the notion that managers in small companies are likely to face greater business risks because it is more difficult for managers to diversify human capital than their counterparts in large companies. We thus interpret this result to be consistent with the *managerial risk-aversion* hypothesis. However, the other two interaction terms *LEVMAN* and *LEV GROW* are not found to be statistically significant.

SIZE is now negative and statistically significant as expected. This finding is consistent with the findings of prior studies (e.g., Yamori, 1999; Hoyt and Khang, 2000), thus suggesting that small companies appear to purchase relatively greater amounts of property insurance than their large counterparts given their potentially greater susceptibility to downside business risks and/or their demand for insurers' real services (e.g., loss prevention). As expected, *FOWN* is positive and statistically significant, implying that Chinese companies with a (relatively) greater degree of foreign ownership tend to purchase more property insurance than domestically owned companies. This could indicate that foreign investors in the PRC may have a stronger degree of insurance awareness than domestic investors.

Otherwise, *STATE*, *TAXRATE*, *TAXLOSS* and *SUBSIDY* are not found to be important determinants of the volume of property insurance used by Chinese PLCs. It is worth noting that *SUBSIDY* appears to be negatively related to both the property insurance participation and volume decisions, suggesting a potential substitutive linkage between government subsidies and the use of commercial insurance.

5.3. Sensitivity tests and robustness checks

5.3.1. Sensitivity tests

In this section, we further test the possible influence of State ownership on the property insurance decision.

First, the significant correlation between *STATE* and *MAN* (-0.164 , $p \leq 0.01$; see Table 2) leads us to use an alternate proxy for State ownership and test the sensitivity of our results. Specifically, we use a dummy variable *STATEDUM* (1 = with State ownership; 0 = without State ownership) to replace *STATE*. The computed correlation coefficient between *STATEDUM* and *MAN* is now -0.093 ($p \leq 0.05$), which is significantly lower than the previous one. The insurance participation and volume decision models are re-estimated and reported under Models (3) and (4) in Table 3. *STATEDUM* is found to be negatively significant in the participation model ($p \leq 0.10$), but insignificant in the volume decision models. This suggests that firms with a greater level of State ownership are less likely to insure their assets than firms with a lower level of State ownership thus providing some support for our hypothesis H3a. Comparing the findings of Models (1) and (3) reveals that, in general, the results of the other variables are qualitatively unaffected.

It appears that from our participation decision results, *MAN* and *STATE* have a different impact on the insurance decisions of Chinese firms, and so we examine further the interaction of *MAN* and *STATE* on the corporate purchase of property insurance. This is done using a dummy variable for managerial ownership (that takes the value of 1 when *MAN* = 0 and 0 when *MAN* > 0). The dummy variable representing managerial ownership is then multiplied by *STATE* to derive an interaction term—*STANOMAN*. This interaction term is then included and the participation and volume decisions are re-estimated. In unreported results,²⁴ the coefficient of *STANOMAN* is -2.529 (significant at the 10% level in a two-tailed test) in the participation decision model, but insignificant in the volume decision model. This indicates that there is a significant difference in the relation between State ownership and propensity to insure for firms with and without managerial ownership. Specifically, firms with managerial ownership are more likely to purchase property insurance than firms without managerial ownership, other things being equal. This finding provides further evidence that managerial ownership in China encourages corporate risk management activities like insurance—a result that is different from prior US-based studies.

Second, Leung and Young (2002) report that as part of the banking sector reforms of 1998, Chinese banks introduced new (market-based) lending procedures. This raises the possibility of a structural change in the incidence and level of commercial property insurance purchases during the period of our analysis. For example, after the 1998 reforms, commercial banks could have significantly tightened their credit policy by requesting collateral and associated insurance covers. As a result, the leverage-insurance relation is likely to have changed before and after the reform. We test this possibility by including a dummy variable (*CHG*, assigned 1 for 1999 and 0 for 1997–1998),²⁵ we then interact this dummy with *LEV* and include the multiplicative interaction term (i.e., $CHG \times LEV$) in the model and redo the estimations. In unreported results, $CHG \times LEV$ is not significant in the participation model, indicating that there was no significant change in the relation between leverage and insurance participation decision before and following the reform. Additionally, *LEV* was found to have no significant impact on the amount of insurance purchases in

²⁴ Except for the new variable *STANOMAN*, all other results remain essentially the same.

²⁵ Because the reform started in the second half of 1998, therefore we only treat year 1999 as the post-reform period to allow for the possible lag effect of the reform.

both the pre- and post-reform periods. However, the coefficient of $CHG \times LEV$ is negative and statistically significant ($t = -2.36$, $p \leq 0.05$). This means that compared with the period 1997–1998, the same-leverage firm seems to purchase less property insurance in 1999. Therefore, it appears that the reform in 1998 did not result in a significantly positive change on the corporate purchase of property insurance in China. Instead, the above decrease in the leverage-insurance relation might reflect the impact of the Asian financial crisis that broke out at the end of year 1997 when many Chinese firms were adversely affected. Otherwise, the results of the models with $CHG \times LEV$ are essentially unchanged.

Third, the observed different impact of some determinants on insurance participation and volume decisions in the PRC could be driven by many factors (such as cash flow constraints and behavioral factors—for example, managers' past loss experiences and future loss estimates) (e.g., see Brown and Hoyt, 2000). Testing for the effects of behavioral factors is outside of the scope of the present study. Nonetheless, we try to test for possible consequences of corporate cash flow constraints on insurance decisions. We thus partition our sample of insuring companies into two groups—those with and without cash flow constraints. A company is defined as having cash flow constraint if it is above the 75 percentile of the sample leverage (i.e., 1.40) and concomitantly below the 25 percentile of internal cash balances (i.e., 0.16). We then conduct both a sample t -test and a Mann–Whitney U test to compare the level of INS between the above two groups. In both tests, the computed t - and z -statistics are negatively significant at the 0.01 level. This finding thus lends some support for the notion that while facing severe cash flow constraints, managers might cut back business expenditure (including expensive insurance premiums) in order to meet obligations under debt contracts.

5.3.2. Further robustness checks

The purchase of property insurance could also help to expand a company's debt capacity (Grace and Rebellio, 1993), thus raising the possibility of a two-way causal linkage between INS and LEV . If this is the case, our estimation of LEV may be biased. Therefore, as suggested in Kennedy (1998, p. 165), we perform an omitted-variables version of the Hausman test to investigate the possible endogeneity problem with LEV . First, we introduce an instrumental variable— $INTCOV$ (interest cover, the ratio of the annual interest expenses incurred to earnings before interest and tax (EBIT)) that are correlated with leverage, but not directly related to property insurance usage.²⁶ Second, we regress LEV on all the other exogenous variables (including $INTCOV$) and the fixed-effects to derive its fitted value as a refined instrument. Third, we regress INS on LEV , its fitted instrument, and all other independent variables (including fixed-effects). An F -test, with the null hypothesis that the coefficient of the instrument equals zero, is then conducted. The computed F -statistic ($F_{1364} = 0.305$) is statistically insignificant at the 0.10 level, suggesting that we cannot reject the null hypothesis that LEV is contemporaneously uncorrelated with the

²⁶ $INTCOV$ could proxy for a firm's insolvency risk. While insurance may (potentially) enhance debt capacity, thereby increasing interest expenses, the presence of insurance may also lead creditors to lower the rate of interest charged. Additionally, $INTCOV$ is affected by a firm's EBIT. Therefore, the relation between $INTCOV$ and insurance is unwarranted and we feel that it is reasonable to assume that the interest-to-EBIT ratio is contemporaneously uncorrelated with the error term.

error term. Therefore, an endogeneity issue with respect to *LEV* should not be a serious problem in this study.

6. Conclusions

Three main conclusions emerge from our study. First, conceptual frameworks, such as agency-theory, appear to offer important insights into the determinants of the corporate purchase of property insurance in China. Specifically, the positive impact of leverage on insurance propensity could reflect creditors' "me-first" rules that require collateralized assets to be insured in order to give lenders *ex ante* protection against potential *ex post* losses. While different from previous research findings from the US, the positive role of managerial share ownership in the volume decisions of property insurance further suggests that managers' risk aversion (e.g., arising from their concerns over job security and ill-diversified personal wealth) could also help to explain corporate insurance decisions in China. The observed positive linkage between a firm's growth options and the level of property insurance usage also indicates the intention of debtholders, managers and/or shareholders to use property insurance to mitigate acute information asymmetries in companies with high growth options. Moreover, this study finds that some determinants could interact with each other to exert a joint influence on firms' insurance decisions. For example, the (positive) impact of managerial ownership on propensity to insure increases with the levels of leverage.

Second, we find evidence that the existence of State ownership could decrease the managerial desire to use commercial property insurance. In contrast, the presence of high levels of foreign ownership appears to encourage the corporate procurement of property insurance. This finding adds to the literature that, along with managerial ownership, State and foreign ownership can play important but differing roles in corporate risk management activities—an insight not provided by prior studies. Also our results suggest that the (positive) role of managerial ownership in an emerging market like China can be different from that observed in more developed markets (e.g., the US). However, the finding on the tax motive for corporate purchase of insurance is mixed. For example, tax convexity arising from tax exempt/rebates (manifest in low effective taxation rates) appears to motivate Chinese managers to purchase property insurance. In contrast, the convexity of corporate tax schedules (arising from the existence of operating loss carry-forwards) appears to be treated as a binding financial condition, thereby encouraging Chinese managers to curtail business expenses (including property insurance spending).

Third, an interesting result is that in some cases the same determinant factor (e.g., leverage and asset structure) could have different effects on the property insurance participation and volume decisions. Indeed, once a company's management decides to insure its asset risks, many factors (e.g., cash flow constraints, managers' past risk/loss experiences and perceptions of future exposures) can affect the volume of property insurance purchased. This suggests that the insurance volume decision is inherently more complicated than the insurance participation decision, thereby warranting more detailed investigations.

Finally, we believe that our results could have important implications for various parties with a commercial interest in the Chinese corporate sector. For example, the under-

insurance of asset-loss risk that appears to exist in the Chinese corporate sector suggests that creditors and/or shareholders may have to screen and monitor more closely the risk management practices of indigenous managers. Additionally, the empirical regularity that appears to exist (e.g., between firm size, foreign ownership and the corporate use of property insurance in China) could help insurance suppliers, including foreign insurers, to better target potential customers.

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