

ON THE CORPORATE DEMAND FOR INSURANCE: THE CASE OF KOREAN NONFINANCIAL FIRMS

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ABSTRACT

Several theories have been developed to explain the motives for corporate insurance purchases, but there are few empirical tests of these theories. Furthermore, the empirical results are not consistent across studies, suggesting the need for further research. This study uses accounting data for 433 publicly listed nonfinancial firms in Korea to test the determinants of insurance demand for the period 1990 through 2001. Our results support the theory that firm size, tax considerations, and firm ownership are important determinants of insurance demand. Firms that are members of chaebols demand more insurance than unaffiliated firms, all else equal. Contrary to theory, our results also indicate that firms that have higher debt-to-equity ratios demand less insurance than less leveraged firms, and that firms that have greater liquidity demand more insurance. This might be related to the overall high debt levels of firms in the period leading up to the Korean financial crisis in 1997, but that investigation is beyond the scope of this study.

INTRODUCTION

Risk aversion as a motive for the purchase of insurance by individuals is well supported. However, the motive for the purchase of insurance by large, publicly traded corporations is less well understood. Mayers and Smith (1982) and Main (1983) argue that since individual shareholders can diversify firm-specific insurable risk by holding a portfolio of stocks, insurance does not increase the value of the firm because insurance premiums contain loading factors. Thus, even though they might be risk averse as individuals, well-diversified shareholders would not choose to reduce their wealth by authorizing the firm to purchase insurance against its own idiosyncratic risk. Contrary to this theoretical prediction, however, evidence indicates that corporations purchase substantial amounts of insurance. For example, commercial property and liability insurance in the U.S. market accounts for just over 50 percent of the approximately \$350 billion in insurance premiums collected in 2002 (Hartwig, 2003).

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Several theories have emerged to explain this seemingly irrational behavior. One argument is that convexity in the tax code encourages insurance purchases as a way to decrease expected tax liabilities (see, e.g., Main, 1982, 1983; Mayers and Smith, 1982). Mayers and Smith (1982) also argue that insurance allows firms to reduce expected bankruptcy costs by shifting the cost of high-severity events to an insurer. In addition, regulators might require the purchase of some forms of insurance, such as workers compensation insurance in the U.S. market. Furthermore, insurers provide services such as claims settlement and safety recommendations that might be valuable to the firm.

Agency theory provides additional reasons for the corporate purchase of insurance. Myers (1977) argues that shareholders might forego potentially profitable investments if the benefits accrue to bondholders. In this case, insurance can be used to bond investment decisions (see, e.g., Smith, 1986; MacMinn, 1987; Mayers and Smith, 1987; Schnabel and Rouimi, 1989; Garven and MacMinn, 1993). Han (1996) examines the link between optimal managerial compensation contracts and the purchase of insurance when managers are risk averse. Insurance can signal reliability (Main, 1982; Grace and Rebello, 1993) and act as a monitor of firm quality for the firm's shareholders and trading partners. However, a firm with a greater degree of institutional ownership might rely less on insurance to act as a monitor of bankruptcy potential, since the institutional investors may have a comparative advantage in monitoring. The ownership structure of the firm can also influence the purchase of insurance. A closely held firm may be more likely to purchase insurance than a widely held one, since its owners may be less well diversified.

Empirical tests of these theories are scarce owing to the difficulty in gathering information on corporate insurance purchases, especially for U.S. firms. Mayers and Smith (1990) use a cross-section of data from primary insurer purchases of reinsurance for 1981 to estimate corporate insurance demand. Core (1997) focuses on the demand for director and officer liability insurance for a sample of Canadian firms, whereas Yamori (1999) investigates general corporate insurance purchases using a 1986 cross-section of Japanese nonfinancial firms. Hoyt and Khang (2000) extend the analysis to publicly traded U.S. nonfinancial firms. They use a cross-section of U.S. firms in 38 industries to estimate the determinants of the purchase of property insurance for fiscal year 1989. Zou, Adams, and Buckle (2003) study the demand for insurance in China using a sample of firms over the period 1997 through 1999. They use a two-stage process to model the probability of a firm choosing to purchase insurance in the first stage, and the amount of insurance purchased in the second stage.

All of these studies have found some support for the various theories of insurance demand, but the results are not consistent across the studies. For example, consistent with theory, Mayers and Smith (1990) find that reinsurance purchases are related to firm ownership, with more concentrated ownership leading to greater reinsurance demand. However, Core (1997) found that more concentrated ownership produced a lower demand for directors' and officers' liability insurance, and Yamori (1999) found no significant relation between measures of firm ownership and insurance demand.¹

¹ This is attributed to the fact that all firms in the study are large, publicly traded firms, with a significant concentration of institutional ownership of shares, especially among members of keiretsu (see note 4).

Contrary to theory, Zou, Adams, and Buckle (2003) found that insurance demand was negatively related to firm risk levels and to liquidity, suggesting that firms facing financial distress may reduce expenditures on discretionary insurance purchases.

Our study adds to this empirical literature in several important ways. Mayers and Smith (1990) focus on one industry, whereas Core (1997) studies one specialized type of insurance. Yamori (1999) and Hoyt and Khang (2000) consider more general insurance demand models but do not control for the potential impact of time effects. Because of data-gathering costs, all of these prior studies rely on cross-sectional analysis. This might lead to bias in the results if insurance purchases are influenced by insurance market cycles or other economic conditions over time. Furthermore, it is likely that current-year demand for insurance is related to the previous year's loss experience. Studies that rely on a single year of observations cannot control for this potential effect. Although Zou, Adams, and Buckle (2003) use a cross-sectional time series analysis, the generalizability of their results may be limited by the relatively short (3-year) period, and the fact that the Chinese commercial insurance market is strictly regulated with respect to price.²

In the current study, we analyze a more general model of insurance demand across a broad range of industries and a number of time periods, using data from the Korean market. Unlike U.S. firms, Korean firms report insurance premium expenditures and property-casualty losses in their published financial statements. Our data are drawn from a sample of 433 manufacturing firms listed on the Korean stock exchange for the period 1990 through 2001.³ Using a longer time series allows us to control for the potential impact of insurance and economic cycles, as well as the fact that the current year's insurance purchase may be affected by casualty losses or firm performance in the previous period. An important contribution of this research is that we can test whether theories of insurance demand are consistent across different countries and institutional environments.

Below, we discuss several important differences between the U.S. and Korean models of firm organization. Combined with our time series data, these institutional features allow us to examine some of the predictions of the theory of insurance demand in a dynamic environment, and also provide specific insights into the Korean economic system. The article is organized as follows. In "Institutional Environment," we briefly describe important features of the Korean economy during the period of our study. In "Insurance Demand Theories," we review the theories that support the demand for insurance by large corporations, and develop testable hypotheses. In "Empirical Analysis," the data are described in detail, and the estimation methodology is discussed. In "Empirical Results," we present the empirical results, and the last section concludes.

INSTITUTIONAL ENVIRONMENT

Although there are similarities between U.S. and Korean firms, the institutional framework is somewhat different. Like Japanese firms, large Korean manufacturers are often

² The authors note that insurers' inability to charge risk-based premiums implies that insurance demand will not be influenced by insurance prices that are related to risk class. This is not the case for the Korean market analyzed here.

³ Other industries, such as financial service and real estate firms, are excluded because of different reporting methods in accounting.

members of conglomerates, called chaebols.⁴ The chaebols developed as a result of extensive government intervention in the economy in the early 1960s, which sought to strengthen Korea's economy by encouraging the growth of heavy manufacturing through exports (Beck, 1998; Nam, 2004). One tool to encourage economic development was credit rationing. Subsidized credit was granted to firms that met production and export targets, allowing such firms to grow relatively quickly, and to acquire other firms (Chang and Chang, 1994; Gul and Kealey, 1999). By 1996, the chaebols were responsible for approximately half of all sales in the Korean economy (Beck, 1998). The chaebols are large, diversified, family-run companies with extensive networks of subsidiaries. Beck (1998) reports that the average number of subsidiary firms within a chaebol was 26.8 at the end of 1997.

A distinctive feature of the chaebol structure is that the chaebol general manager (chairman) is typically a minority owner but effectively controls a large block of shares in the subsidiary firms. For example, the Korean Fair Trade Commission reported that the average equity ownership of the chairmen of the 36 largest chaebols in the top-level company of the chaebol was just 1.95 percent in 2003.⁵ However, relatives of the chairmen held an additional 2.66 percent of shares, whereas subsidiary firms held 41.71 percent. This interlocking ownership of equity allows the chairmen to control approximately 46.5 percent of the group's equity shares on average. Figure 1 illustrates this structure using the ownership and control of shares by Lee Kun-Hee, Chairman of Samsung Electronics and son of the founder.⁶ Samsung is the second largest chaebol in Korea. Group Chairman Lee Kun-Hee owns just 8.3 percent of Samsung Electronics directly. However, he also controls 14.1 percent of Cheil Jedang, which owns 3.2 percent of Samsung Electronics. Cheil Jedang owns 11 percent of Samsung Life, and Lee owns 15 percent of Samsung Life directly. Samsung Life, in turn, owns 8.7 percent of Samsung Electronics. According to Beck (1998), Samsung had an in-group shareholding ratio of 46.7 percent as of the end of 1998.

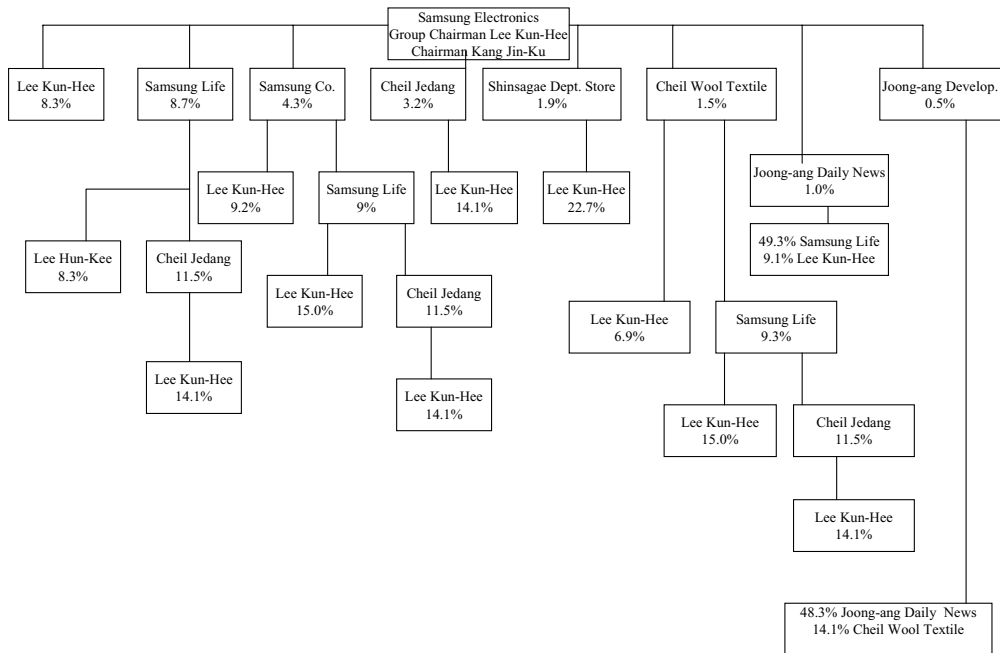
This concentration of control, despite apparently minor shareholdings by controlling managers, might have important implications for insuring decisions of chaebol firms. The lack of effective separation of ownership and control might lead to unacceptable exposure for the independent shareholders, leading to an increased demand for insurance. Also, it might be that the chaebol managers, although seemingly minor shareholders in the managing company and the chaebol subsidiaries, are exposed to company-specific risk. This is because they have a large share of assets invested in the chaebol firms in the aggregate. Alternately, it might also be the case that insurance is less important for members of chaebols, because there is a greater degree of authority for the controlling shareholders, and thus increased ability to monitor the actions of the subsidiaries (La Porta, Lopez-de-Silanes, and Shleifer, 1999).

⁴ These are similar to Japanese keiretsu, which are groups of large firms with interlocked equity stakes, often centered around a financial institution. See Krueger and Yoo (2001) and Chan and Nahn (1994) for a complete discussion of this organizational form.

⁵ As reported in Business Breaking News at www.inq7money.net/, accessed April 20, 2005.

⁶ This figure is drawn from LaPorta, Lopez-de-Silanes, and Shleifer (1999) and is based on Samsung Electronics' ownership and control structure as of 1995. Note that it does not include shares held across all of the subsidiaries of Samsung Electronics.

FIGURE 1
Principal Shareholders in Samsung Electronics



Source: This figure is taken from La Porta, Rafael L., Florencio Lopez-de-Silanes, and Andrei Shleifer, 1999, Corporate Ownership Around the World, *The Journal of Finance*, 54: 485. Used with permission of Blackwell Publishing.

Interestingly, our data span the Korean financial crisis of the mid 1990s. The Korean economy expanded rapidly through the 1980s, and then slowed dramatically in the early 1990s. Even in periods of growth, the chaebols had unusually high debt-to-equity ratios (Beck, 1998). By 1997 the Korean currency collapsed, and 6 of the 30 largest chaebols had gone out of business. At the height of the financial market crisis, the debt-to-equity ratios of one of the largest chaebols, Hyundai, reached 4.4 (Krueger and Yoo, 2001). The reforms imposed by the International Monetary Fund required the chaebols to reduce their leverage ratios as a condition of bank restructuring. This could have important implications for motives to purchase insurance, which is discussed later.

INSURANCE DEMAND THEORIES

Tax Treatment

There are several tax-related motives for corporations to purchase insurance. The first is that insurance premium payments are deductible from taxable income in the year that premiums are paid, thereby reducing current tax burdens. Conversely, self-insured property losses are deductible from income in the year that they are incurred, and only to the extent of book value. Hence the cost of the destroyed property is written off over time through depreciation deductions. This gives rise to a second tax-related

motive for insurance. Main (1983) shows that, as the spread between book value and replacement cost of damaged property increases, insurance demand increases.⁷ This is because insurance recoveries are not considered taxable income to the firm as long as they are used to replace damaged property. However, the difference between the book value and the replacement value of the property is subject to a capital gains tax. As long as the capital gains tax rate is lower than the corporate profit tax rate, firms will demand insurance.

Mayers and Smith (1982) argue that convexity in the tax code generates a demand for insurance. Because insurance decreases the variability in firm earnings, expected tax liabilities are lower, and expected net cash flows are higher with the purchase of insurance. The Korean corporate tax rate is based on two levels of income. For lower levels of net income (under 100 million won in 2002), the tax rate is a flat 15 percent. For income greater than 100 million won, the tax is 15 million won + 27 percent of the amount over 100 million won.

Bankruptcy

Bankruptcy costs include direct costs of resolution, including legal and administrative fees, as well as indirect costs such as loss of market share, reputation, and credit. Mayers and Smith (1982) argue that the direct costs are likely to be less than proportional to firm size, with smaller firms experiencing relatively higher direct costs of bankruptcy. Since insurance can reduce the probability of a firm experiencing bankruptcy from a large (insurable) loss, smaller firms might be more likely than larger ones to purchase insurance. Furthermore, regardless of firm size, a firm with relatively less liquidity or greater leverage in its capital structure, and thus a relatively higher probability of bankruptcy, may be more likely to purchase insurance. This is because its ability to fund uninsured losses through cash flow, borrowing, or other capital market sources will be more restricted.

Regulation

Regulators might have an incentive to encourage the purchase of insurance if they believe that insurers have a comparative advantage in assessing loss distributions. Since firms in regulated industries can pass the cost of insurance along to consumers, there is little competitive disadvantage to purchasing insurance. This implies a relatively higher demand for insurance in regulated versus unregulated industries, all else equal (Mayers and Smith, 1982). Grillet (1992), however, argues that regulators are efficient monitors of bankruptcy potential, and thus regulated firms would not have a motive to purchase insurance to protect against bankruptcy. This implies a lower demand for insurance for regulated firms.

Insurance Services

Firms that choose to retain losses rather than insure them must allocate resources to loss reserving, claims administration, loss control, and other functions typically

⁷ Note that this argument is developed based on features of the U.S. tax code. However, the capital gains tax rate in Korea is the same as the corporate income tax rate, so this motive might not apply to the same extent as for U.S. firms.

performed by insurers. They also lose any benefit that might be gained from pooling with similar risks within the insurance mechanism. Since there are likely to be economies of scale associated with providing these services, smaller firms are more likely than large firms to pay insurers to perform them, assuming that insurers have a comparative advantage in these areas (Mayers and Smith, 1982).

Agency Theory and Underinvestment Incentives

Myers (1977) argues that, in some cases, shareholders will forego a positive net present value project when the benefit accrues to bondholders. For example, in the case of a property loss, shareholders must decide whether to repair or replace the damaged asset or not. If there is risky debt in the capital structure, it may be in the best interests of the shareholders not to make the necessary investment. Bondholders recognize this incentive in advance, and price it into the bond payoff structure. In the absence of insurance, shareholders then bear the costs associated with this disincentive to reinvest. Mayers and Smith (1987) show that insurance controls this incentive problem, which results in higher bond valuations at the date of issue. MacMinn (1987) and Garven and MacMinn (1993) explicitly model this underinvestment conflict, and show how insurance can eliminate the incentive to underinvest. The incentive problem is likely to be greater in firms with relatively more debt in the capital structure, so insurance demand should be greater for more highly leveraged firms.

Ownership Form

Another agency theoretic motive for insurance purchases arises from the ownership structure of the firm. The essential element of the agency problem is the separation of ownership and control. Owners invest in the firm with the expectation of receiving a return on their investment. However, investors must develop mechanisms to ensure that their funds are not expropriated by managers, or otherwise lost. If a firm is closely or privately held, the argument is that the owner(s) will have a greater proportion of assets invested in the firm, and thus a decreased ability to diversify firm-specific risk across other investments. If owners have relatively less opportunity to diversify firm-specific risk, they will be more likely to demand insurance, all else equal (Mayers and Smith, 1982).

However, if a relatively large block of shares of a firm is held by institutional owners, rather than individuals, then direct monitoring of the managers by the institutional investors may be more efficient than using insurance to protect invested assets against potential expropriation by managers. Because of the free-rider problem, it has been argued that only relatively large investors have the incentive and resources to invest in monitoring or other costly interventions directly (see, e.g., Grossman and Hart, 1980; Shleifer and Vishny, 1997). However, small investors will benefit from monitoring by institutional investors, even though they do not bear the cost (Gillian and Starks, 2003). The institutional investor has a greater incentive to monitor because the return from doing so will likely exceed the costs. Therefore, if there is a relatively higher level of institutional ownership within the firm, the demand for insurance might be lower than otherwise, all else equal.⁸

⁸ Of course, institutional investors might choose instead to sell shares in firms, but these trades may be so large as to drive share prices down. There are several articles that argue that

Other Stakeholders

Smith (1986) argues that claimholders other than stock- and bondholders may also motivate the firm to purchase insurance. Trading partners (suppliers and buyers) often require the purchase of insurance to bond-trading agreements since their own income streams can be interrupted by a failure of a key supplier (buyer) to deliver (purchase) inputs when needed, for example. This can lead to variability in earnings across time for the dependent trading partner. The contractual provision might be more likely when the trading partners are more geographically separated, and thus direct monitoring is more difficult. Similarly, financial institutions that use commercial property to secure loans often require the purchase of insurance as a condition of the loan (Webb, Flitner, and Trupin, 1996).

Risk Class

The theory discussed thus far indicates that insurance demand should vary by firm size, capital structure, tax incentives, firm ownership, regulation, expected bankruptcy costs, and incentives of other stakeholders. As a practical matter, insurance demand might also be influenced by insurance rating factors that measure risk characteristics. If a firm experiences an insured (or uninsured but insurable) loss in a prior period, its insurance premium rate would likely increase, causing the firm to adjust its insurance purchases. Furthermore, insurance rates typically reflect the risk characteristics of industry groups, in addition to the experience of particular firms, so that higher-risk industries face higher insurance rates, all else equal.

EMPIRICAL ANALYSIS

Data Description

The Korean insurance market is fairly well developed. The Korean market is the second largest in Asia after Japan, and Korea ranks first in property–liability insurance revenue as a percent of GDP, with nonlife insurance accounting for 3.38 percent of GDP. Property-liability insurance revenue in 2002 was just over \$16 billion, and accounted for 1.48 percent of global premium (SwissRe, 2003).

The data for this study are drawn from firms listed on the Korean Stock Exchange from 1990 through 2001. Because of peculiarities in accounting, we focus on nonfinancial firms only. Our initial sample consists of all 433 nonfinancial firms listed on the exchange in a total of 30 industry classes. We use Korean Investors Services–Financial Analysis System (KIS–FAS) accounting data to estimate the determinants of insurance demand. All independent variables are measured as of the end of the fiscal year, under the assumption that insurance purchases are made at the beginning of the following fiscal year. All values are reported in U.S. dollars, using the exchange rate reported as of the end of March of the following year.⁹

institutional trading distorts markets away from equilibrium prices, or increases share price volatility. (see, e.g., Krauss and Stoll, 1972; Chan and Lakonishok, 1993, 1995, 1997).

⁹ The exchange rates per U.S. dollar used are shown in the appendix. Since the insurance industry accounting period runs from April 1 to March 31 these are calculated as of March 31 of the following year.

Korean firms report insurance premium expenditures within the general expense entry of the income statement. There is also an insurance premium component reported in the cost of merchandise. Our measure of insurance premiums paid is the sum of these two reported figures. These reported figures represent commercial property insurance purchases, including buildings, autos, and other property; business interruption; marine insurance; and liability insurance. Liability insurance makes up a very small proportion of the total demand. Costs for employee benefits, workers compensation, and other social insurance programs are not included. Therefore, our data allow us to test the predictions of the theory for property insurance expenditures, including insurance on property in transit. Firms that report total assets or total liabilities less than or equal to zero for any year are removed from the sample, leaving 401 firms remaining in the sample for the 12-year period, for a total of 4,812 observations. Insurance purchases by these 401 firms accounted for 37 percent of all commercial insurance purchased in Korea in 2001. All firms in the sample reported a positive payment for insurance in each period.

Measurement of Variables

The dependent variable for our study is insurance demand. Ideally, we would have a measure of the number of insurance units purchased per unit price of insurance for each firm in our sample. However, in practice, it is difficult to measure insurance demand directly using accounting data. Insurance premiums paid are a compound measure of both unit price and quantity. Furthermore, unit price varies by the risk class of the insured. Yamori (1999) uses direct premiums paid by firms as the dependent variable. However, this does not control for differences in risk factors across firms that could make a given amount of insurance more expensive for a firm in a higher risk class, nor does it control for differences in the insurable asset base across firms.¹⁰ Mayers and Smith (1990) measure insurance demand by calculating the ratio of reinsurance purchased to total insurance premiums. This measure does control for differences in the insurable base across firms. To control for differences in each insurer's risk profile, and thus demand for reinsurance, the proportion of direct premium written in each line of business is also included as an explanatory variable. Core (1997) uses data from proxy statements to measure directors and officers liability limits purchased. Although this measure provides a direct observation of insurance units purchased, it does not control for differences in price per unit of coverage that might be influenced by risk class. To overcome this, Core includes measures of firms' litigation risk as independent variables. Since U.S. noninsurance firms do not report insurance purchases on financial statements, Hoyt and Khang (2000) use a survey to collect data on property insurance purchases. The dependent variable in that study is a measure of insurance premiums paid relative to insurable property value. This dependent variable specification has the advantage of controlling for the level of assets exposed to loss, and further isolates insurance demand from factors such as firm size. In addition, a variable that measures "total cost of risk" across industries is included

¹⁰ There is no control for industry or company specific risk classification factors included on the right-hand side of the regression equation, so it is not clear whether differences in insurance purchases across firms are driven by the theoretical factors modeled or by industry risk differences.

in their model of insurance demand to control for differences in risk across industry groups.¹¹ Like Hoyt and Khang (2000), Zou, Adams, and Buckle (2003) use a measure of insurance demand that controls for differences in the insurable asset base across firms. Both systematic and unsystematic risks are included as independent variables to measure the sensitivity of insurance demand to differences in risk across firms.

We follow Hoyt and Khang (2000) and Zou, Adams, and Buckle (2003) and construct a variable that measures insurance demand relative to insurable value for each firm in our sample over the period 1990 through 2001. Since the amount of insurance purchased in 1 year is typically based on insurable values and loss experience from the previous period, our dependent variable is calculated as the ratio of premiums paid at the beginning of year t to total tangible assets of the firm less land value in year $t - 1$.¹² Because of significant skewness in this variable across the firms in our sample, our measure is transformed using the natural log function.

Tax Treatment. Because insurance premiums are tax deductible when paid and uninsured property losses are tax deductible at book value when the loss occurs, the demand for insurance should be greater for firms that have more cumulative depreciation relative to property value. We measure this by the ratio of cumulative depreciation to total fixed assets net of land value. If the tax motive is an important determinant of insurance purchases, this measure should be positively related to insurance demand.

Underinvestment and Bankruptcy Probability. The theories above indicate that firms that face a higher probability of bankruptcy are more likely to demand insurance. We include several measures of a firm's bankruptcy probability. The ratio of working capital to total assets is a well-established measure of a firm's short-term liquidity. A firm with a higher working capital ratio is less likely to experience financial distress because of an inability to meet its short-term obligations than a firm with relatively less working capital. Therefore, we expect this variable to be negatively related to the demand for insurance. We also include the firm's leverage ratio as an indicator of longer-term liquidity. This is measured as the ratio of total assets to total liabilities. The leverage ratio is expected to be negatively related to the demand for insurance as well, since a firm with a higher leverage ratio has more assets to support its liabilities and may not value insurance as highly as a less well capitalized firm.

The underinvestment hypothesis discussed earlier also has implications for the firm's bankruptcy probability. A firm that has a relatively higher debt-to-equity ratio is

¹¹ Total cost of risk includes insurance premiums, retained losses, loss control investments, and risk management administration. The authors use data from the 1990 Cost-of-Risk Survey, published jointly by the Risk and Insurance Management Society and Tillinghast Towers Perrin.

¹² Tangible assets include land, buildings and structures, equipment and machinery, vehicles, tools, personal property, and construction in progress. Our data set includes observations of the independent variables for all years between 1990 and 2002 inclusive. However, since our independent variables are lagged 1 year behind the dependent variable, the effective years covered by our analysis are 1990 through 2001.

at greater risk of bankruptcy. The firm is also relatively more exposed to business downturns, since it must fund debt payments out of constrained cash flow or increased borrowing when net income declines. Such a firm is also more likely to experience a conflict between debt holders and equity owners in the event of a property loss. Empirically, we cannot separate these effects using accounting data. However, in either case, the expectation is that a higher debt-to-equity ratio is associated with a greater demand for insurance.

Firm Size. Firm size may be inversely related to the demand for insurer services, as Mayers and Smith (1990) suggest. Also, since bankruptcy costs are likely not proportionate to firm size (Mayers and Smith, 1982), large firms may have less incentive to purchase insurance as a shield against bankruptcy costs.¹³ Our measure of firm size is the natural log of total assets for the firm.

Regulation. The hypotheses about the role of insurance in regulated firms are contradictory. Most of the empirical studies have used an indicator variable to control for regulated utilities. Thus, a significant finding for this indicator variable may be related to utility industry characteristics, rather than to regulation itself. We determine which industries are most stringently regulated based on a report by the Korea Ministry of Planning and Budget¹⁴ and construct an indicator variable that is set equal to one if the firm is a member of the energy, utilities, mining, or transportation industry, and zero otherwise.

Ownership Structure. The theories above argue that if stockholders can hold well-diversified portfolios, then the corporate purchase of insurance is redundant from their viewpoint. For closely held firms, though, shareholders might have relatively more capital invested in the firm, and insurance helps diversify this firm-specific risk. We measure the firm's ownership structure by including the proportion of the firm's equity held by majority shareholders. Majority shareholdings are measured by the holdings of the largest individual (noninstitutional) shareholder with at least 5 percent ownership of the firm. In this case, the majority shareholder might act more like a relatively undiversified individual, and demand insurance to protect him from firm-specific risk.¹⁵

¹³ There is also an argument that firms with relatively higher indirect costs associated with bankruptcy, such as a loss of reputation, are more likely to purchase insurance all else equal (Grillet, 1992). We included this reputation effect, measured by the ratio of intangible to total assets of the firm, but it was not significant for any model we estimated, and did not qualitatively affect the results reported here, so it was dropped from consideration.

¹⁴ The report can be found at www.mpb.go.kr, accessed September 9, 2006.

¹⁵ The ownership of shares by managers of the firm may also influence the insurance purchasing decision, as managers weigh the costs of bankruptcy against the cost of insurance from a shareholder's perspective. However, our data do not report on managerial shareholdings unless the individual manager shareholder is one of the largest five shareholders, or aggregate shares held by all employees makes the employee group one of the largest five shareholders. We collected data on manager and employee ownership of shares for our sample and found that employee ownership is reported for just 12 firms. The regression models were reestimated using this data, and there is no change in the results. Thus, these are not reported here.

Membership in a chaebol might also affect the demand for insurance. Since members often hold shares in each other, the concentrated and interlocked ownership structure might increase the demand for insurance. Alternately, since the member firms are so closely linked through trading relations, increased transparency and a greater ability to monitor trading partners, might reduce the demand for insurance. To control for differences in demand for insurance between members of chaebol and other firms, an indicator variable that is set equal to one if the firm is a member of a chaebol is included in one model of the empirical estimation. We also estimate a second model to determine whether the theories of insurance demand discussed earlier are supported more generally by omitting chaebol firms from the analysis.

The share of the firm's equity that is held by institutional owners might also affect the demand for insurance. We include the proportion of shares held by financial services firms as a measure of institutional shareholding. Since institutional owners may be very well diversified, insurance demand should be lower as institutional ownership increases. If institutional owners are more efficient monitors of bankruptcy potential, then insurance demand should be lower as well.¹⁶

Korea began its economic transformation after launching the first of its 5-year plans in 1962 (Chan and Nahn, 1994). Part of that transformation was driven by government ownership of firms in key industries such as steel and chemicals. Although the government began divesting itself of ownership as the economy evolved, it still holds shares in some firms. Moreover, the government may take control of a private firm if it is experiencing financial distress. Since the government is a shareholder, it might be a more efficient monitor of bankruptcy potential than a private insurer, thus reducing the demand for insurance by other shareholders of the firm. Furthermore, if a large uninsured loss were to occur, the government might be willing to provide relatively low-cost financing to the firm. If this is so, then we would expect the demand for insurance to be negatively related to government ownership. We use the share of the firm's equity owned or controlled by the government to investigate this. For our sample, the largest share of government ownership is 79 percent.¹⁷

Exports. A large proportion of the Korean GDP derives from exports of manufactured products. In 2001, exports accounted for approximately 36 percent of GDP (KOTRA, 2004). On average over the period 1990 through 2001, the firms in our sample derive

¹⁶ Since it might be that the majority shareholder is the government or a financial services firm, we also included interaction terms to test this. While the interaction terms were statistically significant and of the same sign as the stand-alone variables, the coefficients on the variables that measure government share and financial services ownership alone were significantly reduced. When the interaction terms were included and the underlying share variables were excluded from the estimation, the results were essentially the same as including the share variables alone and omitting the interaction terms. This indicates that the share variables and the interaction terms are substitutes. None of the other variables were affected. Therefore, we do not report the interaction effect here.

¹⁷ Because the government can take control of firms in financial distress, we would expect to see the share of government ownership related to our measures of bankruptcy probability. Therefore, we included interaction terms to control for this in our estimation. Since these were not significant and did not affect our other results, they are not reported here.

26 percent of their sales from exports. Because of uncertainties in the shipment of goods, exporters are often required to purchase marine insurance. Our dependent variable is total commercial insurance purchases for the period. This includes a substantial portion for marine insurance. For our sample period, marine insurance represented just over 28 percent of total commercial insurance premiums paid. Because of the importance of exports in the economy and because marine insurance purchases cannot be separated from our measure of insurance demand, we include the proportion of the firm's revenue that is derived from exports to control for the case where trading partners (importers) might require the purchase of insurance.

Risk Class. Insurance unit prices are based in part on the insured's industry classification. We control for differences in frequency and severity of loss across firms in different industries by including indicator variables for industry classifications (based on Korean SIC codes) for each industry sector as independent variables in our empirical models. As an additional measure of firm risk class, we include an indicator variable set equal to one if the firm experienced a property casualty loss in the prior period. Since insurance prices are related to insurable losses, firms that experience losses should face higher rates per unit of coverage the following period. If units of coverage (and insurable assets) remain the same, our measure of insurance demand should increase for firms that experienced a loss in the prior period. In addition, because the firm did experience a loss, it might be inclined to increase insurance amounts purchased in the next period. In each case, we would expect a positive relation between insurance demand and property casualty losses in the prior period. However, it is possible that firms facing resource constraints will reduce insurance units purchased in response to insurance rate increases caused by property casualty losses, thus holding the amount spent on insurance constant from one period to the next, or even decreasing the amount of insurance purchased relative to insurable assets.¹⁸

Table 1 summarizes the definitions of the variables used in this analysis and indicates our expectations about the effect of each on insurance demand. Below, we discuss our methodology and the results of our estimation.

Empirical Methodology

We use firm-level accounting measures over the time period 1990 through 2001 to examine the determinants of insurance demand. Because our data set consists of cross-sectional observations over time, we used panel data analysis methodology.¹⁹

¹⁸ Two alternate measures of property-casualty losses were also tested, property-casualty losses in the prior period relative to net income, and relative to sales revenue. Neither is significant in our estimation. These are subject to very skewed distributions, with the majority of firms reporting no positive property-casualty losses for our period.

¹⁹ It is common in panel data analysis to use fixed-effects methods to control for unobservable differences within cross-sectional units. However, fixed-effects methods are costly in terms of degrees of freedom lost, and are especially so when there are relatively a large number of cross-sectional units. Our model includes industry group and time dummy variables. Under this specification, the *F*-test for fixed effects does not reject the hypothesis that the intercepts are identical across companies. Random effects models were also estimated but did not perform as well as the models reported here and did not result in any changes in signs or significance for the important independent variables.

TABLE 1
Variable Definitions and Expected Signs

Variable Name	Definition	
<i>Dependent variable</i>		
Insurance demand	Log(insurance premiums paid _{<i>t</i>} /(tangible assets – land _{<i>t-1</i>}))	
<i>Independent variables</i>		
<i>Firm Size</i>	Log(total assets)	(–)
<i>Ownership</i>		
Chaebol indicator	Indicator = 1 if the firm is a member of a chaebol	(?)
Majority share	The proportion of shares owned by the largest shareholder, with ownership of at least 5% of shares.	(+)
Financial institution ownership	Share of stock held by banks	(–)
Government ownership	Proportion of the firm shares controlled or owned by the government	(?)
<i>Regulation</i>	Indicator = 1 if the firm is in the energy, utilities, mining, or transportation industry	(?)
<i>Underinvestment</i>		
Debt-to-equity ratio	log(total liabilities/market value of equity)	(+)
<i>Bankruptcy</i>		
Leverage	Total assets/total liabilities	(–)
Liquidity	(Current assets – current liabilities)/total assets	(–)
<i>Tax shields</i>		
Depreciation	Total accumulated depreciation/(total fixed assets – land)	(+)
<i>Exports</i>	Exports/gross sales	(+)
<i>Risk class</i>		
Property-casualty loss indicator	Indicator = 1 if the firm experienced a property-casualty loss last period, 0 otherwise	(+)

Note: Indicator variables for each industry group are also included as controls for insurance risk, but those are not shown here.

Our empirical model includes indicator variables for industry groups and for each year. Because of the distinctive features of chaebol firms discussed earlier, we estimate one model for the full sample of firms, and a second model for the subsample of firms that are not members of chaebols.

The summary statistics for the variables used in the estimation are presented in Table 2. Column 1 shows the mean and standard deviation of the variables used for the whole sample, and columns 2 and 3 show these measures for the subsample of non-chaebol and chaebol firms, respectively. There are significant differences in the characteristics of chaebol and non-chaebol firms. Column 4 shows the Z-test statistics for statistically significant differences in means of the measures used in our analysis. Chaebol firms are much larger, with an average of 19.77531 for the log of firm assets compared to 18.52932 for non chaebol firms, and this difference is statistically significant at greater than the

TABLE 2

Summary Statistics for Full Sample, Chaebol, and Non chaebol Firms, Sample Period 1990 Through 2001

Variable Name	Full Sample	Non chaebol Firms	Chaebol Firms	Z-Statistic for Differences in Means
<i>Dependent variable</i>				
Insurance demand	-4.61924 (1.23426)	-4.5978 (1.185)	-4.66553 (1.3334)	1.69*
<i>Independent variables</i>				
log(assets)	18.92392 (1.40717)	18.529 (1.2024)	19.7753 (1.4398)	-29.26***
Chaebol indicator	0.3167 (0.46524)			
Majority share	26.5233 (15.2987)	27.101 (15.162)	25.2764 (15.5214)	3.805***
Financial institution share	8.6948 (9.8769)	7.577 (9.2749)	11.116 (10.6775)	-11.215***
Government share	1.552 (4.907)	1.277 (3.675)	2.144 (6.812)	-4.643***
Regulation indicator	0.04854 0.2149	0.04213 -0.2009	0.0624 -0.2419	-3.05***
log(debt-to-equity ratio)	0.6642 0.9248	0.6275 0.9676	0.7386 0.8202	-4.12***
Leverage	1.7563 (0.8645)	1.8052 (0.9465)	1.6512 (0.6412)	6.586***
Liquidity	0.09184 (0.18894)	0.1179 (0.19714)	0.03566 (0.1558)	15.54***
Depreciation	0.50815 (.4659)	0.53167 (0.516)	0.4574 (0.3275)	6.01***
Profit margin	0.01888 (0.3253)	0.01425 (0.3785)	0.02887 (0.1575)	-1.88*
Exports	0.26925 (0.3024)	0.2565 (0.30512)	0.2967 (0.2946)	-4.329***
Property-casualty loss indicator	0.0394 (0.00277)	0.03254 (0.1774)	0.0543 (0.2267)	-3.29***

Notes: Results of difference in means test whether differences in non chaebol and chaebol firm means are significantly different from zero. Significance levels: *10%, **5%, and ***1%. Means are shown with standard deviations below in parentheses.

1 percent level. Chaebol firms also have higher proportions of both government and institutional ownership on average than non chaebol firms, and these differences are also statistically significant at greater than the 1 percent level. In addition, chaebol firms tend to have relatively more exports, lower depreciation rates, and higher profit margins than non chaebol firms. Chaebol firms are also statistically more likely to have recorded property-casualty losses than non chaebol firms.

Interestingly, non chaebol firms are much better capitalized than chaebol firms for our period. For our measures of firm risk, both leverage and liquidity ratios are

significantly lower for chaebol firms, and the difference is statistically significant. This could reflect the relatively easier access to capital that chaebol firms enjoy, as discussed earlier. Moreover, the debt-to-equity ratios are significantly higher on average for chaebol firms. We next estimate regression models to control for the joint effects of our variables on insurance demand.²⁰

EMPIRICAL RESULTS

The regression results are shown in Table 3. Two models are shown. The results of model 1 are for the full sample, and those of model 2 are for the subsample of non chaebol firms only. The estimated coefficient for our measure of firm size is negative and significantly related to the demand for insurance for both the full sample and for non chaebol firms. This is consistent with theory and supports the idea that larger firms demand relatively less insurance. This may be because they do not attach a high value to the bundle of services provided by insurers, or because bankruptcy costs are less than proportional to firm size.

Model 1 includes a dummy variable as a control for membership in a chaebol, and we find that membership in a chaebol is positively and significantly related to higher demand for insurance for the full sample of firms. Our measure of institutional ownership, bank shareholdings, is positive and statistically significant for both the full sample and for the sample of non chaebol firms.²¹ This is contrary to expectation, but it may be the case that financial institutions behave more like individual shareholders in this market, preferring that the corporation purchase insurance to protect their investments from expropriation. This might also be because institutional shareholders, including banks, have not historically been activists in Korea. In fact, prior to 1998, institutional investors, including banks and bank trusts, were not permitted to exercise voting rights in the shares they owned (Park, 2003). Thus, their roles as monitors are more limited in this setting as compared to countries with an established culture of institutional activism.

The estimated coefficient on our variable to control for the degree of concentration in firm ownership, majority shareholdings, is negative and significant at the 1 percent level for both equations estimated, indicating that insurance demand decreases as firm ownership becomes less dispersed. One explanation for this might be that larger shareholders are able to efficiently diversify their portfolios, and thus rely less on the firm to purchase insurance. Alternately, majority shareholders may be able to exercise direct control over management and therefore do not rely on insurance as a proxy for monitoring in this market. Similarly, the estimated coefficient on the share of government ownership of the firm is negative and statistically significant at the 1 percent level for both the full sample, and the non chaebol firm sample, providing

²⁰ Goldfeldt–Quandt, White, and Breusch–Pagan tests all revealed the presence of heteroskedasticity related to firm size. Therefore, a weighted least squares model using the square root of an independent variable related to firm size will reduce the heteroskedasticity (Greene, 1993). Both assets and market value of equity were tested as alternate measure to sales, but the use of the square root of sales performed best. We also tested for autocorrelation and collinearity but found no evidence that our results are influenced by these.

²¹ We also included the share of ownership by insurers as a measure of institutional shareholdings, but this was not significant for either model and so was dropped from the analysis.

TABLE 3

Weighted Least Squares Regression Results, 1990 Through 2001

Variable	Model 1 Full Sample		Model 2 Non chaebol Firms Only	
	Coefficient	Standard Error	Coefficient	Standard Error
Intercept	-2.438	0.275***	-3.27	0.349***
log(assets)	-0.178	0.0146***	-0.1365	0.0191***
Chaebol indicator	0.111	0.0344***		
Majority share	-0.0017	0.00087***	-0.00449	0.0011***
Financial institution share	0.0029	0.0016*	0.00465	0.00203**
Government share	-0.0201	0.0041***	-0.022	0.00517***
Regulation	2.17	0.162***	2.189	0.287***
log(debt-to-equity ratio)	-0.0466	0.0192**	-0.0325	0.0231
Leverage	-0.103	0.0132***	-0.0851	0.0151***
Liquidity	0.85	0.081***	0.837	0.0958***
Depreciation	0.085	0.024***	0.1086	0.0276***
Exports	0.106	0.0488**	0.1156	0.0572**
Property-casualty loss indicator	0.119	0.072*	0.0072	0.0949
Year indicators				
1990	0.396	0.0635***	0.396	0.0777***
1991	0.425	0.0633***	0.4036	0.0771***
1992	0.447	0.0638***	0.4302	0.07783***
1993	0.397	0.06394***	0.3942	0.07807***
1994	0.369	0.0639***	0.3667	0.07798***
1995	0.463	0.0645***	0.4704	0.0785***
1996	0.417	0.0651***	0.423	0.07908***
1997	0.233	0.0654**	0.2253	0.0795***
1998	0.157	0.0653*	0.1468	0.07929*
1999	0.101	0.0664	0.1095	0.0809
2000	0.175	0.06685***	0.1842	0.0811***
Model F-statistic	65.52		40.13	
Adjusted R ²	40.72%		35.70%	

Note: The estimated coefficients for the industry indicator variables are not reported here to conserve space. Significance levels: *10%, **5%, and ***1%.

Dependent variable: $\log(\text{premiums paid}_t / (\text{Tangible assets} - \text{Land}_{t-1}))$.

strong support for the idea that government ownership may substitute for insurance, at least in Korea.

Previous empirical studies have found conflicting results regarding the relation of regulation to insurance demand. Although both Core (1997) and Yamori (1999) found a positive and significant relation between regulated utilities and insurance demand, Hoyt and Khang (2000) found a negative and significant relation. Our analysis indicates that firms in regulated industries purchase more insurance on average, supporting the ideas that insurance can proxy for regulatory oversight, or that firms in regulated industries can more easily pass on insurance costs. The estimated coefficient

on the regulation indicator variable is positive and statistically significant at the 1 percent level for both the full sample, and the non chaebol firm sample.

The variable that measures tax-related motives for insurance demand is significant and of the expected sign for both models. Firms with a greater proportion of cumulative depreciation demand more insurance. This lends additional support to the hypothesis that the spread between book value and replacement cost of property can drive insurance purchases.

The results for our measures of bankruptcy probability are not consistent with the theoretical predictions. We expect our measures of liquidity and leverage to be negatively related to the demand for insurance. Greater liquidity and a higher assets-to-liabilities ratio should be associated with a lower demand for insurance. Similarly, more debt relative to equity in the capital structure implies a greater demand for insurance. The coefficient on our leverage variable, the assets to liabilities ratio, is negative and highly significant, as expected, indicating that firms that are better capitalized rely less on insurance. This result is consistent for both models 1 and 2. However, the result for our measure of liquidity, working capital to total assets, indicates the opposite. The coefficient on this variable is positive and highly significant for both types of firms, indicating that the demand for insurance declines (increases) as liquidity declines (increases). One explanation for this might be that firms that are facing a short-term cash crunch might reduce discretionary purchases, including insurance. Although not supportive of the theory, this result is consistent with the findings of Zou, Adams, and Buckle (2003) for the Chinese market.

Similarly, the coefficient for the debt-to-equity ratio is negative and significant for the full model. Although negative, the estimated coefficient on the debt-to-equity ratio is not statistically significant for the non chaebol firms. This indicates that the results for the full sample are driven by the presence of chaebol firms. These results are contrary to the theory that firms that have a greater risk of bankruptcy will demand more insurance.²² A possible explanation for the negative relation between debt-to-equity and the demand for insurance might be that the chaebol firms in this study have very high debt-to-equity ratios on average. For year 2002, the average ratio was 3.7, and the top decile of firms had debt-to-equity ratios ranging from 6.4 to 69.5. This compares to an average of 1.88 for U.S. manufacturing firms in 2002 (<http://www.bizstats.com/corpdcurrent.htm>, May 15, 2004).

²² To determine if these results were due to multicollinearity among these three variables, we reestimated the model omitting all three variables. None of the other results were qualitatively changed. We then ran three regressions using only one of these measures in each model. Again, our other results are robust to the inclusion of these measures. Moreover, the coefficients on the variables in question are as reported above. To examine the robustness of the results for these variables, we also estimated three models including only time and industry indicator variables, and each measure of bankruptcy probability separately. The signs and significance for the coefficients on these variables were unchanged. Finally, we estimated the full model and calculated variance inflation factors. All of the VIFs were below 2, confirming that multicollinearity is not likely to be a problem. Therefore, we conclude that our results are not due to statistical bias. Furthermore, as an alternate measure of bankruptcy probability, we tested Tobin's q ratio as a substitute for the debt-to-equity ratio. However, this was correlated with our leverage variable at 78%, and so is a close substitute for leverage.

One of the systematic problems in the Korean economy in the period leading up to the financial crisis in 1997 was that banks extended credit to firms that were already overleveraged. Withholding additional financing might jeopardize the repayment of the loans outstanding. It might be the case that already leveraged firms could readily substitute debt financing for insurance, and thus had no debt-related motive for purchasing insurance. This might also explain the positive relation between our measure of liquidity and the demand for insurance. The financing alternatives available to Korean firms during this period require further study.²³

We do find a positive and statistically significant relation between insurance demand and exports as a percentage of sales. As expected, firms that rely more on exports as a source of revenue tend to purchase more insurance, all else equal. However, although the estimated coefficient for the property-casualty loss indicator variable is positively related to the demand for insurance in the current period for the full sample, it is not significant for the non chaebol firms. Again, this indicates that the results for the full sample are driven by the chaebol firms. One reason why non chaebol firms' insurance demand may not be sensitive to prior period losses is that the losses of non chaebol firms are very small on average as compared to chaebol firms. The average ratio of property loss to sales is 0.000144 percent for non chaebol firms, whereas it is 0.00239 percent for chaebol firms, a difference of 16.6 times.

CONCLUSION

In perfect capital markets, there is no theoretical reason for the purchase of insurance by firms if shareholders can hold well-diversified portfolios of stocks. However, when transaction and agency costs are introduced, motives for insurance demand can be derived. Insurance purchases may be driven by the structure of the tax code, bankruptcy costs or bankruptcy probability, real services provided by insurers that are valued by shareholders, or differences in ownership structure or regulation across firms. Because of the difficulty in gathering data related to insurance purchases, there have been relatively few empirical tests of these theories. However, because Korean firms report insurance premiums paid on their financial statements, we are able to analyze a large sample of Korean firms over an 11-year time period.

Our article analyzes the drivers of insurance demand for Korean firms. Unlike most prior studies, the use of time series data in this article allows us to control for effects of macroeconomic factors, insurance underwriting cycles, or past loss experience on the demand for insurance. Our article provides mixed support for the theoretical arguments. Like Hoyt and Khang (2000), we do find support for tax-related insurance purchases. Accumulated depreciation is positively related to insurance demand. We also find that larger firms demand less insurance, which supports the "real services"

²³ There are several studies that argue that, rather than underinvestment, overinvestment in uneconomical projects was encouraged by industrial policy and financial regulation in the period leading up to the currency crisis in 1997. Banks had high concentration of loans with their largest borrowers, and limited financial disclosure made credit risk difficult to evaluate. In addition, many chaebols established their own nonbank financial institutions to supply credit to the chaebol member firms, and these added to the extension of debt financing for this group of firms. (See Lindgren et al., 1999, for a comprehensive discussion of conditions in credit markets in Korea in this period.)

hypothesis, as well as the bankruptcy costs hypothesis. In support of the findings of Mayers and Smith (1990), we do find that firms with higher levels of inside share ownership, as measured by membership in a chaebol, demand more insurance. Our evidence indicates that government ownership reduces the demand for insurance, whereas firms that have a greater share of majority ownership demand less insurance than firms that are more widely held. This latter finding is contrary to theoretical predictions.

We also find conflicting results with respect to the role of insurance in firms that have a higher probability of bankruptcy. Although our measure of leverage, the assets-to-liabilities ratio, is significantly related to the demand for insurance, both the debt-to-equity ratio and the liquidity ratio are statistically significant, but of the opposite sign that theory predicts. Although this might be related to the peculiar features of the Korean economy during our study period, further investigation is required.

One further extension of the research is to examine changes in insurance demand over time in response to changes in the underlying environment. This is particularly interesting given the dramatic and rapid change in economic conditions and regulation of Korean firms over the time period for which we have data. It might be that further analysis of time-related effects can provide more information about the determinants of insurance demand for Korean firms. However, that is beyond the scope of this investigation.

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