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Keywords: Captive insurance, risk management, corporate governance, ownership structure

JEL Classifications: G20, G22, G30, G32

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This article examines the effects of captive insurance usage on firm borrowing costs, marginal tax rates, dividend payouts and investments in intangible asset development. Using a panel dataset from 2009 to 2022, we find that firms using captive insurance benefit from decreased borrowing costs and marginal tax rates, as well as from its association with increased dividend payments and greater levels of investment in intangible asset development. Our results hold when considering the ex-post and ex-ante situations of firms adopting captive insurance structures. Firms with higher levels of holdings by insiders and institutional blockholders are more likely to use captive insurance, as are firms with higher levels of total executive compensation and higher proportions of stock-based compensation. However, firms with higher proportions of options-based compensation are less likely to use captive insurance. Comparisons across financial and governance models indicate that the relationship between captive insurance usage and governance variables is stronger than the relationship between captive insurance usage and financial variables.

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1. Introduction

Captive insurance is an increasingly popular risk-management tool used by firms of all sizes and across all industries. A captive is a wholly-owned subsidiary insurance company created by a parent company to pool or finance its own risks. An insurance captive provides a mechanism for firms to self-insure certain risks while providing financial and tax benefits, as well as direct access to the wholesale reinsurance markets (Culp, 2006; Rejda & McNamara, 2017). In recent years, the insurance captives industry has witnessed an increased form of regulatory competition among jurisdictions, particularly in the US, where more than 3,100 captives are domiciled in Vermont, Utah, Delaware and North Carolina (Bruner, 2020; LaCroix, 2022). Existing work has focused mainly on the role of captives as a risk-sharing arrangement for large firms. As a result, little is known about the impact of captive usage on financial performance. While Chen et al. (2023) document a connection between captive insurance usage and firm cash flow, their study is limited in scope as well as sample set. A comprehensive examination of the effects of captive usage on firm financial performance over time and across industries and firm size is lacking. Moreover, the extent to which the use of insurance captives relates to a firm's ownership structure is unexplored by the existing literature.

Theory suggests that under perfect market conditions, firms would not engage in insurance transactions or hedging because the costs involved would erode firm value. However, the literature on corporate hedging suggests that, because of market imperfections, insurance and hedging activities by firms can have a positive financial impact (Froot et al., 1993; Aretz &

Bartram, 2010). Prior studies find that by decreasing the volatility of cash flows over time, hedging has been shown to lower a firm's costs of financial distress, thereby allowing it to access credit markets more cheaply. Also due to the reduction in the volatility of a firm's profits and losses over time, hedging has been shown to help firms lower their effective tax rates (Smith & Stulz, 1985). Thanks to decreased variability in earnings, hedging also enables firms to increase expenditures on dividends and investments.

A second explanation for hedging and insurance usage involves aspects of corporate governance. In a firm with a concentrated number of large investors, the investors are incentivized to push the firm to engage in hedging and insurance activities, as it is cheaper for the firm to hedge these risks than it is for individual investors who have large exposures to the firm. This is the case, even though most shareholders with smaller stakes in the firm would find it cheaper to diversify such risks through portfolio diversification (Main, 1982). Similarly, in a firm in which executives are largely invested in the firm (in terms of insider shareholdings and stock and options compensation), these executives are incentivized to hedge and insure the assets they hold in the firm through firm-wide hedging and insurance activities, as they may not be able to diversify such risks through portfolio diversification if a large portion of their assets is tied up in firm securities. This would also be the case in firms with large stakes held by a founder or a founder's family. Hedging and insurance activities also matter for firms with large shareholdings by passive institutional investors. Indeed, since there is likely to be less of a check on management activity, management may find it in their best interest to engage in captive insurance usage in order to provide greater financial stability and, consequently, employment stability – especially if we consider that management's human capital is invested in the firm.

Two opposing views can be distinguished with respect to the relation between firms and the use of captive arrangements. The first holds that the tax deductibility provided to captive insurers plays a role in how firms choose their risk-management strategies. This view is based on a large literature that suggests that the benefit of income taxation is a key factor in why firms establish captive insurance structures (Cross et al., 1988; Han & Lai, 1991; Lai & Witt, 1995; Porat & Powers, 1995; Scordis & Porat, 1998). Conversely, the second view holds that financial issues explain the formation of a captive insurance subsidiary by larger firms. This view holds that the use of captives helps to promote the firm value of the non-insurance parent corporation (Chang & Chen, 2019; Scordis et al., 2007). To address these two views, we analyze the financial effects of captive insurance usage and the connection with the corporate governance characteristics of firms using captive insurance structures.

To examine whether captive insurance usage will yield similar benefits as hedging, we use a panel dataset consisting of the annual financial data of US-listed non-financial corporations with securities registered with the SEC over the period 2009-2022 to explain non-financial firms' use of captive insurance structures and the impact on firm financials. The annual financial data are supplemented with evidence of captive insurance usage gleaned from keyword searches and subsequent manual screening of SEC filings for all firms in the dataset. We screened financial filings dating back to 1994 in order to find any earlier mentions of captive insurance usage.

We take a three-pronged approach to analyze the financial and governance aspects of captive insurance usage. First, we examine the relationship between firms' use of captive insurance

and their financial characteristics over time and identify its statistically significant effects on borrowing costs, effective marginal tax rates, and expenditures on dividends and investments. Second, we examine the relationship between insider and institutional investor holdings data, along with executive compensation data, in order to compare the governance aspects of firms that do and do not use captive insurance structures. Third, we compare the relative power of the financial versus corporate governance motives through a comparison of the econometric models.

To characterize the role played by captive insurance structures, we first present evidence showing that the use of captive insurance subsidiaries is widespread among large and midsize companies in the US. Those same tabulations point to a notable pattern in the data. For example, firms utilizing a captive insurance structure tend to have a larger market capitalization and more broadly diversified business structures. Consistent with our first hypotheses, we find that firms' captive insurance usage decreases the costs of financial distress by indicating a strong relationship between captive insurance and decreased borrowing costs.

Our second hypothesis is linked to the literature on the tax deductibility of premiums paid to captive insurers (Cross et al., 1988; Han & Lai, 1991; Hofflander & Nye, 1984; Lai & McNamara, 2004; Lai & Witt 1995). The tax savings literature has shown that the growth of captive insurance usage is linked to favorable tax treatment of captive subsidiaries. Our empirical findings support the tax savings hypothesis. We predict that captive insurance allows firms to take advantage of tax effects, resulting in lower effective marginal tax rates.

Our findings suggest that companies enjoy a lower tax rate once they adopt a captive insurance arrangement and that this benefit persists over time.

Next, we study whether firms using captive insurance structures are driven by corporate dividend policies. Our third hypothesis is that firms using captive insurance are able to commit to higher levels of expenditures on dividends. To gauge how companies' captive insurance arrangements are likely to affect dividend payouts, we use OLS models in which the dependent variable is the sum of all dividend payments and share repurchases scaled by total assets. These regressions also contain a number of controls, including proxies for firm size, leverage effects, intangible assets and industry-fixed effects.

We also explore the relationship between captive insurance usage and firm investments in intangible asset development. An analysis of executive compensation data shows, as predicted, that greater absolute levels of executive compensation, as well as higher proportions of stock-based compensation, are correlated with a higher likelihood of captive insurance usage, while higher proportions of options-based compensation are related to a lower likelihood of captive insurance usage.

Another factor reinforcing the use of captive insurance is holdings by insiders and large shareholders. Models including holdings data show that, as predicted, higher levels of insider holdings are also strongly correlated with captive insurance usage. While there are competing hypotheses on the role of institutional blockholders, our results suggest that such holdings are related to higher likelihoods of captive insurance usage, though the strength of this relationship is weaker than with other governance variables. Finally, comparisons across

financial and governance models show a stronger relationship between governance variables and captive insurance usage, indicating that governance considerations dominate financial ones.

This work contributes to the literature in three ways. First, it contributes to the literature on risk management by showing that captive insurance and hedging have similar effects in addressing risk (e.g., Mayers & Smith, 1990; Yamori, 1999; Hoyt & Khang, 2000; Adams & Buckle, 2003; Adams & Zou, 2008; Regan & Hur, 2007; Picard & Pinquet, 2011). Moreover, this article is also related to the literature on the role of risk-management strategies in reducing R&D risk (Geczy et al., 1997; Lewent & Kearney, 1990). Our findings here confirm the predictions made in the theoretical literature on corporate risk management, hedging, and insurance usage and are consistent with the previously mentioned empirical studies on the financial effects of hedging (Aretz & Bertram, 2010; Haushalter, 2000; Graham & Rogers, 2002; Nance et al., 1993). Similarly, the results related to captive insurance and governance are largely consistent with predictions based on the prior theoretical and empirical literature on hedging and governance (Tufano, 1996; Scordis & Porat, 1998; Geczy et al., 1997; Knopf et al., 2002). Furthermore, by investigating the link between corporate governance and the financial implications of hedging, this work links the previous strands of literature exploring governance and financial motives of hedging (Froot et al., 1993; Lessard, 1991; Smith & Stulz, 1985).

The remainder of the article is organized as follows: Section 2 discusses the theoretical background and hypothesis development in the context of the relevant prior literature.

Section 3 presents the dataset and methodology of the analyses. Section 4 discusses the results of the analyses, and Section 5 concludes.

2. Theory and Hypotheses

This section briefly introduces the background of the captive insurance decision of parent corporations and the tested hypotheses.

The literature on the corporate choice to form a corporate insurance subsidiary suggests that it may be an effective mechanism for reducing the firm's exposure to company-specific risks. Some prior literature has examined the effect of captive insurance formation (Cross et al., 1986). Interestingly, Adams and Hillier (2000) find that the formation of a captive insurance subsidiary elicits no market reaction. The rationale is that firms with a captive insurance subsidiary are likely to have agency conflicts and poor managerial ethics (Scordis & Porat, 1998). Similar results are found in Wood et al. (1988) and Diallo and Kim (1989) in the context of US captive insurance studies. Therefore, while prior research has typically shown that there is little, if any, shareholder value associated with forming a captive insurance subsidiary, we focus on whether the predictive impacts of captive insurance usage on firms' risk management can increase firm value. Furthermore, we test the predicted governance motives for adopting captive insurance structures and compare the relationship between the financial and governance motives. We begin with an overview of captive insurance and the theoretical predictions of its impacts on firm financials found in the risk management literature.

Background on captive insurance

The motive to create a captive insurance arrangement is to self-insure against some of the business risks of the parent corporation. While there are many types of captives, and while they vary in the types of risks covered, all captives allow companies an opportunity to diversify their risks. For example, a firm can self-insure by simply setting aside cash provisions in the event of realized losses or by establishing a subsidiary company to act as an insurance provider. In the latter case, the subsidiary company is said to be a captive insurance entity. The operational entities of the firm identify risks they wish to self-insure and essentially purchase insurance for these risks from its own captive insurance subsidiary. A company that decides to self-insure by setting aside cash reserves must generally do so with taxable income; however, the parent company can generally deduct insurance premiums paid to a firm's captive insurance subsidiary as operating expenses (Main, 1982, 1983). As is also the case with third-party insurance companies, the premiums are invested in order to pay out claims when they arise. The captive insurance entity can also pool all of the insured liabilities from related group entities and resell the risk to reinsurance companies. In this way, the captive insurance entity provides the consolidated firm with access to the reinsurance market, in which risks can be externally insured more cheaply than if each individual group entity in the consolidated firm purchased insurance separately.

Captive insurance companies may be domiciled in financial centers, where there are generally legal and tax advantages for insurance and reinsurance firms. The most popular offshore domiciles for captive insurance entities tend to be Bermuda, the Channel Islands, the

Isle of Man and, to a lesser extent, Luxembourg (Adams & Hillier, 2000; Cole & McCullough, 2008). Within the United States, Vermont, Utah and, more recently, Delaware have become popular jurisdictions (Bruner, 2020). Due to the large presence of the insurance and reinsurance industries in these jurisdictions, the captive insurance company has access to a specialized pool of lawyers, accountants, tax advisors, and actuaries and other insurance professionals who are able to identify and pool various risks to which different group entities are exposed. Such specialized staff and advisors are necessary to comply with transfer pricing regulations governing related party transactions. These transactions require the premium payments made by group entities to the captive insurance entity to be priced according to insurance industry standards at prevailing third-party market prices for the insured risks.

An additional tax benefit of captive insurance usage is related to the transfer pricing of the related party transactions among group entities that are paying premiums to the captive insurance entity (OECD, 2020). Captive insurance is often popular for insuring hard-to-price risks, such as cyber insurance, terrorism and political conflict insurance, and director and officer ("D&O") insurance (Bruner, 2020; LaCroix, 2022; Lesourd & Schilizzi, 2011). These types of risk make captive insurance particularly appealing for a few reasons. First, the large premium prices charged on the open market may not be attractive to a firm, and, therefore, self-insurance is generally more cost-effective. The second reason involves an additional tax benefit of captive usage related to transfer pricing, which allows the firm to charge the very large market rate for such contracts to related entities. These entities then pay large premiums out of pre-tax revenue to the captive insurance entity, which is able to justify the high premiums with similar third-party quotations, resulting in greater group profits in the

jurisdiction of the captive insurance entity, which is most often a low-tax jurisdiction.

Captive insurance as risk management

Prior studies have established the extent to which firms engage in risk management. A central insight from this theoretical literature is that firms commonly face market imperfections that lead to a situation in which a firm can improve value by managing risk through insurance or hedging. Hedging and insurance are, in many ways, substitutes for managing risk. The costs of insurance equate with the costs of hedging activities, and the insurance company equates with hedging counterparties. For hedging, which requires funds, transaction costs include the labor and management costs of devising and managing a company's hedging policy, as well as the transaction costs in terms of broker fees and bid-asks spreads associated with trading the necessary hedging instruments. For insurance companies, transaction costs cover the companies' operational costs and cost of capital.

The capital asset pricing model (CAPM) identifies two types of risk—systemic and firm-specific. Systemic risks cannot be diversified and affect every asset proportionately to the asset's covariance with the market (i.e., the beta term in the CAPM). The implication for investors is that they can diversify away firm-specific risk by constructing a diversified portfolio in which the covariance of firm-specific risks approaches zero. (Sharpe, 1964; Lintner, 1965). Since investors can diversify risks in this way, firm expenditures on any type of risk management, hedging, insurance, or captive insurance should yield to decreases in shareholder value.

A firm may try to insure firm-specific risks, and an insurance seller agrees to sell such a contract if it can diversify that risk by underwriting uncorrelated firm-specific risks of other firms. If the firm is able to purchase the insurance contract at the expected loss, then the value of the firm remains unchanged. However, given positive transaction costs, an insurance seller would be unwilling to sell a contract at this price, as it would need to cover its own operational costs. If a firm tries to buy a contract to insure firm-specific risks for more than the expected value of losses from this risk, then this would not add any additional value for investors since they diversify firm-specific risks through a diversified portfolio. Therefore, attempts by the firm to insure, hedge, or otherwise manage firm-specific risks with positive transaction costs would result in decreased firm value.

It may be beneficial for a firm to buy insurance against systemic risks since investors cannot diversify away such risks (Doherty, 1997). However, since the systemic risks faced by the firms are, by definition, correlated, an insurance company cannot create a portfolio of policies underwriting systemic risk where the risks are uncorrelated. The risks are simply transferred from firms to the insurance company, and since the risks are correlated and additive, the insurance company cannot reduce its exposure through pooling and diversification as it would with uncorrelated risks.

However, given market imperfections, there are several ways that risk management can help firms increase value, given positive transactions costs (Froot et al., 1993). The risk-management literature indicates that hedging and insurance can be beneficial to firms by decreasing costs of financial distress and, thus, decreasing firms' borrowing costs and

effective marginal tax rate and allowing the company to commit more money to regular dividends and investment expenses. we consider these arguments in turn.

Costs of financial distress

In the absence of bankruptcy costs, a solvent firm should find it equally costly to cover a loss by receiving an insurance claim payout, realizing the gain from a hedging contract, or raising additional funds from capital market sources (Modigliani & Miller, 1958; Bessembinder, 1991; Main, 1982). However, investors consider the positive expected costs of financial distress when they invest in the debt or equity of a firm. These include potential costs arising from a bankruptcy procedure (Warner, 1977; Weiss, 1990; Altman, 1984), as well as the value of the implicit call option on the firm's assets held by equity holders and written by the firm's debtholders (Black & Scholes, 1973). The nature of this call option on the firm's assets also means that there is the potential for a conflict of interest between equity and debtholders, with equity holders preferring that the firm undertake riskier investments since this will increase the volatility value of the implicit call option held by equity holders (Black & Scholes, 1973; Jensen & Meckling, 1976; Galai & Masulis, 1976). However, depending on the relative influence of debtholders vis-a-vis equity holders, the opposite can also happen, and firms may underinvest in order to ensure their ability to meet obligations to debtholders (Myers, 1977; Bessembinder, 1991). Insurance can reduce these costs of financial distress.

Captive insurance can decrease a firm's borrowing costs in three different ways. The first is based on the fact that a firm utilizing captive insurance has higher levels of assets on its balance sheet from premium payments made by operating entities. In the event of financial

distress, this means more assets are available to be liquidated in order to cover debtholders' claims.

Second, insurance helps to smooth the volatility of cash flows over time. Profits in profitable years are reduced slightly to pay for insurance premiums, and losses are reduced in years in which loss-occurring events take place due to the payment of insurance claims against those losses. Froot et al. (1993) find that positive firm expenditures on risk-management practices, including hedging and insurance, can decrease borrowing costs by resulting in decreased volatility and, consequently, higher predictability of cash flows to repay debtholders.

Third, Smith and Stulz (1985) and Bessembinder (1991) find that the smoothing of cash flows over time leads to a reduction in the conflicts of interest between debtholders and equity holders thanks to the decreased volatility of the firm's expected returns. Using the logic of options pricing, the decreased volatility of firm earnings reduces the value of the implicit call option on the firm's assets held by equity holders. This means that equity holders are less incentivized to influence the firm to pursue riskier investment opportunities (Black & Scholes, 1973). The result is that debtholders are more likely to be repaid in full. This suggests an initial baseline hypothesis on the effect of captive insurance on borrowing costs.

Hypothesis 1: Firms using captive insurance structures are able to reduce their short-term borrowing costs thanks to lower costs of financial distress.

Taxes

Tax effects are postulated as a market imperfection that can create conditions whereby firms are potentially able to increase firm value through risk management even when positive transaction costs exist. There are several mechanisms by which hedging or insurance transactions result in a lower effective marginal tax rate for a firm. By purchasing insurance, a firm can realize several potential tax advantages. The first advantage comes from the classification of insurance premiums as an operating expense. This means that the purchase of insurance, regardless of whether it is from a third party or a captive insurance entity, is made with a firm's pre-tax income. Therefore, purchasing insurance is more tax-advantageous for a firm than self-insuring by setting aside provisions for losses, which would need to be taken from post-tax income (Main, 1982, 1983).

The second potential tax benefit from insurance or hedging results from the ability of firms with volatile earnings to smooth their profits and losses over time. While losses can often be carried forward or carried back in order to be deducted from a firm's profits in other years, most tax codes limit the amount of time such losses can be carried forward. By purchasing insurance, a firm does not have to worry about the ability to carry forward or carry back losses arising from events that can, instead, be insured. In this second scenario, the firm pays insurance premiums to cover the possibility of a loss-creating event. In years in which such an event does not occur, the insurance premiums reduce the firm's profits; however, when a loss-creating event does occur in a profitable year, the firm receives payouts from insurance claims to reduce losses in years in which the insured loss-creating event has occurred. A firm would, theoretically, be willing to pay a premium for this insurance above the expected loss, equal to the present-discounted value of the tax benefits it would be able to receive from

carry-forward or carry-back losses, plus the additional benefit accruing from not having to worry about the expiration of such losses (Main, 1982).

The third tax benefit is that the ability of hedging or insurance to smooth a firm's earnings over time can allow companies facing a convex tax function to lower their effective tax rates. A convex tax function, as in the case of a progressive tax regime, means that firms pay a higher effective tax rate for higher levels of annual earnings. By reducing profits in years in which no losses occur through insurance premiums, firms are able to realize a lower effective tax rate and yet still reap the other benefits of having insurance for certain loss-creating events. In the case of captive insurance, the benefit is potentially greater because the firm's own captive insurance entity is investing the paid-in premiums and earning profits on the invested capital, which also accrue to the consolidated firm. Graham and Rogers (2002) and Graham and Smith (1999) find that companies facing a convex tax function are able to lower their effective tax rates by using hedging to reduce earnings volatility over time.

A fourth potential benefit can also accrue from the use of insurance. As discussed in the section on costs of financial distress, a firm can lower its costs of financial distress by purchasing insurance. Facing a lower cost of financial distress, a firm is able to rebalance its capital structure and increase its leverage in such a way as to further exploit the tax-deductible benefit of interests payments (Graham & Rogers, 2002; van Binsbergen et al., 2010). The discussion above suggests:

Hypothesis 2: Captive insurance usage by firms allows firms to take advantage of tax effects resulting in lower effective marginal tax rates.

Dividends and Investments

Cash flow variability can lead to variability in expenditures, and, therefore, firms expecting high variability in cash flows would be reluctant to commit to regular expenditures. Since many firms use regular dividends or stock buybacks to signal investors (Ofer & Siegel, 1987; Comment & Jarrell, 1991; Healy & Palepu, 1988) or to cater to a specific clientele of investors (Graham & Kumar, 2006; Baker et al., 2007; Shefrin & Statman, 1984), firms tend to commit to a level of dividends that they are comfortable maintaining over time. The use of insurance or hedging to reduce cash flow variability enables firms to commit to higher levels of regular expenditures on dividends and share buybacks (Froot et al., 1993; Lessard, 1991; Smith & Stulz, 1985). These findings and theories suggest:

Hypothesis 3: Firms using captive insurance structures are able to commit to higher levels of expenditures on dividends.

The argument that risk-management methods such as hedging and insurance can help ensure that firms make cash flow commitments resulting in higher expenditures on dividends and share buybacks has also been applied to expenditures on intangible asset development, under the assumption that most R&D projects are long-term and require consistent, ongoing payments (Geczy et al., 1997; Lewent & Kearney, 1990). As a result, it is likely that:

Hypothesis 4: Firms using captive insurance spend more on intangible asset development.

Governance Motives

Smith and Stulz (1985) present the case that managers with a large share of their personal wealth invested in a firm are likely more motivated to reduce firm risk than the average shareholders, who can diversify risk across their portfolios. This invested wealth can take the form of existing shareholdings (possibly paid out previously as stock compensation), a large proportion of annual salary paid out as stock-based compensation, or simply a large total salary package, as this implies that the manager has a large amount of human capital invested in the firm as the present discounted value of future earnings.

Several empirical studies find that firms are more likely to hedge when they pay executives more stock compensation and less likely when they pay more options compensation (see, for example, Tufano, 1996; Geczy et al., 1997; and Knopf et al., 2002). The idea is that managers are motivated to hedge when they are more invested in the firm; the firm is assuming hedging costs, and since executives receive a large portion of their wealth in stock, they would find it difficult to otherwise diversify this away. Options compensation would motivate less hedging since hedging decreases firm volatility and, consequently, share price volatility. The decreased share price volatility would result in options on the firm's stock being less valuable. Thus, we propose the following two hypotheses:

Hypothesis 5a: High overall levels of compensation, as well as high levels of stock compensation, are positively correlated with captive insurance usage since this means that executives have a large proportion of their wealth in the form of human capital (i.e., the present discounted value of future earnings) invested in a single firm.

Hypothesis 5b: Higher levels of options compensation are more likely to be negatively correlated with captive insurance usage since managers would be disincentivized to reduce the firm's share price volatility since the value of their options would decrease.

Rebello (1995) and Huberman (1997) argue that managers may use hedging to signal firm quality to the market, thereby increasing their own prestige as well. However, in some cases, this can lead to a situation in which managers might use hedging or some form of risk management. Though their use of risk management would be detrimental to the firm, they would do so in order to increase their own prestige at the expense of overall firm value. Scordis and Porat (1998) argue that establishing a captive insurance entity can also be a way for managers to increase their stature, and they find evidence that firms with heightened manager-owner conflicts are more likely to operate captive insurance entities. Again, this may lead managers to form captive insurance entities when the benefits to their particular firm do not outweigh the costs of establishing a captive insurance entity.

With respect to institutional ownership characteristics, we consider two competing hypotheses. On the one hand, investors with large holdings would have both the incentives to actively monitor firm behavior and the means, through increased voting power, to ensure that firms avoid excessive risk taking. This would also lead to the prevention of captive insurance structures if they were value-destroying and were being pursued for the private benefit of blockholders or management. If, however, such structures are value-enhancing, then the interests of management and shareholders would be aligned. On the other hand, large institutional investors may assume a more passive role, in part because monitoring costs and

the free-rider problem would lead to a failure of collective action. Similarly, when we examine the influence of ownership concentration and large blockholders, we must also consider two competing effects. Concentrated ownership could result in blockholders using their influence to pursue private benefits to the detriment of total firm value. However, high ownership concentration could lead to more-efficient monitoring, which could benefit all shareholders, not just blockholders (Barclay & Holderness,1989; Shleifer & Vishny,1986; Black, 1990; Karpoff et al., 1996; Agrawal & Knoeber, 1996; Huddart, 1993; Maug, 1998).

The presence of large, outside blockholders can also have conflicting effects. If the hedging or captive insurance is likely to be value-creating because of the financial benefit of increasing firm value (as discussed in the financial benefits sections above), then blockholders would be motivated to advocate its implementation. The reason is that there would be alignment between (1) the private benefits they would receive since they would not be able to diversify their large holding stake as cheaply as average shareholders could and (2) the increases in firm value from the hedging or captive insurance usage. These motives also align with those of management, who are, through their holdings and compensation packages, heavily invested in the firm. This illustrates how captive insurance as a form of risk management can help to align managerial and shareholder motives and mitigate managerial conflicts (Hartzell & Starks, 2003). However, if the private benefits hypothesis dominates for the blockholders, and their interests conflict with the goal of increased total firm value, then they may prevent firms from engaging in value-creating risk management, be it hedging policies or captive insurance formation (see, for example, Smith & Stulz, 1995; Tufano, 1998; and Breeden & Viswanathan, 2015). Thus, we expect that:

Hypothesis 6: Insider holdings and holdings by institutional blockholders are positively correlated with captive insurance usage, as executives and large shareholders would prefer firms to hedge because their ability to diversify portfolio risk may be more limited due to the large investments in a single firm. Despite the possibility that blockholders may be more motivated to seek private benefits than to increase overall firm value, these interests are likely to align in the case of captive insurance usage.

3. Data and Methodology

This section describes the data and methodology employed to test our hypotheses regarding firms' captive insurance usage.

The sample used in this study consists of a panel dataset consisting of non-financial companies with primary securities listed on equity exchanges in the United States over the period of 2009-2022. We screen in Compustat for non-financial companies with assets over 500m and a market cap over 500m. To screen for industry, we use the Global Industry Classification Standard (GICS) developed by MSCI and Standard & Poor's (S&P) (S&P 2018) and filter out any companies belonging to the GICS sector "financials" (GICS sector code 40).

We add annual financial accounting data from Compustat. From Bloomberg, we access measures of firm borrowing costs, as well as insider holdings data and executive compensation data. Institutional holdings data drawn from 13F filings are from the Refinitiv

(formerly Thomson Reuters) database on Institutional Holdings. Any investment manager with at least USD 100 million in assets under management is required to file form 13F with the SEC, listing their equity ownership stakes (17 CFR § 240.13f-1). In addition to key indicators of firm financial data from Compustat, the panel data are complemented with effective marginal income tax rates based on the methodology employed by Blouin et al. (2010) and weighted average annual borrowing costs on short-term debt. The data used to calculate the effective marginal tax rates are also from Compustat. Then we remove any firm-year observations for which there are any missing values.

A keyword search through SEC filings, along with a manual review, has allowed us to flag firms in the dataset that employ captive insurance structures. For each firm and each year, we code a dummy variable indicating whether or not a firm utilizes a captive insurance structure in that year. A value of 1 indicates that a firm uses captive insurance, based on keyword searches of SEC filings and manual screenings, and a value of 0 indicates that no evidence of captive insurance usage has been found. Additionally, for firms in the dataset using a captive insurance structure, we create a variable denoting how long, in years, the firm has been using captive insurance. For those firm-year observations in which the firm later uses captive insurance, we allow this variable to take negative values indicating the number of years before a captive insurance structure is formed.

Finally, year and industry dummy variables are generated to control for year and industry effects. Table 1 describes all the variables included in the analysis. Summary statistics for all variables are presented in Table 2.

Summary characteristics of the dataset and a discussion of general trends of captive insurance usage are presented in Table 3. Over time, more and more firms are using captive insurance across all industries. Panel B in Table 3 shows the number of company observations for each year in the dataset and the percentage of companies using captive insurance in each year. For firms in the dataset that do implement captive insurance structures at some point over the 2009-2022 observation period, Panel C shows the years of captive insurance formation and the number of firms forming captive insurance structures in each year. Panel D shows a snapshot of captive insurance usage by industry, revealing a general trend of usage across all non-financial industry sectors.

There is a high correlation of captive insurance usage with firm size, whereby larger firms are more likely to use captive insurance. Panel E illustrates that the likelihood of a firm using captive insurance structures increases with the firm's market capitalization. There are two key explanations for this likelihood. First, there are economies of scale—the costs of setting up and managing captive insurance subsidiaries make the structure more cost-efficient for larger firms, which already have many subsidiaries and employ legal and tax advisory firms that focus on such large corporate structures (Bruner, 2020). This means that for very large firms, the benefits of establishing and managing a captive insurance structure exceed the costs. Second, this may also indicate a herd mentality, whereby the advisors of large multinational firms attempt to sell captive structures to all of their clients (Adams & Hillier, 2000). For instance, most major accounting and corporate law firms have specialized practices focusing on the setup and management of captive insurance entities.

Methodology

In order to test the relationships between captive insurance and the four financial variables it is intended to impact—borrowing costs, tax rates, dividends, and expenditures on intangible asset development—ordinary least squares (OLS) models are used to regress on these financial variables as the dependent variables. To test the effect of captive insurance usage, a dummy variable is used to indicate whether the firm is using captive insurance in the current year. This variable is then replaced with a variable indicating how long the firm has used captive insurance or, in the case of negative values for this variable, how long it will be before the firm uses it.

In all of the models, we control for size using the natural logarithm of assets, profitability using return on assets (ROA), leverage using the ratio of total debt to assets, and the value of intangible assets by using Tobin's Q. For certain models, additional control variables are used as appropriate, and these are discussed in the context of each analysis below. In order to control for year and industry effects, dummy variables are used for years and for each GICS industrial sector classification.

To test the robustness of our models, we use several strategies. we use two sets of models—a combined set with all observations and a set with only companies that used captive insurance structures at some point over the 2009-2022 period. We repeat the same regression with the captive use flag (indicating if the firm is using a captive insurance structure in the current year) for both sets. The addition of the second model allows us to compare the before and after effect of company-year observations where the firm is currently using captive insurance with company-year observations where the firm will at some later point adopt a captive

insurance structure. This helps to ensure that the use of captive insurance is not simply coincidental with other firm characteristics exogenous to the model, which are affecting the dependent financial variables.

Then we rerun the regression on the subset of companies that used captives at some point over the 2009-2022 period, replacing the captive use flag with the variable that indicates how long the firm has been using captive insurance; and for firms that are not currently using captive insurance, this variable takes a negative value that indicates the number of years before the firm will begin using captive insurance. In addition to serving as a robustness check, this model considers whether the amount of time before and after captive insurance usage has an impact on the dependent financial variable.

In order to investigate the link between governance and captive insurance usage, we use logit models in which the dependent variable is the dummy variable that indicates whether or not the firm is using captive insurance in the current year. The dependent variables are data on executive compensation: the natural logarithm of total executive compensation; the ratio of stock compensation to total executive compensation; and the ratio of options compensation to total executive compensation. Control variables are used for firm size (the natural logarithm of total assets), profitability (ROA), leverage (total debt to assets), and tangibility (Tobin's Q). Dummy variables are used to control for year and industry effects.

The logit model is first run on the entire dataset and then repeated for the subset of company-year observations for firms that used captive insurance at some point during the 2009-2022 period. Then, a third model is run: this is an OLS regression using the same subset of

companies as the second model, but the dependent variable is replaced with the variable indicating the number of years since the firm began using captive insurance or, for firms that have not yet begun using captive insurance, a negative value indicating how many years it will be before the firm forms a captive insurance entity.

The three regression models featuring executive compensation variables are then repeated, replacing the executive compensation variables with variables on ownership characteristics: the total proportion of shares owned by institutional investors; the proportion of shares owned by blockholders; and the proportion of shares held by insiders.

Finally, two additional sets of models are created to test the relative importance of the governance and financial variables we have examined. First, the three models are repeated again, combining all executive compensation and ownership variables in order to test the robustness of the results and compare the relative strength across these three variables. Second, these models are repeated, and all governance variables are replaced with the financial variables tested previously: borrowing costs; marginal tax rate; dividends; and expenditures on intangible asset development. These two models allow for comparisons between the financial and governance aspects of captive insurance usage in order to examine which factors are more influential.

4. Results

This section contains further details on the construction of the econometric models. We begin with a brief overview of the factors influencing each of the dependent variables based on a review of the relevant theoretical and empirical literature. The literature has influenced the selection of explanatory and control variables used to construct our models. We include these variables in our models in order to control for other effects on the dependent variable besides captive insurance usage. We then present the results of our tests with respect to each dependent variable.

Borrowing costs

Using insurance can affect a firm's debt capacity and help lower its borrowing costs (Adams & Zou, 2008). Captive insurance offers an interesting setting in which to examine the effect of its usage on a firm's cost of debt. The dependent variable is sourced from Bloomberg and measures the after-tax weighted average cost of debt for the firm's debt securities as a spread over the risk-free rate (the ten-year government bond rate in this case). The cost of debt field is calculated using government bond rates of corresponding maturities, a debt adjustment factor, the proportions of short- and long-term debt to total debt, and the firm's effective tax rate (Bloomberg Financial Terminal). The independent variable of greatest interest is a dummy variable indicating whether or not the firm uses a captive insurance structure; in the third model variant run on the subset of companies that use captive insurance at some point over the 2009-2022 period, this variable is replaced by a variable indicating how long a firm has used captive insurance structures or how long it will be before a captive structure is adopted, in which case the variable takes a negative value. The control variables are chosen based on the theoretical literature on costs of financial distress and are similar to those used in

empirical studies of borrowing costs by Altman (1968), Begley et al. (1996), and García-Teruel and Martínez-Solano (2007).

Firm size affects borrowing costs because the level of asymmetric information between borrowers and lenders is generally higher for smaller firms, making it more costly for lenders to assess their credit quality (Berger & Udell, 1998). Smaller firms also tend to have less access to capital markets and correspondingly less pricing power in negotiating borrowing rates (Titman & Wessels, 1988). Because these factors generally increase borrowing costs for smaller firms, we control for firm size by using the natural logarithm of total assets as a control variable.

We include the current ratio (current assets divided by current liabilities) in the models examining borrowing costs. The current ratio is often used in the empirical literature as one indicator of a firm's ability to repay its debt obligations. This also serves as one proxy for a firm's costs of financial distress. Firms with a higher current ratio have a higher level of current assets available to cover current liabilities. This means that a lender should be more easily able to liquidate current assets in order to cover unpaid liabilities; therefore, the costs of financial distress are lower when the current ratio is higher.

Since a firm's costs of financial distress are also higher when there is greater overall leverage due to conflicts of interest between equity and debtholders, we incorporate the leverage measures of total debt to assets as a control variable for leverage in our analyses. We use Tobin's Q ratio of the market value of a firm's equity and debt to the book value of firm assets in order to control for effects from firms that have large levels of internally developed

intangible assets, significant unrecognized appreciation of assets, or other indicators of high growth; all of these affect a firm's ability to increase leverage.

We include the ratio of short-term to total debt as a controlling variable for several important reasons. Myers (1977) and Leland and Toft (1996) find that longer-term debt increases conflicts of interest between shareholders and debtholders less than short-term debt does. Therefore, a greater proportion of short-term debt can reduce these conflicts of interest and lead to lower costs of financial distress while maintaining the same level of overall leverage. Additionally, Diamond (1991) argues that a firm's choice between short-term and long-term debt depends on credit ratings, access to capital markets, and information asymmetries. Therefore, the inclusion of the short-term to total debt ratio helps to control for these factors.

The levels of the risk-free rate, inflation and other macroeconomic factors are also important variables to consider in analyzing short-term borrowing costs (Walker, 2010). However, since these variables affect all firms at the same time, the use of year dummies in our regression models mean that such common, time-dependent fixed-effects are already controlled for in the regression models.

The results of our models testing the impact of captive insurance usage on short-term borrowing costs are reported in Table 4. To this end, the results of the three model variations confirm our hypothesis that captive insurance decreases costs of financial distress by indicating a strong relationship between captive insurance usage by firms and decreased borrowing costs. Model 3, which considers how long a firm has been using captive insurance,

confirms the effects and indicates that the decrease in borrowing costs after a firm adopts a captive insurance structure continues slightly over time.

The signs of the effects of the other independent and control variables on borrowing costs are largely consistent with the theoretical predictions discussed above. Larger firms, as measured by the natural logarithm of total assets, enjoy decreased borrowing costs. Higher levels of intangible assets (measured by Tobin's Q) are correlated with lower borrowing costs. The relationship between the proportion of short-term debt to total debt and borrowing costs is negative across our models. This is consistent with the arguments of Myers (1977) and Leland and Toft (1996) that higher proportions of short-term debt reduce costly conflicts between debt and equity holders since the frequent rollover of short-term debts provides debtholders with a greater voice. However, this may also be related to Diamond's (1991) argument that a firm's preference for short-term versus long-term debt is parabolically related to its credit quality. Diamond (1991) finds that high-credit-quality firms will find it relatively cheaper to borrow short-term debt, but poor-quality firms will have access only to expensive short-term debt.

Our results are consistent with the empirical literature on the effects of hedging on borrowing costs and demonstrate that captive insurance usage yields similar results to hedging on firm borrowing costs. Geczy et al. (1997) find that firms using currency derivatives for hedging have lower borrowing costs, and an analysis by Haushalter (2000) indicates that firms with more-extensive hedging policies generally have lower costs of debt.

Marginal Tax Rates

Taxes are perennially a market imperfection and play an important role in capital structure determination because of the tax deductibility of interest payments. This tax deductibility makes debt financing relatively cheaper than equity financing and allows firms to take advantage of the tax benefit of debt financing to increase leverage. Of course, this will continue only up to the point where the costs of increased leverage—in terms of costs of financial distress and conflicts of interest between debtholders and shareholders—begin to outweigh the benefits of the interest tax deduction (Modigliani & Miller, 1958; DeAngelo & Masulis, 1980; Leland, 1994; Graham, 2000; Leland & Toft, 1996).

In order to test whether captive insurance helps companies lower their effective tax rates, we model the effect of captive insurance usage on effective marginal tax rates, which, in our dataset, reflect the effective marginal tax rate faced by the firm after considering the firm's interest rate deduction benefits. Data on tax rates are from the Wharton Research Data Service (WRDS) Marginal Tax Rates Database. This database uses firm-level data from Compustat and a methodology developed by Blouin et al. (2010).

As discussed above, the theoretical and empirical literature suggests that a company's capital structure decision is directly related to the firm's effective tax rate because of the tax-deductibility of interest payments (Modigliani & Miller, 1958; DeAngelo & Masulis, 1980; Leland, 1994; Graham, 2000; Leland & and Toft, 1996). Therefore, we use the leverage calculations of total debt to assets in order to control for this effect of leverage on tax rates. Leland and Toft (1996) further show that long-term debt, as compared to short-term debt, allows companies to exploit greater tax benefits; however, Diamond (1991) argues that firms

with better credit quality prefer short-term to long-term debt because it is relatively cheaper. If firms with higher absolute profits have better credit quality along with higher tax rates, they face a tradeoff between the additional tax savings of long-term debt and cheaper short-term debt. For this reason, we also include the ratio of short-term debt to total debt to control for these effects. To control for firm size, we use log assets, and to control for the absolute level of profits, we use the log of net earnings.

Table 5 presents the results of our models. In all the model variations, we find that firms utilizing captive insurance tend to have a lower marginal tax rate. While model 3 shows that there is a statistically significant negative effect related to the length of time a company has used captive insurance, the magnitude of this effect is minimal. Nonetheless, this model variant helps to confirm the role of captive insurance in helping firms lower their effective tax rates.

The results for firm size, measured by the natural logarithm of assets, indicate a negative relationship between firm size and effective tax rates. This may be because larger firms have greater access to tax advisers, lawyers and lobbyists, along with the political clout to find and take advantage of as many tax benefits as possible in pursuit of a lower overall tax bill. As can be seen when considering the relationship between marginal tax rates and total level of firm profits, measured by the natural logarithm of net income, firms with higher absolute levels of profits tend to pay higher marginal tax rates. The positive relationship between profit and tax rates indicates, consistent with the empirical findings of Graham and Smith (1999), that most firms tend to face a convex tax function, suggesting an overall progressive nature of the corporate tax system.

In general, the results of our models provide strong support for our hypothesis that firms are able to decrease their effective tax rates through captive insurance usage. Furthermore, companies enjoy a lower tax bill once they adopt a captive insurance structure, and this benefit continues, albeit modestly, over time. These results support the tax-saving motivation for using captive insurance and is consistent with the empirical literature on the tax-saving benefits of hedging as a risk-management technique (Graham & Rogers, 2002; Graham & Smith, 1999).

Dividends

Modigliani and Miller (1961) argue that, under perfect market conditions, investors should be indifferent about how a firm pays out profits. Regardless of whether a firm pays out earnings through dividends or share repurchases, the money is redistributed to shareholders. Even if a firm does not return earnings to investors, as long as the firm continues to invest in projects that will earn the firm's equity cost of capital, the firm's market capitalization will increase by the amount of the earnings, and investors can simply sell some appreciated shares in order to convert some of the firm's profits into cash.

When examining a firm's payout policy, it is essential to control for a firm's asset level, level of intangible assets, and leverage. If a firm decides to increase payouts by reducing investments in intangible assets or selling assets, then the opportunity cost of the forgone investments or decrease in firm assets has an effect on shareholder value. Similarly, if a firm

increases its borrowing to pay dividends, the change in the firm's leverage affects shareholder value. (Modigliani & Miller, 1961; Lintner, 1962).

In order to test the relationship between captive insurance usage and a firm's payouts to shareholders, we use OLS models in which the dependent variable is the sum of all dividend payments and share repurchases, scaled by total assets. This includes dividends paid in cash or in shares. Dummy variables for both year and industry are used to control for year and industry effects. As a control for firm size, we use the natural logarithm of total assets. To control for leverage effects, we use the ratio of a firm's total debt to assets as a control variable. Return on Assets (ROA) is used to control for the level of profitability. In order to control for the effects of firm investments in intangible assets, as well as for the value of internally developed intangible assets that do not appear on the balance sheet, we use Tobin's Q ratio as a control variable. This is consistent with similar empirical studies (O'Brien, 2003; Geczy et al., 1997).

The results of the regressions on dividends in Table 6 show strong evidence supporting a positive relationship between expenditures on dividends and share repurchases and captive insurance usage. The years-of-captive-use variable in model 3 illustrates that the benefit of using captive insurance is statistically significant not only before and after a captive insurance structure is employed, but also in the time before and after a firm begins using captive insurance.

The results of the above analyses are consistent with the empirical literature on the relationship between dividends and hedging. Nance et al. (1993) find a positive relationship

between hedging and dividend payouts. In contrast, Haushalter (2000) finds that firms with hedging programs are more likely to have lower dividend payouts. However, Haushalter's study focuses on hedging policies in industries (oil and gas producers) in which liquidity is important; and, for these firms, high dividend payouts may act as a substitute for hedging since dividends can be decreased to increase liquidity if necessary.

Investments

The argument that risk-management methods such as hedging and insurance can help ensure that firms meet their commitments has been used to posit a positive relationship between captive insurance usage and expenditures on dividends and share buybacks, as well as on higher R&D expenditures under the assumption that most R&D projects are long-term and require ongoing payments (Geczy et al., 1997; Lewent & Kearney, 1990). This would suggest that there should be a positive relationship between captive insurance usage and firm expenditures on intangible asset development; and the same would apply to expenditures on advertising, as it is also an investment in intangible assets such as brand value and customer loyalty.

In order to test the relationship between captive insurance usage and a firm's level of investment in intangible asset development, we use OLS regressions on the sum of R&D and advertising expenditures divided by assets as a proxy for a firm's level of investment in internally developing and enhancing intangible assets. To control for the existing level of intangible assets, we use Tobin's Q ratio as a control variable. Additionally, we use the natural logarithm of assets to control for size effects, ROA to control for firm profitability,

and the ratio of total debt to assets as a control for leverage. Dummy variables for years and industries are used to control for time and industry effects.

Table 7 shows the results of these regressions, presenting strong evidence of a positive relationship between investments in R&D and advertising and captive insurance usage. The variant of the models on the subsets of companies that used captive insurance at some point during 2009-2022 confirm this result for companies using versus not using captive insurance, as well as for the before and after effect of companies adopting captive insurance usage. These results also support the empirical evidence in Geczy et al. (1997), showing a positive relationship between currency-hedging activities and R&D expenses.

Governance Factors

In order to investigate the impact of corporate governance factors on captive insurance usage, we use logit regression models of governance variables as independent variables and the binary captive use variable as the dependent variable. This logit regression is repeated for the subsample of companies that used captive insurance at some point over the 2009-2022 period. Also with this subsample, we run an OLS regression with the same set of independent variables, with the dependent variable being the number of years the firm has been using captive insurance or the number of years prior to the firm adopting captive insurance. Control variables are used to control for firm size (the natural logarithm of assets), profitability (ROA), leverage (total debt to assets), and the level of intangible assets (Tobin's Q). Year and industry effects are controlled for by using dummy variables for years and GICS industry

sectors. Table 8 shows the models examining governance variables. Compensation variables are considered in Panel A and ownership variables in Panel B.

The models on compensation variables show that firms are more likely to utilize captive insurance when they pay levels of total executive compensation and higher proportions of compensation as stock. Furthermore, the models indicate that firms are less likely to hedge when they pay higher options-based compensation, as the decreases in volatility from firm hedging will result in decreased value of options on the firm's securities. The results of model 3 regressing on the years-of-captive-use variable illustrates that as companies adopt captive insurance structures, the proportion of options compensation decreases over time as the proportion of stock compensation increases, even holding the overall level of compensation constant. Relatively speaking, options compensation becomes much less attractive since the captive insurance structure decreases firm volatility, and, consequently, the value of options contracts declines.

The models of ownership variables indicate that firms with higher levels of insider holdings and higher levels of holdings by institutional blockholders are more likely to use captive insurance. Despite the demonstrated statistical significance of the measurement of institutional blockholder ownership, the magnitude of the relationship between insider holdings and captive insurance usage, as well its the statistical significance, is much stronger than that for blockholders. This pattern for insider holdings is also consistent across the three model variations.

The results related to captive insurance usage and compensation and ownership variables are consistent with our hypotheses and with the theoretical and empirical literature on these factors in relation to firms' risk management and hedging activities. Smith and Stulz (1985) argue that firms with high levels of insider shareholdings are more likely to engage in risk-management activities, as the high managerial holdings mean that insiders are not able to diversify their portfolios as cost effectively as the average shareholder and, therefore, disproportionately benefit from the firm engaging in risk-management activities. Institutional blockholders with significant portions of their total portfolio invested in a single firm would similarly find it difficult to hedge more cheaply through portfolio diversification. The argument concerning diversification can be easily extended to compensation variables, as managers paid with higher salaries and higher proportions of stock can be thought of as having their human capital invested in the firm in the form of future earnings. Our findings with regards to compensation are consistent with empirical studies on firms' hedging activities (Tufano,1996; Geczy et al., 1997; Knopf et al., 2002).

In order to compare the governance and financial variables, two additional sets of models are created. Panel A of Table 9 shows models combining all compensation and governance variables. Panel B of Table 9 replaces the governance variables with the four financial variables (borrowing costs, marginal tax rates, dividends, and investments in intangible assets) found to be impacted by captive insurance usage. Comparisons across models, considering model fit measures (r-square values), as well as the magnitude and statistical significance of the financial and governance variables (coefficients and p-values), indicate that the governance-related variables are more predictive of captive insurance usage than the financial variables.

5. Conclusions

This article examines the financial benefits that firms experience through captive insurance usage and the relative importance of financial and governance variables in a firm's decision to adopt captive insurance.

Our panel dataset consists of non-financial companies with primary securities listed on equity exchanges in the United States over the period 2009-2022. We find that there is a high correlation between captive insurance usage and firm size. Our findings are consistent with the view that the costs of setting up and managing captive insurance subsidiaries make the structure more cost-efficient for larger firms that already have many subsidiaries and employ legal and tax advisory firms that focus on such large corporate structures.

Our empirical investigation also looks at whether captive insurance can decrease a firm's costs of financial distress and effective marginal tax rate. Supporting the tax minimization hypothesis, we find that firms using captive insurance tend to have a lower marginal tax rate. Our results show that there is a statistically significant negative effect related to the amount of time a company has used captive insurance, though the magnitude of this effect is minimal. This is also consistent with empirical studies showing that corporate hedging can accomplish similar goals.

Supporting the financial hypothesis, this work also shows that the ability of firms to meet their expense commitments is associated with their captive insurance usage. In particular, we find strong evidence supporting a positive relationship between expenditures on dividends and share repurchases and the use of captive insurance. Results reveal that the benefit of captive insurance is statistically significant not only before and after a captive insurance structure is employed, but also in the time before and after a firm begins using captive insurance.

In examining the relationship between captive insurance and governance, we show that higher levels of ownership by insiders and blockholders affect a firm's decision to use captive insurance structures. We observe, however, that despite the statistical significance of the measurement of institutional blockholder ownership, the magnitude of the relationship between insider holdings and captive insurance, as well as its statistical significance, is much stronger than that for blockholders.

We also examine the influence of executive compensation levels and the proportions of stock and options compensation on the firm's captive insurance decision. Firms are more likely to utilize captive insurance when they pay higher levels of total executive compensation and higher proportions of that compensation as stock. Furthermore, we find that firms are less likely to hedge when they pay higher options-based compensation, as the decreases in volatility from firm hedging will result in decreased value of options on the firms' securities. For companies that adopt captive insurance structures, the proportion of options compensation actually decreases as the proportion of stock compensation increases, even holding the overall level of compensation constant. These findings suggest that options

compensation becomes much less attractive since the captive insurance structure decreases firm volatility, and, consequently, the value of options contracts declines. The results are consistent with the theoretical literature on governance and risk management and the empirical literature examining firms' hedging decisions in relation to compensation structures.

This article contributes to the literature on captive insurance structures, which has tended to focus on the impact of the corporate insurance decision. The results of our analyses link the theoretical literature on risk management to captive insurance usage and add to the empirical literature on firms' hedging practices to include captive insurance usage. In all, this research provides direct comparisons between the financial results of captive insurance usage and the governance motives. Thus, by showing that governance-related motives are more important to firms' decisions about adopting captive insurance structures, this work has implications for shareholder perspectives on the benefits of forming an in-house risk-financing mechanism.

Table 1 - Variable definitions

This table provides definitions, sources and relevant calculations for the variables used in our analyses.

Variable	Definition
total institutional ownership	This is the proportion of a company's shares owned by institutional investors. Institutional holdings data are sourced from Refinitiv (formerly Thomson-Reuters) Institutional Holdings database and are drawn from 13F filings with the SEC. Asset managers with at least USD 100 million in assets under management are required to disclose the securities they manage in 13F filings with the SEC (17 CFR § 240.13f-1). Source: Refinitiv Institutional Holdings Database
blockholder holdings	This is the proportion of a company's shares held by institutional blockholders (i.e., institutional investors with at least a 5% ownership stake). Institutional holdings data are calculated from data sourced from the Refinitiv Institutional Holdings database, which draws from 13F filings with the SEC. Source: Refinitiv Institutional Holdings Database
insider holdings	This variable is used to measure the shareholdings of insiders. Specifically, it is the shares held by executives and non-employee directors. Source: Bloomberg
log assets	We use the natural logarithm of a company's assets in order to control for relative firm size in the analyses. Source: Compustat.
ROA	As a control variable for company profitability, we use the return on total assets (ROA). ROA is calculated as: Net Income / Total Assets. Source: Compustat
current_ratio	The current ratio is used in models of firm cost of debt. It is calculated as: current assets / current liabilities. Source: Compustat
captive flag	This variable is a dummy variable that takes the value of one if a firm is using a captive insurance structure during the current year. It is determined based on keyword searches and hand screenings of

	company SEC filings accessed via the Wharton Research Data Services (WRDS) SEC Analytics Suite.
years of captive usage	This variable indicates the number of years since a company began using a captive insurance structure. It can take negative values indicating the number of years before the company adopted a captive insurance structure. It is determined based on keyword searches and hand screenings of company SEC filings accessed via the Wharton Research Data Services (WRDS) SEC Analytics Suite.
net income	This variable is used in modeling firms' marginal tax rate. Source: Compustat
marginal tax rate	This variable approximates the effective marginal tax rate faced by the firm after considering the firm's interest rate deduction benefits. These data are from the Wharton Research Data Service (WRDS) Marginal Tax Rates Database. This dataset uses Compustat data and a methodology developed by Blouin et al. (2010).
Tobins_Q	we use Tobin's Q ratio to control for the level of a firm's intangible assets. It is the ratio of the market value of a firm to the book value of the firm's assets. The ratio is computed as: (Market Capitalization + Total Debt) / Total Assets. Source: Compustat
total debt to assets	In order to control for leverage, we calculate the ratio of total firm debt to total assets. Source: Compustat
short-term to total debt	This variable is used in modeling firms' cost of debt; it is the proportion of the firm's short-term debt to total debt. Source: Compustat
Industry	we use industry sector dummies based on the two-digit GICS industry sector codes. Source: Compustat
cost of debt	This field is sourced directly from Bloomberg and is used to approximate firms' borrowing costs. It measures the after-tax weighted average cost of debt for the firm's debt securities as a spread over the risk-free rate (the country's long-term bond rate (10-year)); it is calculated using government bond rates of corresponding maturities, a debt adjustment factor, the proportions of short- and long-term debt to total debt, and the firm's effective tax rate. Source: Bloomberg

log total exec comp	This variable is the natural logarithm of the total value of compensation paid to all company executives. Source: Bloomberg
stock to total comp	This is the ratio of the value of stock-based compensation awarded to company executives to the total compensation paid to all company executives. Source: Bloomberg
options to total comp	This is the ratio of the value of options awarded to company executives to the total compensation paid to company executives. Source: Bloomberg
dividends to assets	This is the ratio of cash and stock dividends, as well as stock buybacks, to total assets. Source: Bloomberg
advertising and R&D expenses to assets	This variable is used to model company investments in intangible asset development. It is the sum of company expenditures on research and development (R&D) and advertising divided by total assets. Source: Compustat

Table 2 – Variable summary statistics

This table presents summary statistics for all variables used in the analyses, with the exception of year and industry dummy variables (n=16787 distinct company-year observations).

Summary Statistics, using the observations (n=16787)

Variable	Mean	Minimum	Maximum	Std. Dev.
assets	10177	633	41842	25720
total debt to assets	0.2625	0	1.6047	0.2002
short-term to total debt	0.0918	0	11.66	6518
current_ratio	2.2202	0.1346	4.9550	1.7939
Tobins_Q	1.9630	0.5978	12.8356	1.2075
ROA	0.0493	-0.0600	0.1597	0.0800
cost of debt	2.3003	0.1233	18.97	1.2644
captive flag	0.7510	0	1	0.4336
years of captive usage	6.6645	-12	29	6.6826
net income	570.79	-168.25	53394	2227
marginal tax rate	0.3046	0	0.39	0.0755
dividends to assets	0.0181	0	1.4618	0.0376
advert+R&D to assets	0.0350	0	0.5380	0.0552
total exec comp	19063000	416830	49100000	18614000
stock to total comp	0.3336	0	1.1355	0.2093
options to total comp	0.1450	0	0.4840	0.1699
total institutional ownership	0.8029	0.3504	1	0.2169
blockholder holdings	0.2465	0	1	0.1576
insider holdings	0.0275	0	0.0998	0.0738

Table 3 – Database descriptive statistics

This table presents various descriptive statistics of the dataset. Panel A reports the number of year-company observations and the proportion of these observations in which captive insurances structures are being utilized in the current year for that company, along with the total number of unique companies appearing in the dataset and the proportion of those companies using captive insurance structures in at least one year during the 2009-2022 period. Panel B reports the number of unique companies appearing in the dataset for each year over the 2009-2022 period and the proportion of companies using captive insurance structures in each year. Panel C shows the number of companies in the dataset that formed captive insurance structures during each year. Panel D provides a breakdown by industry of companies appearing in the dataset for 2022, as well as the proportion of companies using captive insurance structures during that year. Panel E provides a breakdown by market capitalization ranges for companies appearing in the dataset for 2022, as well as the proportion of those companies using captive insurance structures during that year.

Panel A

year-company observations	16787
percent using captives in current year	29%
unique companies	1842
percent using captives during 2009-2022	34%

Panel B

year	number of companies	percent using captives
2009	1012	21%
2010	1078	21%
2011	1074	23%
2012	1129	24%
2013	1244	24%
2014	1287	26%
2015	1292	29%
2016	1233	31%
2017	1241	34%
2018	1238	34%
2019	1252	33%
2020	1231	34%
2021	1233	34%
2022	1243	34%

Panel C

year of captive formation	number of companies
1994	13
1995	11
1996	6
1997	19
1998	13
1999	16
2000	10
2001	14
2002	26
2003	17
2004	27
2005	29
2006	18
2007	19
2008	20
2009	12
2010	17
2011	28
2012	27
2013	26
2014	45
2015	57
2016	49
2017	42
2018	31
2019	27
2020	35
2021	32
2022	38

Panel D: Companies by industry in 2022

Industry	companies	percent using captives
Energy	121	32%
Materials	116	45%
Industrials	260	44%
Consumer discretionary	205	27%
Consumer staples	72	28%
Healthcare	136	35%
IT	204	27%
Communications	62	24%
Utilities	67	33%

Panel E: Companies by market capitalization in 2022

market cap	companies	percent using captives
over 200bn USD	17	65%
10bn to 200bn USD	284	43%
2bn to 10bn USD	535	32%
less than 2bn USD	407	29%

Table 4 – Borrowing costs

This table reports the results of ordinary least squares (OLS) regressions modeling the effect of captive insurance usage on firms' borrowing costs. The dependent variable is the cost of debt measurement provided by Bloomberg. Model 1 includes the entire dataset; Models 3 and 4 use the subset of observations for companies that used captive insurance at some point over the 2009-2022 period. Models 1 and 2 include the captive flag dummy as an independent variable; this is a dummy variable indicating whether the company is using a captive insurance structure in the current year. Model 3 replaces this variable with the years-of-captive-usage variable. This variable indicates the years since the company began using a captive insurance structure; it can take negative values indicating the number of years prior to the company adopting captive insurance. All independent variables are lagged by one year except for the captive flag dummy variable and the years-of-captive-usage variable. All models use dummy variables to control for year effects and industry group effects. Standard errors appear in parentheses below coefficients, and statistical significance is denoted at the *10 percent, **5 percent, and ***1 percent levels. Definitions of all variables along with relevant calculations appear in Table 1.

Dependent variable: cost of debt			
	1	2	3
log assets	-0.0257***	-0.0505***	-0.0482***
	(0.0073)	(0.0117)	(0.0118)
total debt to assets	1.3951***	1.5566***	1.5400***
	(0.0517)	(0.0871)	(0.0871)
short-term to total debt	-0.0000**	-0.0000***	-0.0000***
	0.0000	0.0000	0.0000
current_ratio	0.0457***	0.0588***	0.0574***
	(0.0068)	(0.0110)	(0.0110)
Tobins_Q	-0.0613***	-0.0633***	-0.0619***
	(0.0091)	(0.0198)	(0.0197)
ROA	-2.1642***	-2.2412***	-2.2246***
	(0.1273)	(0.2308)	(0.2309)
captive flag	-0.4413***	-0.4452***	
	(0.0359)	(0.0576)	
log years of captive usage			−0.0539**
			(0.0264)
year effects	yes	yes	yes
industry effects	yes	yes	yes
n	16787	4872	4872
Adj. R2	0.4149	0.4597	0.4603

Standard errors appear in parentheses below coefficients

* denotes significance at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level

Table 5 – Marginal tax rate

This table reports the results of ordinary least squares (OLS) regressions modeling the effect of captive insurance usage on firms' marginal tax rates. The dependent variable is the effective marginal tax rate faced by the firm after accounting for the interest tax shield of debt. It is calculated using the methodology employed by Blouin et al. (2010). Model 1 includes the entire dataset; Models 3 and 4 use the subset of observations for companies that used captive insurance at some point over the 2009-2022 period. Models 1 and 2 include the captive flag dummy as an independent variable; this is a dummy variable indicating whether the company is using a captive insurance structure in the current year. Model 3 replaces this variable with the years-of-captive-usage variable. This variable indicates the years since the company began using a captive insurance structure; it can take negative values indicating the number of years prior to the company adopting a captive insurance structure. All independent variables are lagged by one year except for the captive flag dummy variable and the years-of-captive-usage variable. All models use dummy variables to control for year effects and industry group effects. Standard errors appear in parentheses below coefficients, and statistical significance is denoted at the *10 percent, **5 percent, and ***1 percent levels. Definitions of all variables along with relevant calculations appear in Table 1.

Dependent variable: marginal tax rate			
	1	2	3
log assets	-0.0004	-0.0074***	-0.0073***
	(0.0006)	(0.0015)	(0.0015)
total debt to assets	-0.0091***	-0.0389***	-0.0396***
	(0.0024)	(0.0065)	(0.0065)
short-term to total debt	-0.0063	0.0056	0.0059
	(0.0097)	(0.0041)	(0.0041)
log net income	0.0037***	0.0141***	0.0142***
	(0.0005)	(0.0013)	(0.0013)
captive flag	-0.0024**	-0.0047***	
	(0.0010)	(0.0016)	
log years of captive usage			-0.0039**
			(0.0019)
year effects	yes	yes	yes
industry effects	yes	yes	yes
n	16787	4872	4872
Adj. R2	0.1141	0.2095	0.2101

Standard errors appear in parentheses below coefficients

* denotes significance at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level

Table 6 - Dividends

This table reports the results of ordinary least squares (OLS) regressions modeling the effect of captive insurance usage on firms' expenditures on dividends and share repurchases. The dependent variable is the sum of cash and stock dividends, as well as share repurchases scaled by assets. Model 1 includes the entire dataset; Models 3 and 4 use the subset of observations for companies that used captive insurance at some point over the 2009-2022 period. Models 1 and 2 include the captive flag dummy as an independent variable; this is a dummy variable indicating whether the company is using a captive insurance structure in the current year. Model 3 replaces this variable with the years-of-captive-usage variable. This variable indicates the years since the company began using a captive insurance structure; it can take negative values indicating the number of years prior to the company adopting a captive insurance structure. All independent variables are lagged by one year except for the captive flag dummy variable and the years-of-captive-usage variable. All models use dummy variables to control for year effects and industry group effects. Standard errors appear in parentheses below coefficients, and statistical significance is denoted at the *10 percent, **5 percent, and ***1 percent levels. Definitions of all variables along with relevant calculations appear in Table 1.

Dependent variable: dividends to assets			
	1	2	3
log assets	0.0008***	0.0003	0.0002
	(0.0003)	(0.0006)	(0.0006)
total debt to assets	0.0185***	0.0072*	0.0072*
	(0.0019)	(0.0042)	(0.0042)
Tobins_Q	0.0053***	0.0111***	0.0111***
	(0.0003)	(0.0010)	(0.0010)
ROA	0.1025***	0.0658***	0.0656***
	(0.0048)	(0.0114)	(0.0114)
captive flag	0.0093**	0.0094**	
	(0.0040)	(0.0040)	
log years of captive usage			-0.0078**
			(0.0039)
year effects	yes	yes	yes
industry effects	yes	yes	yes
n	16787	4872	4872
Adj. R2	0.244	0.2287	0.2259

Standard errors appear in parentheses below coefficients

* denotes significance at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level

Table 7 – Investments

This table reports the results of ordinary least squares (OLS) regressions modeling the effect of captive insurance usage on firms' investments in intangible asset development. The dependent variable is the sum of the firms' expenditures on advertising and research and development (R&D) scaled by assets. Model 1 includes the entire dataset; Models 3 and 4 use the subset of observations for companies that used captive insurance at some point over the 2009-2022 period. Models 1 and 2 include the captive flag dummy as an independent variable; this is a dummy variable indicating whether the company is using a captive insurance structure in the current year. Model 3 replaces this variable with the years-of-captive-usage variable. This variable indicates the years since the company began using a captive insurance structure; it can take negative values indicating the number of years prior to the company adopting a captive insurance structure. All independent variables are lagged by one year except for the captive flag dummy variable and the years-of-captive-usage variable. All models use dummy variables to control for year effects and industry group effects. Standard errors appear in parentheses below coefficients, and statistical significance is denoted at the *10 percent, **5 percent, and ***1 percent levels. Definitions of all variables along with relevant calculations appear in Table 1.

Dependent variable: advertising and R&D expenses to assets			
	1	2	3
log assets	-0.0005	-0.0002	0.0001
	(0.0004)	(0.0005)	(0.0005)
total debt to assets	-0.0321***	-0.0280***	-0.0290***
	(0.0024)	(0.0036)	(0.0036)
Tobins_Q	0.0168***	0.0175***	0.0176***
	(0.0004)	(0.0008)	(0.0008)
ROA	-0.1272***	-0.0682***	-0.0668***
	(0.0061)	(0.0099)	(0.0098)
captive flag	0.0064***	0.0072***	
	(0.0011)	(0.0017)	
years of captive usage			0.0059***
			(0.0011)
year effects	yes	yes	yes
industry effects	yes	yes	yes
n	16787	4872	4872
Adj. R2	0.3714	0.3126	0.3152

Standard errors appear in parentheses below coefficients

* denotes significance at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level

Table 8 – Governance characteristics

This table reports the results of regressions modeling the relationship between governance variables and captive insurance usage. Panel A examines firms' compensation characteristics, and Panel B considers various ownership characteristics. In each panel, Models 1 and 2 show the results of logit regressions on the "captive use flag" variable which is a dummy variable indicating whether a company is using a captive insurance structure during the current year. Model 3 uses an ordinary least squares (OLS) regression in which the dependent variable represents the number of years since a company began using a captive insurance structure; this variable can take negative values indicating the number of years prior to the company adopting a captive insurance structure. In Model 1 the entire dataset is used in the regression, and in Models 2 and 3, only the subset of the dataset consisting of companies that used captive insurance structures during any year of the 2009-2022 period is used for the regressions. All models use dummy variables to control for year effects and industry group effects. Standard errors appear in parentheses below coefficients, and statistical significance is denoted at the *10 percent, **5 percent, and ***1 percent levels. For logit models, "Adj. R2" is McFadden's pseudo-R squared. Definitions of all variables along with relevant calculations appear in Table 1.

Panel A: Compensation variables

Dependent variable:	captive use flag	captive use flag	years of captive use
Model type:	logit	logit	OLS
	1	2	3
log assets	0.1064***	-0.0182	0.8722***
	(0.0281)	(0.0584)	(0.1405)
total debt to assets	1.0933***	1.3950***	-1.2720*
	(0.1336)	(0.2998)	(0.6906)
Tobins_Q	-0.2854***	-0.0748	-0.5673***
	(0.0328)	(0.0640)	(0.1673)
ROA	1.0148***	0.6274	3.3713*
	(0.3822)	(0.7918)	(1.9528)
log total exec comp	0.2629***	0.4999***	1.0910***
	(0.0529)	(0.1092)	(0.2041)
stock to total comp	0.3324**	0.5607*	2.8851***
	(0.1571)	(0.3275)	(0.7777)
options to total comp	-0.6024***	-2.3488***	-6.5154***
	(0.1966)	(0.3947)	(1.0039)
year effects	yes	yes	yes
industry effects	yes	yes	yes
n	16787	4872	4872
Adj. R2	0.2383	0.2644	0.2626

Standard errors appear in parentheses below coefficients

* denotes significance at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level

Panel B: Ownership variables

Dependent variable:	captive use flag	captive use flag	years of captive use
Model type:	logit	logit	OLS
	1	2	3
log assets	0.2125***	0.1815***	0.8976***
	(0.0237)	(0.0542)	(0.1124)
total debt to assets	1.1188***	0.6489*	-1.5356**
	(0.1510)	(0.3533)	(0.7319)
Tobins_Q	-0.4195***	-0.3767***	-0.8460***
	(0.0372)	(0.0714)	(0.1677)
ROA	1.1607***	1.5684*	4.9661**
	(0.4263)	(0.9218)	(2.1122)
total institutional ownership	0.2589	-0.5616	0.6446
	(0.1842)	(0.3859)	(0.7699)
blockholder holdings	0.3742***	0.3529**	2.3788*
	(0.0691)	(0.1454)	(1.2310)
insider holdings	1.3695***	1.2725***	2.1619***
	(0.4811)	(0.4709)	(0.4807)
year effects	yes	yes	yes
industry effects	yes	yes	yes
n	16787	4872	4872
Adj. R2	0.1761	0.1759	0.1763

Standard errors appear in parentheses below coefficients

* denotes significance at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level

Table 9 – Governance and financial model comparisons

This table reports the results of regressions modeling the relationship between governance variables and financial variables and captive insurance usage. Panel A examines the compensation and ownership characteristics of firms, and Panel B considers the financial measures that captive insurance is proposed to affect. In each panel, Models 1 and 2 show the results of logit regressions on the "captive use flag" variable, which is a dummy variable indicating whether a company is using a captive insurance structure during the current year. Model 3 uses an ordinary least squares (OLS) regression in which the dependent variable represents the number of years since a company began using a captive insurance structure; this variable can take negative values indicating the number of years prior to the company adopting a captive insurance structure. In Model 1 the entire dataset is used in the regression, and in Models 2 and 3, only the subset of the dataset consisting of companies that used captive insurance structures during any year of the 2009-2022 period is used for the regressions. All models use dummy variables to control for year effects and industry group effects. Standard errors appear in parentheses below coefficients, and statistical significance is denoted at the *10 percent, **5 percent, and ***1 percent levels. For logit models, "Adj. R2" is McFadden's pseudo-R squared. Definitions of all variables along with relevant calculations appear in Table 1.

Panel A: All governance variables

Dependent variable:	captive use flag	captive use flag	years of captive use
Model type:	logit	logit	OLS
	1	2	3
log assets	0.1417***	0.1168	1.0507***
	(0.0337)	(0.0755)	(0.1586)
total debt to assets	1.1075***	0.6263*	-1.5492**
	(0.1531)	(0.3669)	(0.7402)
Tobins_Q	-0.3948***	-0.2927***	-0.6276***
	(0.0384)	(0.0747)	(0.1740)
ROA	1.1388***	1.4668	3.4382
	(0.4325)	(0.9648)	(2.1491)
log total exec comp	0.2089***	0.2576**	-0.9715
	(0.0592)	(0.1288)	(0.9005)
stock to total comp	0.3619**	1.0241***	2.1060*
	(0.1813)	(0.3947)	(1.2361)
options to total comp	-0.5989***	-2.3548***	-4.576***
	(0.2226)	(0.4875)	(0.5008)
total institutional ownership	0.1466	-0.6253	-0.0596
	(0.1933)	(0.4079)	(0.2772)
blockholder holdings	0.4814***	0.193	3.0508***
	(0.4248)	(0.5753)	(0.8297)
insider holdings	1.3933***	1.2714***	6.4691***
	(0.4814)	(0.4800)	(1.0754)
year effects	yes	yes	yes
industry effects	yes	yes	yes
n	16787	4872	4872
Adj. R2	0.1687	0.1851	0.1864

Standard errors appear in parentheses below coefficients

* denotes significance at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level

Panel B: All financial variables

Dependent variable:	captive use flag	captive use flag	years of captive use
Model type:	logit	logit	OLS
	1	2	3
const	-23.9936	24.3158	1.2606
	(142.1132)	(124.8987)	(1.2958)
log assets	0.2817***	0.2340***	0.9701***
	(0.0211)	(0.0482)	(0.0977)
total debt to assets	0.6835***	0.1674	2.2684***
	(0.1628)	(0.3766)	(0.7816)
Tobins_Q	-0.2131***	-0.1551**	-0.0282
	(0.0381)	(0.0727)	(0.1734)
ROA	0.6624	0.5139	3.5607*
	(0.4472)	(0.9229)	(2.0545)
cost of debt	-0.1264**	-0.1323**	-0.3831***
	(0.0580)	(0.0599)	(0.1426)
marginal tax rate	-0.0073	-1.7682*	-5.0775**
	(0.4328)	(0.9037)	(2.0139)
dividends to assets	2.4817**	1.0005	1.6581
	(0.9849)	(1.1303)	(3.1137)
advert+R&D to assets	5.5473***	5.5328***	18.4498***
	(0.8242)	(1.4276)	(3.5298)
year effects	yes	yes	yes
industry effects	yes	yes	yes
n	9349	2912	2912
Adj. R2	0.0525	0.1311	0.0994

Standard errors appear in parentheses below coefficients

* denotes significance at the 10 percent level; ** at the 5 percent level; *** at the 1 percent level

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