CEO Overconfidence or Private Information: Evidence from U.S. Property-Liability Insurance Companies

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ABSTRACT

This paper uses conventional measures of CEO overconfidence: option holdings-based and net stock purchase-based measures to examine the impact of CEOs who hold firm-specific risk on insurer's risk-taking and firm performance in U.S. publicly traded property-liability insurance companies. We find that two CEO overconfidence measures are negatively associated with insurer's risk-taking and positively related to firm performance. We also provide evidence that CEOs who maintain high exposure to firm-specific risk exploit their private information to time stock-option exercises in an effort to increase the cash payout from these exercises. Our overall results indicate that CEOs who have private information on their firms' future earnings maximize their personal profits by postponing option exercises or buying additional stocks, and that they tend to take a lower risk to protect their personal wealth in property-liability insurance firms. Therefore, our findings suggest that it may not be CEO overconfidence, but rather the private information and the intention to control the company's risk that drive our results.

Keywords: CEO Overconfidence; Risk Taking; Firm Performance; Reinsurance Demand

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CEO Overconfidence, or Private Information: Evidence from U.S. Property-Liability Insurance Companies

Introduction

This paper examines the impact of CEOs who are exposed to high firm-specific risk on risk-taking and firm performance in the U.S. property-liability insurance companies. Over the last decade, managerial overconfidence has received much attention from scholars and practitioners alike, since this behavioral bias can have a pronounced influence on the firm (Hackbarth, 2008). The literature provides evidence that CEO overconfidence significantly affects corporate policies, including capital expenditures (Malmendier and Tate, 2005), mergers and acquisitions (Malmendier and Tate, 2008), innovation (Hirshleifer et al., 2012), CEO turnover (Campbell et al., 2011), dividend policy (Deshmukh et al., 2013), and corporate diversification (Andreou et al., 2016).[1]

Existing empirical research has examined the important role of CEO overconfidence in risk taking (e.g., Sanders and Hambrick, 2007; Malmendier and Tate, 2008; Hirshleifer et al., 2012; Cain and McKeon, 2016) and show that CEO overconfidence is positively related to corporate risk-taking in non-financial and banking industries[2]. Despite growing research, the relationship between CEO overconfidence and firm performance remains ambiguous. CEO overconfidence may generate positive firm performance by leading risk-averse CEOs to take on appropriate levels of risk (Goel and Thakor, 2008). On the other hand, CEO overconfidence can have a negative impact on firm performance due to value-destroying overinvestment (Malmendier and Tate, 2008). Although the effect of CEO overconfidence on corporate decision-making has been

[1] While most of the literature uses the term "overconfidence", we argue below that the two common measures for overconfidence can be proxies for CEOs with high firm-specific risk and private information.

[2] The implication of these results is that companies should focus more on assessing the impact of managerial overconfidence on risk-taking in order to mitigate managers' excessive risk-taking and to steer managers toward optimal risk-taking (Goel and Thakor, 2008; Campbell et al., 2011; Hirshleifer et al., 2012).

widely studied in the literature, it has received much less attention in the insurance sector. The only study investigating this issue is Berry-Stolzle et al. (2018), which finds that overconfident CEOs tend to understate loss reserves in property-liability insurance firms.

The literature has noted that one of the biggest challenges to the empirical analysis of managerial overconfidence is in constructing proxies for unobservable CEO overconfidence, since overconfidence is a biased belief that cannot be easily measured (Baker et al., 2007). Previous studies have employed different proxies for managerial overconfidence, but the most widely used measures of CEO overconfidence are the option holdings-based and the net stock purchase-based measures developed by Malmendier and Tate (2005). These two conventional overconfidence measures build upon the notion that overconfident CEOs are likely to maintain high levels of personal exposure to firm-specific risk by delaying their option exercise and by purchasing more of their company's stock, since they are too optimistic about the firm's future prospects (Hirshleifer et al., 2012).

Despite their prominence, the validity of the two CEO overconfidence measures has been questioned in several studies. The recent literature has argued that CEO's late option exercise and additional stock purchase may be due to other factors, such as stock mispricing and growth opportunities (Cao, 2011), inside information about the firm's future stock prices, (Bouwman, 2014), private information (Malmendier and Tate, 2005),[3] or firm characteristics and market conditions (Bayat et al., 2016).

In this study, we provide an alternative explanation for the two conventional CEO overconfidence measures (the two measures, hereafter). Our findings suggest that the two measures of overconfidence reflect manager's high firm-specific risk and mangers' private

[3] Malmendier and Tate (2005) suggest that it is possible that the two measures can be proxies for the private information of the manager. But they provide evidence that the two measures are not proxies for private information in their sample.

information based on the literature. Our evidence indicates that CEOs who are exposed to high firm-specific risk, which are difficult to be diversified away, are likely to exhibit low risk-taking behavior (e.g., Smith and Stulz, 1985; Jensen et al. 2004; and Lewellen, 2006), and the two measures can also be interpreted as managers have private information about their firms' positive future (e.g., Malmendier and Tate, 2005; and Bouwman, 2014).

We examine our alternative explanations by looking at the relationship between the two measures and risk-taking and firm performance in the U.S. property-liability insurance industry. Using property-liability insurance firms as a sample has some advantages. It enables us to utilize underwriting risk, investment risk, leverage risk, and reinsurance decisions as proxies for insurer's risk-taking over which CEOs have some level of control and are less subject to market volatility compared to other market-based risk measures used in the literature.[4] Unlike the insurance industry, the risk-taking behavior of non-financial and banking industries cannot be measured directly. For example, the volatility of stock returns, which is a widely used measure of risk-taking in the prior literature, reflects more than the risk-taking behavior of CEOs because stock returns reflect unexpected events and investors' perception of the company. Therefore, by investigating how CEOs who hold high levels of firm-specific risk make underwriting, investment, and reinsurance decisions, we can observe their risk-taking behavior more accurately. Finally, the insurance industry is highly regulated, and thus, the risk-taking behavior of insurance firms may be different from that of other industries. More importantly, the property-liability industry faces catastrophic risks which can have major impact on the profitability of insurance companies and human capital of the managers.

[4] For example, Steve Chevalier, CEO of NLC Insurance Companies, says that he spends at least 20 percent of his time in making reinsurance decisions and believes his counterparts do the same. See https://www.namic.org/pdf/reinsuranceRe/inmag_article.pdf.

Our sample consists of U.S. publicly traded property-liability insurance companies over the period 1996-2015. Our findings are summarized as follows. First, we find that the insurance companies with CEOs with high firm-specific risk (proxied by the wto measures) are negatively related to insurer's risk-taking behaviors, including total risk, underwriting risk, investment risk, and leverage risk, and positively associated with reinsurance demand. These results imply that CEOs who have high firm-specific risk take lower levels of risk to preserve themselves against unexpected losses (e.g., major catastrophes), which could harm their job security as well as their personal capital and undiversified portfolio.[5] Our results imply that CEOs who are highly exposed to firm-specific risk such as catastrophic risks in the property-liability industry are more likely to take low risk (e.g., underwriting risk) and conduct hedging activities (e.g., purchase high reinsurance) to preserve their personal wealth. These results are different from those in previous studies (e.g., Banerjee et al., 2015), which show that firms with overconfident CEOs tend to display higher risk-taking behavior in non-financial industries.

With regard to performance measures, the two measures are consistently found to be positively related to Tobin's Q, return on assets (ROA), return on equity (ROE), and stock return. If CEOs have positive private information about the firm's future earnings, then they would rationally delay the exercise of deep in-the-money options and purchase more of their company's stock even though these actions would increase their personal exposures to firm-specific risk. The private information argument can explain our results that insurance companies with CEOs who have high personal exposure to firm-specific risk have better firm performance. To investigate the private information argument, we perform several tests based on Bartov and Mohanram (2004). The evidence indicates that CEOs who have high firm-specific risk exploit

[5] Hereafter, for simplicity, we use the term "overconfident CEOs" to refer to CEOs who hold significant firm-specific risk, as measured by late option exercise and habitual stock purchases.

their private information to time stock-option exercises in an effort to increase the cash payout from these exercises. This result is consistent with the private information hypothesis.

Taken together, our results show that CEOs who have high firm-specific risk tend to take lower levels of risk (e.g., taking lower underwriting and investment risks and purchasing more reinsurance) and achieve higher firm performance. One possible explanation of these results is that rational risk-averse CEOs who possess private information would maximize their personal profits by delaying option exercises or buying additional shares of their firm's stock, and they tend to take less risk to protect their human capital with their own firms and their personal portfolios. Our results are consistent with Holmstrom (1999) who indicates managers make decisions to protect their human capital.

Our results are different from the traditional finance paradigm: high risk and high expected return. But some literature suggests that the relationship between risk and return is negative. For example, the negative relationship is found between the underwriting risk and return (Witt, 1978; Witt, 1981; Brockett and Witt, 1982), for certain type of utility functions (Brockett and Kahane, 1992). Brockett et al. (1997) find that that ex post evaluation of risk and return is negative correlated. Similarly, Brockett and Garven (1998) show that the conventional positive relationship between and risk and return is not necessarily true. Using ex post mutual fund data, they find that risk and return are negatively related providing support for "Bowman Paradox" in the literature of strategic management. Chari et al. (2019) examine "Bowman Paradox" from the agency theory perspective. They suggest the paradox is resolved because it is possible that risk-averse managers focus on the projects that enhance their own careers but pose risk to shareholders.

Overall, our findings are consistent with the main findings of Bayat et al. (2016) and one empirical result of Bouwman (2014). We conclude that the two measures may capture the private information held by CEOs and are not necessarily proxies for CEO overconfidence for U.S. property-liability insurance companies.

This study potentially contributes to the literature in several ways. First, this is the first empirical investigation into the alternative explanations of two conventional CEO overconfidence measures by examining the effect of CEOs who hold high firm-specific risk on risk-taking and firm performance in the insurance sector. Our results are different from the literature. Second, our study distinguishes itself from the previous literature by utilizing better proxies of CEO's risk-taking behavior. Unlike the prior literature in the non-financial and banking industries that mainly uses market-based risk measures, such as systematic risk, unsystematic risk, and stock return volatility (e.g., Niu, 2010; Banerjee et al., 2015), we examine additional risk measures, including underwriting, investment, and leverage risk-taking, and reinsurance demand which can reflect CEOs' decisions better than market-based risk measures. While market-based risk measures reflect some aspects of firms' risk-taking behavior, there are many other factors that impact these measures. For example, CEOs do not have total control over their market factors such as high inflation.

Third, we provide new evidence supporting for alternative explanation of the conventional CEO overconfidence measures by showing that the pattern of large option exercises by CEOs who hold firm-specific risk is consistent with the manger's private information about the firm's future earnings in property-liability insurance firms. These results suggest that it may not be CEO overconfidence, but rather the private information and the intention to control the company's risk that drives our results. Therefore, we cast doubt on whether the two conventional

measures of CEO overconfidence are appropriate proxies for CEO overconfidence in U.S. property-liability insurance companies.

The remainder of the paper is structured as follows. The Literature Review and Hypotheses Development section provides an overview of the alternative explanations of CEO overconfidence measures and formulates our main hypotheses. The data, sample selection criteria, and empirical methodology are discussed in the Data and Methodology section. The definitions of variables are presented in the Variable Definitions section. Results section presents the empirical results, and Conclusion and Discussion section concludes with a summary of our main findings and some discussions.

Literature Review and Hypotheses Development

Literature Review

Although prior literature has employed different proxies for managerial overconfidence,[6] the most commonly used measures for CEO overconfidence are the option holdings-based and the net stock purchase-based measures developed by Malmendier and Tate (2005). The two CEO overconfidence measures are based on CEOs' late option exercise and additional stock purchases. Malmendier and Tate (2005) point out that rational CEOs are likely to exercise options early or minimize the holding of their firm's stock to address the under-diversification problem, whereas overconfident CEOs who are too optimistic about the outcomes of their decisions tend to do exactly the opposite in order to benefit from the expected future gains. These two overconfidence

[6] Previous studies have used a variety of managerial overconfidence measures, such as the Longholder measure defined by the dummy variable that equals 1 if a CEO ever held an option until the last year prior to expiration (Malmendier and Tate, 2005), manager's propensity to acquire companies (Doukas and Petzemas, 2007), manager's status as an entrepreneur (Barros and Sylveira, 2007), a press-based measure (Malmendier and Tate, 2008; Hirshleifer et al., 2012), a survey-based measure (Ben-David et al., 2013), and the fraction of a firm's voluntarily earnings forecasts that exceeds the ex-post realized earnings (Otto, 2014).

measures have been widely used in many other studies (e.g., Campbell et al., 2011; Hirshleifer et al., 2012; Ahmed and Duellman, 2013; Banerjee et al., 2015; Ho et al., 2016).

Despite their widespread use, there are several alternative explanations for the two CEO overconfidence measures. First, CEOs may choose to delay the exercise of their highly in-the-money options and to buy more of their company's stock because they have private information about future stock prices. If private information is the true reason for CEO's late option exercise or additional stock purchases, the stock returns of firms with CEOs defined as overconfident should be higher than the average stock market return. Bouwman (2014) examines whether CEO's late option exercise is really due to optimism by categorizing CEOs who are defined as optimistic using the option holdings-based measure (*Holders 67*) into those who made gains from exercising their options late and those who did not. She finds that 72.7 percent of *Holders 67* earned significantly positive abnormal returns relative to the S&P 500, suggesting that most of *Holders 67* may actually be rational CEOs with positive private information rather than uninformed optimistic CEOs. [7]

Second, Cao (2011) documents that if firms have better growth opportunities, CEOs tend to postpone their option exercise because they want to profit from growth potential. He argues that CEO's late option exercise, which is closely related to stock mispricing and growth opportunities, may not be the appropriate proxy for CEO overconfidence. Lastly, overconfidence is considered to be a stable and persistent trait (Hirshleifer et al., 2012). However, Bayat et al. (2016) provide evidence against the notion by showing that when CEOs switch firms, they tend to change their option excise decisions. They find that firm characteristics, such as firm's growth potential, cash flow, cash holding, and leverage significantly affect CEOs' decisions to hold or exercise their options, thus questioning the validity of option holdings-based overconfidence measure. In

[7] For a detailed explanation on the option holdings-based overconfidence measure (Holder 67), see Variable Definitions section.

summary, the theoretical and empirical debate on CEO overconfidence measures remains inconclusive and casts some doubts on the argument that the two commonly used CEO overconfidence measures in the literature are good proxies for actual overconfidence.

The Two Measures and Risk Taking

Risk taking has been a main concern for the insurance sector where the protection of policyholders is always paramount among insurer's priorities. In addition, excessive risk-taking or substantial loss variability caused by environmental challenges, such as major natural disasters, may lead to a high likelihood of insurer insolvency (Ho et al., 2013). Since property-liability insurers are mainly in the business of taking the risk, we are interested in whether overconfident CEOs or risk-averse CEOs with high firm-specific risk have impact firm's risk-taking in the property-liability insurance industry. We primarily focus on the CEO's behavior because CEO as an ultimate decision-maker in his/her company is supposed to have some discretion on the firm's risk-taking decisions.

The literature shows that overconfident managers who expose themselves to a substantial degree of risk (Kahneman and Lovallo, 1993) tend to overestimate the precision of exogenous noisy signals (Gervais et al., 2011), underestimate the riskiness of future cash flows (Hackbarth, 2008), and, therefore, undertake projects that are too risky (Malmendier and Tate, 2005). Previous studies find that CEO overconfidence defined using the option holdings-based or the net stock purchase-based measure is positively related to firm's risk-taking in non-financial and banking firms.[8] Hirshleifer et al. (2010) find that firms with overconfident CEOs tend to show higher stock return volatility. Cain and McKeon (2016) show that CEO overconfidence is positively associated with corporate risk-taking. Niu (2010) reports that banks managed by

[8] Other risk-taking related literature includes Malmendier and Tate (2008), which demonstrates that overconfident CEOs are more prone to engage in riskier projects, such as value-destroying M&A activities, and Kim et al. (2016), which shows that firms with overconfident CEOs have higher stock price crash risk than firms with non-overconfident CEOs.

overconfident CEOs tend to take greater risk. Suntheim and Sironi (2012) provide evidence that CEO overconfidence results in higher risk-taking and higher levels of fragility in the banking industry.

On the other hand, it is possible for CEO's late option exercise and additional stock purchases to be negatively associated with insurer's risk-taking behavior. Rational CEOs whose personal wealth and human capital are closely tied to their companies tend to be more risk-averse and to avoid risky investment in order to preserve their own personal portfolios (Smith and Stulz, 1985). Jensen et al. (2004) state that CEOs who are highly exposed to firm-specific risk may want to reduce the riskiness of their firms by underinvesting in risky projects and overinvesting in risk-reducing activities. Lewellen (2006) notes that CEOs with in-the-money options tend to take less risk because in-the-money options make their portfolios more sensitive to stock price volatility, thus leading CEOs who hold undiversified portfolios to be more risk-averse. Also, high investment risk-taking can lead to a more volatile surplus and underwriting capacity, which may weaken the insurers' ability to pay claims and may be detrimental to their survival (Zou et al., 2012). Based on the above arguments, we suggest that CEOs who hold significant firm-specific risk may reduce company risk by adopting less risky underwriting policies, investing more in low risk projects, and choosing a lower level of leverage to protect their personal wealth to protect their human capital. In light of the above competing views, we suggest the following null hypothesis:

Hypothesis 1.1: The two measures are not related to risk-taking in property-liability insurance companies. [9]

We next discuss the relationship between two measures and reinsurance. Reinsurance has been widely used as an effective risk management and hedging tool against unexpected

[9] Since the arguments for the different risk measures are similar, we generally use the term "risk-taking" to denote four different risk-taking measures: total risk, underwriting risk, investment risk, and leverage risk, in our hypothesis development.

catastrophic losses in the property-liability insurance industry (Cummins and Weiss, 2000). While it can be argued that more reinsurance means less risk-taking and thus we do not need to develop a new hypothesis for the effect of CEO overconfidence on reinsurance demand, we believe that it is important to develop a separate hypothesis for two reasons. First, there are substantial costs involved in purchasing reinsurance, and therefore, reinsurance decisions are important to CEOs. Second, as the insurance of insurers, reinsurance enables insurers to transfer risks among each other or to reinsurers, enhancing the financial soundness of insurance companies.[10] CEOs have more control over reinsurance decision than other risk-taking variables. Thus, they tend to purchase more reinsurance if they want to reduce the firm risk. Lastly, reinsurance companies play a crucial role in monitoring the primary insurers' behavior, thereby mitigating insurer's excessive risk-taking. While reinsurance has the advantage of improving financial stability and reducing insolvency risk, it can also have a negative impact on firm performance because of the high cost of reinsurance.[11] Since both risk-taking and firm performance are important to managerial decision-making, CEOs need to make reinsurance decisions wisely.

The relationship between two measures and insurer's reinsurance demand is unclear. Alsubaie (2009) points out that overconfident CEOs underestimate risk and systematically overestimate the returns to their investment projects, therefore engaging in less hedging behavior than non-overconfident CEOs. In line with this argument, it is predict that overconfident CEOs would prefer profitability to more reinsurance because reinsurance is costly.

[10] We do not discuss reinsurance supply because insurance supply, in general, is greater than reinsurance demand. See http://us.milliman.com/uploadedFiles/insight/2017/alternative-capital-shaping-global-insurance.pdf.

[11] Cummins et al. (2008) examine the effect of reinsurance purchase on the costs and the underwriting risk of 554 U.S. property-liability insurers from 1995 to 2003. They find that the average quantity of reinsurance purchased from non-affiliated reinsurers is about $124 million/year, representing about 21 percent of total written premiums.

In contrast, CEOs who hold high levels of firm-specific risk may reduce the riskiness of their firms by increasing the usage of reinsurance in order to protect themselves from unexpected losses that could harm their job security as well as their personal wealth. Thus, the relationship between the two measures and insurer's reinsurance demand cannot be determined. These competing hypotheses lead to the following null hypothesis:

Hypothesis 1.2: The two measures are not related to reinsurance demand in property-liability insurance companies.

The Two Measures and Firm Performance

Existing studies provide mixed results for the effect of CEO overconfidence, defined by the two conventional CEO overconfidence measures, on firm performance. Several studies find that overconfident CEOs can reduce the value of the firm as a result of overinvestment (e.g., Malmendier and Tate, 2005; Campbell et al., 2011). Malmendier and Tate (2008) show that firms with overconfident CEOs who underestimate risk have lower firm performance because they tend to engage in more value-destroying mergers and acquisitions. Hackbarth (2009) contends that managerial overconfidence can lead to a higher probability of default, thereby resulting in high potential costs of financial distress. Chen et al. (2014) find that CEO overconfidence is associated with lower abnormal stock returns and operating performance.

On the contrary, Goel and Tate (2008) document that overconfident CEOs may increase firm value by mitigating the underinvestment problem. Hirshleifer et al. (2010) find no evidence that CEO overconfidence reduces firm performance as measured by sales, Tobin's Q, and ROA. They argue that overconfident CEOs can help firms achieve greater innovative success, and do not necessarily harm firm value or profitability. Vitanova (2014) shows that firms with overconfident CEOs achieve significantly higher firm performance than similar firms with non-overconfident CEOs.

We argue that when CEOs are exposed to high firm-specific risk and have positive private information, they are likely to postpone the exercise of options and/or to purchase more of their company's stock because these kinds of actions would increase their personal wealth. Firms with such CEOs would exhibit higher firm value and financial profitability. Therefore, if private information is valid, we would expect a positive relationship between the two measures and firm performance. Based on the above discussions, we state Hypothesis 2 below.

Hypothesis 2: The two measures are not related to firm performance in property-liability insurance companies.[12]

Data and Methodology

Data and Sample Selection

We utilize seven databases to generate our sample. Specifically, we use the ExecuComp database to construct option holdings-based measure of CEO overconfidence. To compute net stock purchase-based measure, we obtain the data on trading activities of CEOs from Thomson Reuters. Monthly stock returns used to estimate buy-and-hold stock return are derived from the Center for Research in Security Prices (CRSP). The data on Tobin's Q is obtained from the Compustat database. We manually collect the data on corporate governance variables from SEC-filed annual proxy statements (DEF 14A) in the EDGAR database. The information about institutional ownership is extracted from the Thomson-Reuters Institutional Holdings **(**13F**)** database. All other insurance company-specific data are obtained from the annual statutory statements filed with the National Association of Insurance Commissioners (NAIC). Following Ho et al. (2013) and Saghi-Zedek (2016), we use 3-year rolling periods of data to calculate total risk (standard deviation of return on assets), underwriting risk (standard deviation of loss ratios),

[12] Since the arguments for the different performance measures are similar, we generally use the term "firm performance" to denote four different performance measures: Tobin's Q, ROA, ROE, and stock return, in our hypothesis development.

and investment risk (standard deviation of return on investment).[13] For example, standard deviation of the return on assets (ROA) for 1996 is calculated using ROAs from 1996 to 1998.

We initially obtained 1,043 firm-year observations of CEO option holdings from the ExecuComp database for U.S. publicly traded property-liability insurance firms over the period 1996-2015. First, we omit observations with a missing value (258 observations). Similar to Malmendier and Tate (2005), we require CEOs to have at least five years of data on option holdings in calculating option holdings-based measure of CEO overconfidence (81 observations). In addition, following Campbell et al. (2011), we exclude CEOs who do not have options that are at least 67 percent in-the-money during the sample period (139 observations). We drop 55 observations after merging the data set used to construct the two proxies for CEO overconfidence with the data required to calculate risk-taking, firm performance, and control variables. Thus, we have 510 firm-year observations for the option holdings-based measure from 45 publicly traded property-liability insurers over the period 1992-2015. With respect to the net stock purchase-based overconfidence measure, it is required to have information on CEO's trading activities available from Thomson Reuters, thereby losing more observations.[14] Our final sample includes 386 firm-year observations for the net stock purchase-based measure from 34 publicly traded property-liability insurers, over the period 1996-2015.

The ExecuComp and Thomson Reuters database report data on individual annual option holdings and trading activities for the CEO at the holding level, but the NAIC provides firm-specific as well as consolidated data for insurers that are comprised of multiple insurance companies. Since the CEO generally represents an entire insurance group, we use consolidated data for each insurance group based on the aggregation of insurance companies within each

[13] We also calculate risk measures by using 5-year rolling periods data. Our findings are robust to different rolling periods.
[14] Thomson Reuters provides the insider trading data from 1996, leading to more reduction of sample size for net buyer measure.

group. A limitation of using stock insurers is the relatively small sample size, but this is a common concern of all insurance literature conducted with publicly traded property-liability insurers.[15]

Methodology

We conduct regression analyses using a series of pooled, cross-sectional, and time-series data. The estimates of coefficients derived from Ordinary least squares (OLS) regression may be biased if there are some unknown variables or variables that cannot be controlled for that affect the dependent variable (Greene, 2011). To address this potential bias, we employ a two-way fixed effects model.[16] Given the cross-sectional and time-series data structure, the basic regression specification of the two-way fixed effects model for the relationship between CEO overconfidence measures and insurer's risk-taking can be written as follows:

$$\begin{aligned} Risk_{i,t+1} = {} & \alpha_0 + \alpha_1\, Overconfidence_{i,t} + \alpha_2\, Bsize_{i,t} + \alpha_3\, Insider_{i,t} + \alpha_4\, Busy_{i,t} \\ & + \alpha_5\, Duality_{i,t} + \alpha_6\, Institution_{i,t} + \alpha_7\, Size_{i,t} + \alpha_8\, Reinsurance_{i,t} \\ & + \alpha_9\, ProdHHI_{i,t} + \alpha_{10}\, GeoHHI_{i,t} + \alpha_{11}\, Longtail_{i,t} + \alpha_{12}\, Weak_{i,t} + d_t + f_i + \varepsilon_{i,t} \qquad (1) \end{aligned}$$

where *i* indexes the insurance company and *t* represents time (year), d_t is a vector of time fixed-effects, f_i is a vector of firm fixed-effects, and ε_{it} is the error term. $Risk_{i,t}$ is one of several types of risk measures for firm *i* at time *t*.

To examine the relationship between two measures and reinsurance, (firm performance), we employ the lagged-structure model to correct for potential endogeneity problems, such as the reverse causality because CEO's decision to exercise options or purchase more of the firm's

[15] It is common to see small sample sizes in the insurance literature that focuses on publicly traded property-liability insurers (e.g., Eckles et al., 2011; Han et al., 2018; Milidonis et al., 2019).

[16] We conduct a Hausman test of the null hypothesis that the firm-specific error term is uncorrelated with the residuals to determine which model to use between fixed effects or random effects. The Hausman test rejects the null hypothesis for all the estimations, suggesting that the fixed effects model fits the data better.

stock are likely to be influenced by insurer's reinsurance demand and firm profitability.[17] The regression models to test the relationship between two proxies for CEO overconfidence, reinsurance demand, and firm performance have the following specifications:

$$\begin{aligned} Reinsurance_{i,t+1} = \alpha_0 &+ \alpha_1\, Overconfidence_{i,t} + \alpha_2\, Bsize_{i,t} + \alpha_3\, Insider_{i,t} + \alpha_4\, Busy_{i,t} \\ &+ \alpha_5\, Duality_{i,t} + \alpha_6\, Institution_{i,t} + \alpha_7\, Size_{i,t} + \alpha_8 ProdHHI_{i,t} \\ &+ \alpha_9\, GeoHHI_{i,t} + \alpha_{10}\, Longtail_{i,t} + \alpha_{11}\, Weak_{i,t} + \alpha_{12}\, Tax_{i,t} \\ &+ \alpha_{13}\, Coastal_state_{i,t} + \alpha_{14}\, 2year_Loss_Dev_{i,t} + d_t + f_i + \varepsilon_{i,t} \end{aligned} \quad (2)$$

where $Reinsurance_{i,t+1}$ is the reinsurance ratio for firm *i* at time *t*.

$$\begin{aligned} Performance_{i,t+1} = \alpha_0 &+ \alpha_1\, Overconfidence_{i,t} + \alpha_2\, Bsize_{i,t} + \alpha_3\, Insider_{i,t} + \alpha_4\, Busy_{i,t} \\ &+ \alpha_5\, Duality_{i,t} + \alpha_6\, Institution_{i,t} + \alpha_7\, Size_{i,t} + \alpha_8\, Reinsurance_{i,t} \\ &+ \alpha_9\, ProdHHI_{i,t} + \alpha_{10}\, GeoHHI_{i,t} + \alpha_{11}\, Longtail_{i,t} + \alpha_{12}\, Weak_{i,t} \\ &+ d_t + f_i + \varepsilon_{i,t} \end{aligned} \quad (3)$$

where $Performance_{i,t+1}$ is one of several types of performance measures for firm *i* at time *t*+1. The variables in the above equations are discussed in the next section.

The literature suggests that the effect of CEO overconfidence on insurer's risk-taking and firm performance can suffer from the problem of endogeneity (e.g., Ho et al., 2016; Berry-Stölzle et al., 2018). If CEO overconfident variable is not exogenous, the OLS estimator would be biased and inconsistent. To deal with this potential endogeneity bias, we perform three-stage instrumental variable (IV) regression used in Berry-Stölzle et al. (2018).[18] The IV must be correlated with CEO overconfidence and must not be correlated with the error term of the regression related to risk-taking and firm performance. Previous studies have shown that the age

[17] Using lagged explanatory variables also helps us to solve the endogeneity problem among the control variables (Cole and McCollough, 2006; Shiu, 2011).

[18] Berry-Stolzle et al. (2018) argue that using a standard two-stage least squares (2SLS) would not be ideal because CEO overconfidence variable is a binary endogenous variable, and suggest using three-stage procedure proposed by Wooldridge (2002).

of CEO is positively associated with CEO overconfidence (e.g., Crawford and Stankov, 1996; Bruin et al., 2012). Thus, we employ CEO age as an instrument variable for CEO overconfidence. We have no reason to believe that CEO age is directly linked to insurer's risk-taking and firm performance, and therefore, it is not likely to be correlated with the error term in the regression.[19] To conduct the three-stage model, we first estimate a profit model of binary CEO overconfidence measure on CEO age and all other explanatory variables. Next, we calculate the predicted probabilities of the Probit model to use it as an instrument for CEO overconfidence. Lastly, we perform 2SLS methods using the instrumental variable from previous step.

Variable Definitions

The Two Measures

In this study, we use the two conventional CEO overconfidence measures to proxy CEOs with high firm-specific risk. Our first measure is an option holdings-based measure using the information on CEO option holdings for U.S. publicly traded property-liability insurance firms. Like Malmendier and Tate (2005),[20] we classify CEOs into CEOs with high firm-specific risk and CEOs with low firm-specific risk. Specifically, the dummy variable (*OC67*) takes a value of 1 if a CEO postpones the exercise of his/her options that are 67 percent or more in-the-money at least twice over the sample period, and zero otherwise. We classify a CEO with high firm-specific risk from the first time he/she has exercisable options that are 67 percent or more in-the-money. Once a CEO is identified as a CEOs with high firm-specific risk, we assume that he/she remains the same status for the rest of sample period (Hirshleifer et al., 2012). We follow the

[19] We conduct F-test of the joint significance of the excluded instruments and Hansen's J-test of over-identifying restrictions. We find that CEO age fulfills two requirements for the IV, and thus conclude that CEO age is valid instrument for CEO overconfidence.

[20] Hall and Murphy (2002) assume that risk-averse executives hold undiversified portfolios and they should exercise options early if they are rational utility maximizers. In their numerical simulations, Hall and Murphy (2002) show that rational CEOs should exercise their options packages once their options are 67 percent in-the-money (i.e., stock price exceeds the exercise price by more than 67 percent). Malmendier and Tate (2005) adopt this framework as a threshold level for CEO overconfidence.

method employed by Campbell et al. (2011) to compute the average moneyness of the CEO's option portfolio for each year by using the ExecuComp database. Specifically, we first compute the average realizable value for the option by dividing the total realizable value of the exercisable options (ExecuComp variable: OPT_UNEX_EXER_EST_VAL*)* by the number of exercisable options held by the CEO (ExecuComp variable: OPT_UNEX_EXER_NUM) for each year. Next, we subtract the per-option average realizable value from the stock price at the fiscal year end (ExecuComp variable: PRCCF) to obtain an estimate of the average exercise price of the options (i.e., estimated strike price). Lastly, the average percent moneyness of the options equals the stock price at the fiscal year end (PRCCF) divided by the estimated strike price minus 1.

Our second measure of CEO overconfidence or CEOs with high firm-specific risk is based on the tendency of CEOs to habitually increase their equity positions despite their already high personal exposure to firm-specific risk (Malmendier and Tate, 2005). Following the prior literature (e.g., Campbell et al., 2011; Ahmed and Duellman, 2013; Berry-Stölzle et al., 2018), we first identify CEOs whose net stock purchases are in the top quintile of the distribution of all CEOs and those purchases increased their ownership by 10 percent during the year. Based on Ahmed and Duellman. (2013), we omit stock purchases because of option exercises. We use a dummy variable (*Net Buyer*) that equals 1 in the first year in which a CEO displays this behavior and defines the CEO as overconfident or CEOs with high risk for the rest of years. The information on the trading activities of CEOs available from Thomson Reuters are used to compute this measure.

Risk Taking Measures

We employ various risk-taking measures, such as total risk, underwriting risk, investment risk, leverage risk, reinsurance demand, to investigate overconfident CEO's risk-taking behavior in a comprehensive way.[21] First, total risk is the overall risk for shareholders or policyholders, and reflects a combination of underwriting risk, leverage risk, and investment risk (Ho et al., 2013). We measure total risk as the standard deviation of return on assets (ROA), where ROA is calculated as the ratio of net income divided by net admitted assets.

Second, underwriting risk is especially important for insurers because it is closely associated with the uncertainty of insurance contract losses. Underwriting risk is measured by the standard deviation of the firm's loss ratio, where the loss ratio is the ratio of loss incurred divided by premiums earned. Third, investment risk is related to investment activities that may adversely affect an insurer's financial stability. We measure investment risk by using the standard deviation of return on investment (ROI), where ROI is measured by the ratio of net investment gain divided by investment assets. Fourth, leverage risk is crucial to insurers because an insurance company having a relatively lower level of surplus is more likely to become insolvent than a firm with a high level of surplus. Leverage risk is computed as 1 minus the surplus-to-asset ratio. Finally, we measure reinsurance demand as the ratio of reinsurance ceded to the sum of direct premiums written and reinsurance assumed.

Firm Performance Measures

The key performance measures used in this study are identified from the literature. We first employ Tobin's Q as a market-based measure of firm performance. Tobin's Q is a widely used measure in the literature on the impact of CEO overconfidence on firm value (e.g., Malmendier and Tate, 2005; Hirshleifer et al., 2010; Vitanova, 2014). We compute Tobin's Q by dividing

[21] Ho et al. (2013) point out that using different risk measures is better than using one risk measure in the examination of insurer's risk-taking behavior.

market value of assets by the book value of assets, where market value of assets is estimated as the total assets plus market value of equity minus book value of equity. Market value of equity is calculated by multiplying the number of common shares outstanding by stock price at fiscal year-end. Following Daniel and Titman (1997), we estimate book value of equity as stockholder's equity + deferred taxes + investment tax credit – preferred stock.

Following the prior literature (e.g., Elango et al., 2008; Shim, 2011; Huang et al., 2013), we also use several accounting and market-value measures of profitability, such as return on assets (ROA), return on equity (ROE), and stock return as proxy measures of the insurer's performance. We define ROA as the ratio of net income to net admitted assets. ROE is net income divided by insurer's equity capital. Stock return is the annual buy-and-hold stock return as measured by compounding monthly stock returns over the fiscal year.

Control Variables

The extant literature suggests that corporate governance structure may affect the insurer's risk-taking behavior, reinsurance demand, and firm performance (e.g., Garven and Lamm-Tennant, 2003; Brick and Chidambaran, 2008; Cheng, 2008). Thus, we include corporate governance variables, such as board size (*Bsize*), insider percentage (*Insider*), busy board (*Busy*), CEO duality (*Duality*), institutional ownership (*Institution*) in the regression analysis as explanatory variables. In addition, we use several firm characteristics, including insurer size (*Size*), product diversification (*ProdHHI*), geographical diversity (*GeoHHI*), the percentage of long-tail lines (*Longtail*) as control variables. Prior literature has documented a variety of factors affecting insurer's reinsurance demand. We use additional control variables, such as tax effect (*Tax*), coastal states (*Coastal_State*), and 2-year loss development (*2year_Loss_Dev*), where

reinsurance demand is a dependent variable. The definitions of all variables are summarized in Table 1.

Results

Descriptive Statistics

Table 2 presents the descriptive statistics for all variables. The results of *OC67* and *Net buyer* measures show that about 52 percent and 32 percent of firm-years are defined as overconfident or CEOs with high risk for the option holdings-based measure and the net stock purchase-based measure, respectively. Table 3 provides univariate comparisons between CEOs with high risk firms and CEOs with low risk firms. We find that firms with CEOs with high firm-specific risk are likely to take a lower total, underwriting, and leverage risks and purchase more reinsurance relative to those with non-CEOs with high firm-specific risk for both two measures. The results also report that CEOs with high firm-specific risk, on average, have a higher firm value as measured by Tobin's Q for both measures and that they have a greater firm performance (ROA and ROE for the option-based measure and ROE and stock return for the net purchase-based measure, respectively). Notably, we find that CEOs with high firm-specific risk are older than CEOs with low risk for both measures, consistent with Bruin et al. (2012). Pearson's correlation matrix (untabulated) show that the correlation coefficient between the two measures is 0.091, which is very similar to that of 0.080 in Ahmed and Duellman (2013). Also, some independent variables are highly correlated. Thus, we perform the variance inflation factor (VIF) test to check for multicollinearity among independent variables. The untabulated results show that VIFs of all independent variables in the regressions are less than 4. We conclude that multicollinearity does not adversely affect our regression results.

Empirical Results

The estimates of the parameters from the three-stage IV regression of the relationship between two measures and risk-taking are presented in Tables 4 and 5. The three-stage models include firm and year fixed effects, and standard errors are adjusted for heteroskedasticity and within-panel serial correlation. Columns 1 and 6 of Tables 4 and 5 show that the coefficient on CEO age is significantly positive at the 1 percent level for the two measures, implying that the age of CEO is positively correlated with the probability that CEOs with high risk. We find that the coefficients of two measures are negative and significant in total risk, underwriting risk, investment risk, and leverage risk for both the option holdings-based and the net stock purchase-based measures. Some potential explanations for these results are provided below. With respect to the negative relation between the two measures and underwriting risk, CEOs who hold high firms-specific risk may not want to harm their company's underwriting profits by taking on high risk in underwriting activities because high underwriting risk may result in high losses. High losses could have a harmful effect on the profitability of the firm, thereby increasing the concerns on their career and personal wealth. Lower investment risk-taking of CEOs who are highly exposed to company risk may result from reducing the riskiness of their firms by underinvesting in risky projects in an effort to preserve their personal wealth. The negative relationship between the two measures and leverage risk could be explained by the fact that CEOs who maintain high personal exposure to firm-specific risk may prefer to take lower levels of corporate leverage to avoid high financial risk in their personal portfolio. Considering that total risk is a combination of underwriting risk, investment risk, and leverage risk (Ho et al. 2013), it seems reasonable to have the negative relationship between CEOs with high risks and total risk.

We also find that the two measures are positively and significantly related to reinsurance demand at the 5 percent and 1 percent level for the option holdings-based and the net stock purchase-based measure, respectively. These results imply that CEOs who hold high firm-specific risk tend to purchase more reinsurance in order to protect themselves against unexpected losses that could harm their job security as well as their personal wealth. Overall, the above findings suggest that CEOs with high firm-specific risk try to limit their risk exposures to preserve their wealth. These results are consistent with Lewellen (2006) that if CEOs are not well diversified, in-the-money options discourage them from taking more risks and also support the "playing it safe" hypothesis that managers who hold a large ownership stake tend to undertake less risk (Gormley and Matsa, 2016).

Next, we report the estimations of the parameters of the relationship between the two measures and firm performance in Tables 6 and 7. The coefficients of the two measures (both *OC67* and *Net Buyer*) are positive and significant in Tobin's Q, ROA, ROE, and stock return regressions, implying that insurers with CEOs who have high firm-specific risk and private information tend to achieve better firm value and financial profitability. These results, together with the negative relationship between the two measures and risk-taking, suggest that CEOs improve their personal wealth as a result of both higher firm performance and lower risk. This suggests that private information may motivate CEOs to hold their deep-in-the-money options and to increase their equity holdings in U.S. property-liability insurance companies.

To investigate the robustness of the results of private information, we explore whether CEOs with high firm-specific risk use private information to time stock-option exercises in an attempt to maximize the cash payout from these exercises. Following Bartov and Mohanram (2004), we perform the following tests for entire sample and subsample of CEOs with high firm-specific risk

and CEOs with low firm-specific risk, respectively. First, we investigate whether abnormally large exercises by CEOs predict significant positive and negative annual abnormal stock returns. Second, we test whether CEOs inflate earnings prior to abnormally large option exercises in order to increase the cash payout from such exercises. Third, we examine whether the proportion of firms with grants exceeding exercises significantly decreases for firms with abnormally large exercises. To perform the above tests, we first compute the average size of option exercises as the proportion of total compensation from the past 3 years. We classify firms as having abnormally large exercises if there was a greater than 50 percent increase in the proportion. Next, these firms are matched at the year 0 (exercise year) to the closet firm in size, belonging to the same return quintile in year -1, that did not have an abnormally large exercise. We use the matching firms as control firms and compare them with firms with abnormally large exercises (treatment firms). Stock returns are annual buy-and-hold stock returns of firms around the abnormally large option exercise year (year 0) and abnormal return is calculated by the difference between the returns for test firms and those for control firms in the same time period.[22] Our sample consist of 47 matched pair sample over the period 1992-2015.

Panel A of Table 8 reports the results for the full sample of the first test. The return difference between the treatment and control samples in the exercise year (year 0) is positive (4.76 percent) and is statistically significant at the 5 percent level, implying that abnormally large option exercises is related to higher stock returns. We also find that the return difference between two groups in the post-exercise period is negative and significant in year +1 (-6.24 percent), showing the reversal in stock returns around the year in which CEO's abnormally large option exercise occurs. This abnormally positive stock returns in the exercise year and negative stock

[22] We also calculate abnormal returns using Fama-French (1993) three-factor and the Carhart (1997) four-factor models and perform the same tests. We obtain qualitatively similar results with these alternative measures of abnormal returns.

returns in post-exercise period provide support for the use of private information by CEOs to time option exercises, consistent with Bartov and Mohanram (2004). Next, we divide the full sample into two subsamples: CEOs with high risk firms (28 matched pairs) and CEOs with low risk firms (19 matched pairs). The results Panel B and C of Table 8 report that highly significant positive and negative abnormal returns in year 0 and year +1 are found only in CEOs with high risk firms (9.93 percent and -10.71 percent, respectively), indicating that the reversal in stock return for full sample are mainly driven by CEO with high risk firms. These results indicate that CEOs with high firm-specific risk may exploit their private information to time stock-option exercises in order to increase the cash payout from these exercises.

Next, we test whether CEOs use their discretion to inflate earnings prior to abnormally large option exercises in an effort to increase the payout from exercises. We employ loss-reserve errors as proxies for earnings management.[23] The results in Panel A of Table 9 show that the difference in reserve errors between two groups is statistically insignificant in the year -1 (pre-exercise year), and the difference becomes significantly negative in year 0 (exercise year, -0.0080). This suggests that CEOs tend to understate loss reserves to increase earnings before large option exercises. The subsample results in Panel B and C of Table 9 report that difference between treatment and control samples in exercise year is significant and negative (-0.0130) in CEOs with high risk subsample. These results imply that prior to option exercises, CEOs with high firm-specific risk under-report loss reserves to increase earnings in an effort to increase the cash payout from exercises.

[23] Bartov and Mohanram (2004) use discretionary accruals as a proxy for earnings management. But, many studies (e.g., Beaver et al., 2003; Eckels et al., 2011) suggest that using reserve errors to proxy for earnings management is better than abnormal accruals for insurance companies, since insurers are required to report reserve estimates to the National Association of Insurance Commissioner's database every year based on reserve development.

Lastly, Table 10 presents the results of the difference in the proportion of firms with grants exceeding exercises around the abnormally large option exercises. In Panel A of Table 10, we find that in years -3 to -1, the proportion of firms with grants exceeding exercises for the treatment firms is greater than that for the control firms. From the exercise year (year 0), this proportion declines substantially for the treatment sample, but it increases for the control firms. In year 0 (exercise year), the proportion of firms with grants exceeding exercises for the control sample (61.8 percent) significantly exceeds the proportion the treatment sample (42.9 percent). With respect to subsample results in Panel B and C of Table 10, our evidence shows that the same trend of significant difference between two groups (-20.7 percent) in exercise year only exists in CEOs with high risk firm subsample. These results suggest that abnormally large option exercises at a specific point in time may be a strategic behavior by CEOs with high firm-specific risk to increase cash payout from these exercises. In summary, the above findings indicate that current strong earnings performance resulting from earnings management is consistent with the pattern of large exercises of options. The results also suggest that rational risk-averse CEOs with private information rather than overconfident CEOs maximize their personal profits by delaying option exercises or purchasing additional stocks in U.S. property-liability insurance companies.

Robustness Check and Additional Tests

In this section, we report the results of a series of robustness checks of our main findings. First, we examine the robustness of our results to an alternative risk-taking measures. First, we use the Z-score as a proxy for the insurer insolvency risk. The Z-score is inversely related to the likelihood of insolvency, with a higher Z-score indicating a lower probability of default. Z-score is calculated by dividing the sum of ROA and capital to asset ratio by the standard deviation of

ROA. In untabulated results,[24] we find that two measures are significantly positively related to the Z-score, implying that CEOs with high firm-specific risk tend to achieve higher financial stability, consistent with our previous findings that CEO who hold their options longer and buy more of their firm's stock tend to take lower risk. We also use a market-based risk measure to proxy risk. Specifically, we use the standard deviation of daily stock returns to compute the volatility of stock returns. The results show that two measures are significantly and negatively associated with stock return volatility, confirming our previous results (untabulated).

Second, the prior literature has shown that executive compensation is closely linked to the insurer's risk-taking behavior (Downs and Sommer, 1999; Eckles and Halek, 2010). Thus, we include several variables capturing different aspects of CEO compensation, such as bonus, long-term incentive pay, stock options awarded, stock options exercised, and restricted stock as additional control variables in the regressions in order to control for the impact of CEO compensation on insurer's risk-taking. All variables are scaled by total compensation. Untabulated results show that our main results remain robust when we control for CEO compensation variables.

Third, we categorize reinsurance demand into internal and external reinsurance. Affiliated reinsurance ratio is computed as the ratio of affiliated reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed, and non-affiliated reinsurance ratio is calculated as the ratio of non-affiliated reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed. Our untabulated results show that both CEO overconfidence measures are positively related to non-affiliated reinsurance and negatively associated with affiliated reinsurance. This suggests that our main results are mainly driven by non-affiliated reinsurance (external reinsurance).

[24] Untabulated results are not provided to preserve space. The authors would be happy to provide the results upon request.

Fourth, since we use publicly traded property-liability insurance firms, our sample size is relatively small. To deal with a small sample, we utilize a bootstrap approach for the statistical test of significance. First, we draw 1,000 bootstrap sample from our original sample with replacements. Next, we run the regressions with White-corrected standard errors to calculate the heteroskedasticity-consistent t-statistic of the coefficients for the bootstrap samples. The adjusted bootstrap t-statistics generate an empirical distribution to compare against the t-statistic from the original data. Untabulated results show that our main findings (negative relation between the two measures and risk-taking and positive relation between the two measures and firm performance) remain unchanged when we use the bootstrap approach.

Fifth, we re-estimate the relationship between CEOs with high firm-specific risk and risk-taking, and firm performance without firm fixed effects while retaining year fixed effects. Some firm-specific variables may change very slowly so removing all the cross-sectional variation may not be ideal in the empirical setting. We find that our main findings are robust to the alternative regression models using the year fixed effect regression estimation. As the last robustness check, we use A.M. Best ratings as an additional explanatory variable because credit rating could have a significant impact on corporate risk-taking decisions (Graham and Harvey, 2001). Again, our results are qualitative similar.

Conclusion and Discussions

This study examines the impact of CEO who maintain high firm-specific risk on risk-taking and firm performance for U.S. publicly traded property-liability insurers. We argue that two conventional CEO overconfidence measures can also proxies for CEOs with high firm-specific risk. Unlike previous studies, we find that the two measures are negatively associated with insurer's risk-taking and positively associated with firm performance. In addition, we provide

evidence that CEOs who hold firm-specific risk use private information to time abnormally large exercises by manipulating earnings in an attempt to increase the cash payout from option exercises. Property-liability insurance industry is susceptible to unexpected extreme losses caused by earthquakes and hurricanes. Thus, CEOs who hold more deep-in-the-money options and their company stocks are more likely to choose to take lower risk to protect their personal wealth than CEOs with less in-the-money options and stock holdings because higher risk-taking would hurt CEOs who maintain high exposure to firm-specific risk more severely. In addition, CEOs of insurance firms have a certain level of control over underwriting, investment, leverage risks, and reinsurance decisions, and therefore, it seems reasonable for CEOs with high firm-specific risk and private information about the firm's future earnings to take lower levels of risk and increase their future profits.

Taken together, our overall results suggest that it may not be CEO overconfidence, rather the private information and the intention to control the company's risk that drive our results. Our results are robust to using other risk-taking measures, such as the Z-score and volatility of stock returns, using the alternative regression models, and adding executive compensation and A.M. Best ratings as additional control variables.

Our results are different from the traditional finance paradigm: high risk and high expected return. However, our results are in line with some literature that finds the negative relationship between risk and return. (e.g., Witt, 1978; Witt, 1981; Brockett and Witt, 1982; Brockett and Kahane, 1992; Brockett et al., 1997; Brockett and Garven, 1998). Also, our findings provide support for Chari et al. (2019) that risk-averse managers focus on the projects that enhance their own careers but pose risk to shareholders.

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Table 1: Variable Definitions

Variable	Definition
The Two Measures	
OC67	Dummy is 1 if CEO holds unexercised excisable options that are 67 percent or more in-the-money at least twice over the period, and zero otherwise. CEO is defined as overconfident from the first moment they hold unexercised exercisable options that are at least 67 percent in-the-money
Net Buyer	Dummy is 1 if CEO whose net stock purchases are in the top quintile of the distribution of all CEOs and those purchases increased their ownership by 10 percent during the year , and zero otherwise
Risk Taking	
Reinsurance Demand	Ratio of reinsurance ceded divided by the sum of direct premiums written and reinsurance assumed
Total Risk	Standard deviation of return on assets (ROA)
Underwriting Risk	Standard deviation of the firm's loss ratio
Investment Risk	Standard deviation of return on investment (ROI)
Leverage Risk	1 minus the surplus-to asset ratio
Firm Performance	
Tobin's Q	(AT + ME – BE) / AT AT: total assets ME: market value of equity at year-end BE: book value of equity (Following Daniel and Titman, 1997) BE = (Stockholder's equity + Deferred taxes + Investment Tax Credit – Preferred Stock)
ROA	Ratio of net income to net admitted assets
ROE	Ratio of net income to the insurer's equity capital
Stock return	Buy-and-hold return from compounding monthly stock returns over the fiscal year

Variable	Definition
Corporate Governance	
Bsize	Number of all directors
Insider	Percentage of executive directors on the board
Busy	Dummy is 1 if 50 percent or more independent board members hold three or more directorships, and zero otherwise
Duality	Dummy is 1 if the same person is the CEO and Chairperson, and zero otherwise
Institution	Percentage of shares held by institutional investors
CEO Ownership	Proportion of the number of shares owned by CEO
Firm characteristics	
Size	Natural log of total net written premiums
ProdHHI	Sum of the squares of the percentages of net premiums written across product lines
GeoHHI	Sum of the squares of the percentages of direct premiums written across states lines
Longtail	Premiums of long-tail lines divided by total net written premiums
Tax	Ratio of tax-exempt investment income to total investment income
Coastal_state	Dummy is 1 if the insurer is domiciled in a hurricane-prone state (Alabama, Arkansas, Connecticut, Delaware, Florida, Georgia, Louisiana, Maine, Maryland, Massachusetts, Mississippi, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Texas, Vermont, and Virginia), and zero otherwise
2 year_loss_Dev	The development in estimated losses and loss expenses incurred two years before the current year and prior year scaled by policyholders' surplus

Table 1. (Continued)

Table 2. Descriptive Statistics

Variables	N	Mean	Median	Std. Dev	Min	Max
The Two Measures						
OC67	510	0.518	1.000	0.500	0.000	1.000
Net Buyer	476	0.322	0.000	0.468	0.000	1.000
Risk Taking						
Total Risk	510	0.022	0.016	0.027	0.003	0.555
Underwriting Risk	510	0.058	0.049	0.037	0.008	0.260
Investment Risk	510	0.015	0.008	0.038	0.001	0.752
Leverage Risk	510	0.667	0.676	0.084	0.049	0.827
Reinsurance Demand	510	0.215	0.118	0.212	0.000	1.000
Performance						
Tobin's Q	510	1.107	1.059	0.165	0.335	2.149
ROA	510	0.039	0.036	0.025	-0.064	0.200
ROE	510	0.127	0.124	0.084	-0.257	0.574
Stock Return	510	0.096	0.127	0.176	-0.568	1.261
Corporate Governance						
Bsize	510	10.841	11.000	2.034	5.000	17.000
Insider	510	0.154	0.125	0.078	0.063	0.445
Busy	510	0.260	0.000	0.436	0.000	1.000
Duality	510	0.700	1.000	0.456	0.000	1.000
Institution	510	0.732	0.738	0.163	0.326	1.000
CEO age	510	57.60	58.00	6.560	40.00	77.00
Control Variables						
Size	510	21.943	21.958	1.596	12.391	25.056
ProdHHI	510	0.294	0.202	0.235	0.079	1.000
GeoHHI	510	0.156	0.071	0.204	0.038	1.000
Longtail	510	0.748	0.750	0.139	0.261	1.000
Tax	510	0.415	0.403	0.290	-0.504	1.078
Coastal_state	510	0.595	0.000	0.489	0.000	1.000
2year_Loss_Dev	510	-0.028	-0.032	0.121	-0.455	0.554

Table 3. Univariate Comparison of CEOs with High Firm-Specific Risk (OC67) and CEOs with Low Firm-Specific Risk

Variables	OC67=1		OC67=0		Difference Tests	
	Mean	Median	Mean	Median	Mean T-test	Median Wilcoxon test
Total Risk	0.019	0.015	0.023	0.018	-0.004***	-0.003***
Underwritng Risk	0.051	0.044	0.064	0.053	-0.013***	-0.009***
Investment Risk	0.013	0.007	0.016	0.008	-0.003	-0.001
Leverage Risk	0.661	0.675	0.673	0.676	-0.012*	-0.001
Reinsurance Demand	0.244	0.224	0.182	0.095	0.062***	0.129***
Std of Stock Return	0.047	0.041	0.048	0.042	-0.001	-0.001
Tobin's Q	1.137	1.073	1.074	1.039	0.063***	0.034***
ROA	0.042	0.039	0.035	0.035	0.007***	0.004***
ROE	0.133	0.132	0.124	0.115	0.009	0.017*
Stock Return	0.099	0.129	0.093	0.121	0.006	0.008
Size	22.162	22.064	21.705	21.538	0.457***	0.526***
ProdHHI	0.309	0.222	0.277	0.168	0.032	0.054**
GeoHHI	0.121	0.065	0.194	0.081	-0.073***	-0.016***
Longtail	0.729	0.722	0.768	0.765	-0.039***	-0.043***
Tax	0.411	0.397	0.420	0.413	-0.009	-0.016
Coastal_state	0.308	0.000	0.464	0.000	-0.156***	0.000
2year_Loss_Dev	-0.056	-0.048	-0.006	-0.022	-0.050***	-0.026***
Bsize	10.640	10.864	11.142	11.000	-0.502**	-0.136*
Insider	0.159	0.142	0.146	0.119	0.013	0.023
Busy	0.178	0.000	0.383	0.000	-0.205***	0.000
Duality	0.742	1.000	0.671	0.000	0.071	1.000***
Institution	0.760	0.765	0.693	0.719	0.067***	0.046***
CEO age	58.932	59.000	55.609	55.100	3.323***	3.900***

This table provides the results of univariate tests of the differences in mean and median values between CEOs with high firm-specific risk and CEOs with low firm-specific risk. CEOs with high firm-specific risk are firm-year observations when OC67=1, and CEOs with low firm-specific risk are firm-year observations when OC67=0.

Table 3. Univariate Comparison of CEOs with High Firm-Specific Risk (Net Buyer) and CEOs with Low Firm-Specific Risk (Continued)

Variables	Net Buyer=1		Net Buyer =0		Difference Tests	
	Mean	Median	Mean	Median	Mean T-test	Median Wilcoxon test
Total Risk	0.020	0.015	0.022	0.017	-0.002**	-0.002**
Underwritng Risk	0.053	0.045	0.060	0.051	-0.007**	-0.006**
Investment Risk	0.014	0.008	0.015	0.009	-0.001	-0.001
Leverage Risk	0.658	0.657	0.687	0.696	-0.029***	-0.039***
Reinsurance Demand	0.265	0.231	0.191	0.098	0.074***	0.133***
Std of Stock Return	0.047	0.041	0.049	0.042	-0.002	-0.001
Tobin's Q	1.128	1.059	1.097	1.057	0.031**	0.002
ROA	0.039	0.037	0.038	0.035	0.001	0.002
ROE	0.133	0.130	0.118	0.115	0.015*	0.015*
Stock Return	0.098	0.127	0.093	0.116	0.005	0.011*
Size	22.788	22.648	21.551	21.451	1.237***	1.197***
ProdHHI	0.330	0.271	0.213	0.143	0.117***	0.128***
GeoHHI	0.110	0.052	0.195	0.084	-0.085***	-0.032***
Longtail	0.726	0.734	0.759	0.753	-0.033***	-0.019***
Tax	0.379	0.353	0.431	0.447	-0.052*	-0.094***
Coastal_state	0.175	0.000	0.487	0.000	-0.312***	0.000
2year_Loss_Dev	-0.029	-0.041	-0.022	-0.027	-0.007	-0.014
Bsize	10.608	10.000	11.239	11.000	-0.631***	-1.000***
Insider	0.168	0.133	0.128	0.111	0.040***	0.022***
Busy	0.221	0.000	0.284	0.000	-0.063	0.000
Duality	0.748	1.000	0.672	1.000	0.076	0.000
Institution	0.738	0.752	0.725	0.730	0.013	0.022
CEO age	60.390	60.173	55.960	56.000	4.430***	4.173***

This table provides the results of univariate tests of the differences in mean and median values between CEOs with high firm-specific risk and CEOs with low firm-specific risk. CEOs with high firm-specific risk are firm-year observations when net buyer=1, and CEOs with low firm-specific risk are firm-year observations when net buyer=0

Table 4. Regression Results of Risk Taking on CEOs with High Firm-Specific Risk (OC67)

Dependent Variable	**OC67**	**Total Risk**	**Underwriting Risk**	**Investment Risk**	**Leverage Risk**	**OC67**	**Reinsurance Demand**
Intercept	4.358	0.006	0.125	0.054	1.097***	-1.520	3.531***
	(3.267)	(0.029)	(0.127)	(0.050)	(0.198)	(1.328)	(0.302)
CEO Age	**0.026*** **					**0.031*** **	
	(0.004)					**(0.006)**	
OC67		**-0.005** **	**-0.025*** **	**-0.014* **	**-0.025** **		**0.032** **
		(0.001)	**(0.005)**	**(0.008)**	**(0.010)**		**(0.016)**
Bsize	-0.056	-0.001	-0.004**	-0.015**	-0.013***	-0.017	-0.005
	(0.078)	(0.005)	(0.002)	(0.007)	(0.003)	(0.016)	(0.006)
Insider	0.059**	0.004***	0.003	0.009	-0.002**	0.020***	-0.003***
	(0.028)	(0.001)	(0.005)	(0.019)	(0.001)	(0.005)	(0.001)
Busy	-0.385	-0.002	-0.006	-0.007	-0.006	-0.007	-0.115***
	(0.298)	(0.002)	(0.007)	(0.030)	(0.015)	(0.084)	(0.029)
Duality	-0.745**	-0.002	-0.012	-0.002	-0.010	-0.253***	-0.108***
	(0.367)	(0.002)	(0.008)	(0.003)	(0.012)	(0.082)	(0.029)
Institution	0.062	0.007	0.074**	0.045***	0.147***	0.109	0.562***
	(0.104)	(0.006)	(0.028)	(0.012)	(0.043)	(0.307)	(0.107)
Size	-0.161*	-0.010	-0.003	-0.007	-0.008	-0.033	-0.127***
	(0.092)	(0.008)	(0.004)	(0.018)	(0.007)	(0.045)	(0.011)
Reinsurance	0.446	-0.010**	-0.016	-0.013	-0.099***		
	(0.473)	(0.005)	(0.033)	(0.014)	(0.035)		
ProdHHI	0.252***	0.030***	0.036*	0.038***	0.034	0.587***	0.182***
	(0.065)	(0.007)	(0.019)	(0.008)	(0.045)	(0.161)	(0.063)
GeoHHI	-0.904***	-0.003	-0.094**	-0.023	-0.164*	-1.331***	-0.423***
	(0.165)	(0.014)	(0.040)	(0.017)	(0.097)	(0.220)	(0.086)
Longtail	-0.500***	0.041***	0.054	0.011	-0.041	-2.458***	0.562***
	(0.145)	(0.014)	(0.050)	(0.021)	(0.099)	(0.379)	(0.142)
Leverage						1.377***	0.054
						(0.449)	(0.168)
Tax						-0.019	0.173***
						(1.130)	(0.053)
Coastal_state						0.551***	0.087***
						(0.116)	(0.032)
2year_Loss_Dev						0.230	0.201**
						(0.263)	(0.097)
Observations	510	510	510	510	510	478	478
Pseudo R-square	0.472					0.624	
Adjusted R-square		0.206	0.376	0.379	0.215		0.802

The table reports the results of three-stage IV regressions. See Table 1 for variable definitions. P-values derived from heteroskedasticity and within-panel serial correlation robust standard errors are reported in parentheses. ***, ** and * represent statistical significance at 0.01, 0.05, and 0.10 level, respectively.

Table 5. Regression Results of Risk Taking on CEOs with High Firm-Specific Risk (Net Buyer)

Dependent Variable	Net Buyer	Total Risk	Underwriting Risk	Investment Risk	Leverage Risk	Net Buyer	Reinsurance Demand
Intercept	4.374***	-0.057***	-0.015	0.024	0.670***	-7.187***	3.458***
	(3.123)	(0.019)	(0.097)	(0.043)	(0.135)	(1.330)	(0.300)
CEO Age	**0.039*** **					**0.040*** **	
	(0.005)					**(0.006)**	
Net Buyer		**-0.006** **	**-0.025*** **	**-0.005* **	**-0.035** **		**0.052** **
		(0.003)	**(0.006)**	**(0.003)**	**(0.015)**		**(0.025)**
Bsize	-0.074	-0.012**	-0.001	-0.011	-0.012***	-0.030*	-0.003
	(0.071)	(0.004)	(0.002)	(0.007)	(0.003)	(0.017)	(0.006)
Insider	0.014	0.001	-0.003	0.002	-0.004***	0.008	-0.003***
	(0.022)	(0.001)	(0.004)	(0.003)	(0.001)	(0.005)	(0.001)
Busy	-0.304	-0.004	-0.004	-0.001	-0.008	-0.112	-0.127***
	(0.296)	(0.015)	(0.007)	(0.003)	(0.011)	(0.084)	(0.029)
Duality	-0.313	-0.002**	-0.002	-0.004	-0.003	-0.091	-0.108***
	(0.304)	(0.001)	(0.007)	(0.003)	(0.010)	(0.082)	(0.028)
Institution	0.168*	0.003	0.065**	0.049***	0.078**	0.078**	0.660***
	(0.096)	(0.005)	(0.025)	(0.011)	(0.034)	(0.031)	(0.098)
Size	-0.390***	-0.003***	-0.003	-0.001	0.006	-0.221***	-0.137***
	(0.088)	(0.001)	(0.005	(0.002)	(0.005)	(0.044)	(0.010)
Reinsurance	0.620	-0.017***	-0.016	-0.024**	-0.057		
	(0.503)	(0.006)	(0.027)	(0.012)	(0.038)		
ProdHHI	0.468	0.021***	0.008	0.032***	0.092***	0.021	0.134**
	(0.559)	(0.004)	(0.017)	(0.008)	(0.026)	(0.161)	(0.059)
GeoHHI	-0.162	-0.024***	-0.026	-0.004	-0.014	-0.114	-0.304***
	(0.107)	(0.004)	(0.021)	(0.009)	(0.031)	(0.219)	(0.073)
Longtail	-0.247**	0.020***	0.092**	0.021	0.101**	-1.541***	0.525***
	(0.106)	(0.006)	(0.038)	(0.017)	(0.044)	(0.380)	(0.133)
Leverage						2.124***	0.197
						(0.450)	(0.172)
Tax						-0.090	0.113**
						(0.130)	(0.047)
Coastal_state						0.264**	0.079**
						(0.116)	(0.033)
2year_Loss_Dev						0.442*	0.201**
						(0.263)	(0.095)
Observations	386	386	386	386	386	357	357
Pseudo R-square	0.416					0.587	
Adjusted R-square		0.252	0.402	0.374	0.338		0.798

The table reports the results of three-stage IV regressions. See Table 1 for variable definitions. P-values derived from heteroskedasticity and within-panel serial correlation robust standard errors are reported in parentheses. ***, ** and * represent statistical significance at 0.01, 0.05, and 0.10 level, respectively.

Table 6. Regression Results of Firm Performance on CEOs with High Firm-Specific Risk Measure (OC67)

Dependent Variable	OC67	Tobin's Q	ROA	ROE	Stock Return
Intercept	4.358	0.850	0.043	-0.025	-0.037
	(3.267)	(0.588)	(0.072)	(0.261)	(0.423)
CEO Age	**0.015*** **				
	(0.004)				
OC67		**0.051****	**0.018****	**0.082****	**0.120****
		(0.022)	**(0.009)**	**(0.041)**	**(0.061)**
Bsize	-0.056	-0.005	-0.002**	-0.002	-0.014
	(0.078)	(0.009)	(0.001)	(0.005)	(0.010)
Insider	0.059**	-0.004	-0.004	-0.002**	-0.004
	(0.028)	(0.003)	(0.003)	(0001)	(0.003)
Busy	-0.385	0.055	0.008	0.026	0.031
	(0.298)	(0.058)	(0.007)	(0.023)	(0.040)
Duality	-0.745**	0.016	0.008	0.028	0.017
	(0.367)	(0.036)	(0.005)	(0.019)	(0.035)
Institution	0.062	-0.010	-0.034**	-0.141	-0.090
	(0.104)	(0.139)	(0.017)	(0.095)	(0.127)
Size	-0.161*	0.002	0.001	0.003	0.002
	(0.092)	(0.016)	(0.002)	(0.007)	(0.013)
Reinsurance	0.446	-0.036	-0.025*	-0.075	-0.072
	(0.473)	(0.101)	(0.014)	(0.050)	(0.104)
ProdHHI	0.252***	-0.011	-0.023	-0.013	-0.227*
	(0.065)	(0.125)	(0.016)	(0.051)	(0.121)
GeoHHI	-0.904***	0.491*	0.043	0.286*	0.366**
	(0.165)	(0.277)	(0.034)	(0.150)	(0.173)
Longtail	-0.500***	-0.010	-0.026	-0.185	-0.350
	(0.145)	(0.284)	(0.034)	(0.133)	(0.225)
Observations	478	478	478	478	478
Pseudo R-square	0.448				
Adjusted R-square		0.137	0.125	0.162	0.040

The table reports the results of three-stage IV regressions. See Table 1 for variable definitions.
P-values derived from heteroskedasticity and within-panel serial correlation robust standard errors are reported in parentheses. ***, ** and * represent statistical significance at 0.01, 0.05, and 0.10 level, respectively.

Table 7. Regression Results of Firm Performance on with High Firm-Specific Risk (Net Buyer)

Dependent Variable	Net Buyer	Tobin's Q	ROA	ROE	Stock Return
Intercept	-4.921***	2.187***	0.202***	0.902**	0.632
	(3.123)	(0.410)	(0.053)	(0.352)	(0.454)
CEO Age	**0.026*** **				
	(0.004)				
Net Buyer		**0.057****	**0.021****	**0.168****	**0.138***
		(0.023)	**(0.010)**	**(0.075)**	**(0.078)**
Bsize	-0.074	-0.012	-0.002**	-0.007	-0.018*
	(0.071)	(0.009)	(0.001)	(0.005)	(0.010)
Insider	0.014	-0.002	-0.003	-0.004	-0.003
	(0.022)	(0.004)	(0.003)	(0.005)	(0.004)
Busy	-0.304	0.115***	0.001	0.023	0.021
	(0.296)	(0.039)	(0.005)	(0.026)	(0.038)
Duality	-0.313	0.028	0.003	0.029	0.032
	0.304)	(0.033)	(0.004)	(0.019)	(0.035)
Institution	0.168*	0.175	-0.010	-0.001	-0.020
	(0.096)	(0.110)	(0.014)	(0.062)	(0.122)
Size	-0.390***	0.043***	0.005**	0.036**	0.024
	(0.088)	(0.016)	(0.002)	(0.016)	(0.018)
Reinsurance	0.620	-0.159	-0.037***	-0.198***	-0.137
	(0.503)	(0.111)	(0.014)	(0.068)	(0.126)
ProdHHI	0.468	-0.129*	-0.002	0.046	-0.104
	(0.559)	(0.076)	(0.009)	(0.043)	(0.090)
GeoHHI	-0.162	0.016	0.029**	0.006	0.139
	(0.107)	(0.092)	(0.012)	(0.047)	(0.105)
Longtail	-0.247**	-0.308**	-0.028	-0.030	-0.143
	(0.106)	(0.142)	(0.018)	(0.077)	(0.168)
Observations	357	357	357	357	357
Pseudo R-square	0.416				
Adjusted R-square		0.162	0.134	0.176	0.034

The table reports the results of three-stage IV regressions. See Table 1 for variable definitions.
P-values derived from heteroskedasticity and within-panel serial correlation robust standard errors are reported in parentheses. ***, ** and * represent statistical significance at 0.01, 0.05, and 0.10 level, respectively.

Table 8. Stock Return around Abnormally Large Option Exercises

Panel A: Whole sample

Year	N	Mean Raw Returns		Mean Abnormal Returns	
		Treatment Firms	Control Firms	Treatment minus Control	t-stat
-3	47	15.10%	15.00%	0.10%	0.04
-2	47	7.13%	13.82%	-6.69%	-2.37**
-1	47	9.99%	12.77%	-2.78%	-0.95
0	47	19.08%	14.32%	4.76%	2.16**
+1	47	16.81%	23.05%	-6.24%	-2.31**
+2	47	10.78%	10.61%	0.17%	0.80
+3	47	8.90%	10.71%	-1.81%	-0.61

Panel B: CEOs with High Firm-Specific Risk Firms

Year	N	Mean Raw Returns		Mean Abnormal Returns	
		Test Firms	Control Firms	Test minus Control	t-stat
-3	28	13.62%	9.15%	4.47%	1.60*
-2	28	7.73%	9.94%	-2.21%	-0.74
-1	28	11.17%	10.58%	0.59%	0.21
0	28	18.77%	8.84%	9.93%	3.87***
+1	28	12.56%	23.27%	-10.71%	-2.75***
+2	28	12.79%	11.90%	0.89%	0.65
+3	28	9.99%	9.32%	0.67%	0.32

Panel C: CEOs with Low Firm-Specific Risk Firms

Year	N	Mean Raw Returns		Mean Abnormal Returns	
		Test Firms	Control Firms	Test minus Control	t-stat
-3	19	17.28%	23.62%	-6.34%	-2.06**
-2	19	6.26%	19.53%	-13.27%	-2.89***
-1	19	8.24%	16.01%	-7.77%	-1.33
0	19	19.54%	22.40%	-2.86%	-1.09
+1	19	23.07%	22.72%	0.35%	0.10
+2	19	7.83%	8.70%	-0.87%	-0.16
+3	19	7.92%	14.14%	-6.22%	-0.95

Table 9. Reserve Error around Abnormal Large Option Exercises

Panel A: Whole sample

Year	N	Mean Raw Returns		Mean Abnormal Returns	
		Treatment Firms	Control Firms	Treatment minus Control	t-stat
-3	47	-0.0129	-0.0130	0.0001	0.17
-2	47	-0.0049	-0.0027	-0.0022	-2.39**
-1	47	-0.0019	-0.0008	-0.0011	-0.85
0	47	-0.0037	0.0043	-0.0080	-5.00***
+1	47	0.0016	-0.0040	0.0056	4.77***
+2	47	-0.0017	-0.0031	0.0014	1.53
+3	47	-0.0024	-0.0018	-0.0006	-0.48

Panel B: CEOs with High Firm-Specific Risk Firms

Year	N	Mean Raw Returns		Mean Abnormal Returns	
		Treatment Firms	Control Firms	Treatment minus Control	t-stat
-3	28	-0.0049	-0.0045	-0.0004	-0.82
-2	28	-0.0035	-0.0036	0.0001	0.01
-1	28	-0.0013	0.0003	-0.0016	-1.02
0	28	-0.0043	0.0087	-0.0130	-7.21***
+1	28	0.0042	-0.0052	0.0094	6.82***
+2	28	-0.0011	-0.0048	0.0037	3.26***
+3	28	0.0005	0.0007	-0.0002	-0.07

Panel C: CEOs with Low Firm-Specific Risk Firms

Year	N	Mean Raw Returns		Mean Abnormal Returns	
		Treatment Firms	Control Firms	Treatment minus Control	t-stat
-3	19	-0.0248	-0.0255	0.0007	0.81
-2	19	-0.0070	-0.0014	-0.0056	-4.33***
-1	19	-0.0028	-0.0023	-0.0005	-0.20
0	19	-0.0023	-0.0028	0.0005	0.82
+1	19	-0.0020	-0.0024	0.0004	0.25
+2	19	-0.0027	-0.0007	-0.0020	-1.61
+3	19	-0.0068	-0.0054	-0.0014	-1.07

Table 10. Grant > Exercise Proportion (Whole Sample)

Panel A: Whole sample

Year	N	Mean Raw Returns		Mean Abnormal Returns	
		Treatment Firms	Control Firms	Treatment minus Control	t-stat
-3	47	60.4%	45.8%	14.6%	1.76*
-2	47	70.8%	60.3%	10.5%	0.87
-1	47	56.4%	49.1%	7.3%	0.75
0	47	42.9%	61.8	-18.9%	-2.02**
+1	47	44.7%	65.9%	-21.2%	-2.19**
+2	47	58.3%	68.7%	-10.4%	-0.85
+3	47	68.7%	64.5%	4.2%	0.33

Panel B: CEOs with High Firm-Specific Risk Firms

Year	N	Mean Raw Returns		Mean Abnormal Returns	
		Treatment Firms	Control Firms	Treatment minus Control	t-stat
-3	28	59.7%	50.3%	9.4%	0.80
-2	28	72.4%	55.2%	17.2%	1.99**
-1	28	48.3%	44.8%	3.5%	0.24
0	28	41.4%	62.1%	-20.7%	-2.10**
+1	28	43.5%	64.0%	-20.5%	-2.06**
+2	28	58.3%	69.0%	-10.7%	0.88
+3	28	72.4%	62.1%	10.3%	0.83

Panel C: CEOs with Low Firm-Specific Risk Firms

Year	N	Mean Raw Returns		Mean Abnormal Returns	
		Treatment Firms	Control Firms	Treatment minus Control	t-stat
-3	19	61.2%	41.1%	20.1%	2.02**
-2	19	68.4%	64.2%	4.2%	0.25
-1	19	65.4%	53.8%	11.6%	1.07
0	19	48.8%	60.6%	-11.8%	1.12
+1	19	48.6%	68.1%	-19.5%	-2.03**
+2	19	58.0%	68.2%	-10.2%	0.80
+3	19	63.2%	68.4%	-5.2%	-0.43