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

Sangyong Han[a,*] Gene C. Lai[b] Chia-Ling Ho[c]

Washington State University Washington State University Tamkang University

ABSTRACT

This paper uses conventional measures of CEO overconfidence, such as option holdings-based and net stock purchase-based measures to investigate the impact of CEOs who hold firm-specific risk on insurer's risk-taking and firm performance. We focus on the insurance industry because the use of reinsurance demand as the proxy for risk-taking provides a precise measurement of risk-taking. We find that the two CEO overconfidence measures are negatively associated with insurer's risk-taking and positively related to firm performance. We also provide evidence that firms with CEOs defined as overconfident earn positive abnormal returns and purchase more reinsurance compared to the industry average. The overall evidence indicates that CEOs who hold high levels of company-specific risk tend to take lower risk and achieve higher firm performance. One possible explanation of the results is that it may not be CEO overconfidence, but the private information about the firm's future stock prices and the intention to control the company's risk that drive our results.

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[*]Corresponding author

[a] Carson College of Business, Department of Finance and Management Science, Washington State University, Pullman, WA 99164, Tel: +1-509-335-1185, Fax: +1-509-335-3857, sangyong.han@wsu.edu

[b] Carson College of Business, Department of Finance and Management Science, Washington State University, Pullman, WA 99164, Tel: +1-509-335-7197, Fax: +1-509-335-3857, genelai@wsu.edu

[c] Department of Insurance, 151 Ying-Chuan Rd., Tamsui, New Taipei City 251, Taiwan, Tel: 886-2-26215656 ext.2865, clho@mail.tku.edu.tw

1. Introduction

This paper examines the impact of CEOs who maintain high personal exposure to company-specific risk on insurer's risk-taking and firm performance in the U.S. property-liability insurance industry. Recently, a substantial body of literature on managerial overconfidence has focused attention on understanding important patterns of corporate decision-making that have not yet been fully explained by traditional finance theory (Skata, 2008). Existing empirical research has examined the important role of CEO overconfidence in a wide range of corporate decisions, such as risk taking (e.g., Sanders and Hambrick, 2007; Malmendier and Tate, 2008; Hirshleifer et al., 2012; Cain and McKeon, 2014). Specifically, the literature finds a positive relation between CEO overconfidence and risk-taking in non-financial industries.[1]

As far as the relationship between CEO overconfidence and firm performance, despite growing research efforts, the relation remains ambiguous. CEO overconfidence may generate positive firm performance by leading risk-averse CEOs to take on sufficient 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).

Prior literature has noted that one of the biggest challenges to the empirical study on managerial overconfidence is to construct proxies for unobservable CEO overconfidence, since overconfidence is a biased belief that cannot be easily measured (Baker et al., 2007). Although previous studies have employed different proxies for managerial overconfidence, the most commonly used measures of CEO overconfidence are option holdings-based and 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

[1] 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).

high levels of personal exposure to company-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 prospects (Hirshleifer et al., 2012).

Despite the wide use of these measures, there have been several alternative explanations for the two CEO overconfidence measures. CEO's late option exercise and additional stock purchase may be due to other factors, such as stock mispricing and growth opportunities (Cao, 2011) or insider information about the firm's future stock prices (Bouwman, 2014).

In this study, we revisit the alternative explanations of these two conventional CEO overconfidence measures. We examine this issue by looking at the relationship between the two CEO overconfidence measures, risk-taking and firm performance in the U.S. property-liability insurance industry. We focus on the insurance industry because the use of reinsurance demand as the proxy for risk-taking enables us to directly observe CEO's risk-taking behavior in insurance companies.[2] 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 just the risk-taking behavior of CEOs because stock returns reflect unexpected events and investors' perception of the company.

Thus, by investigating how CEOs who hold high levels of company-specific risk make reinsurance decisions, we can clearly see whether CEO's late option exercise and buying more of their firm's stock are really due to CEO overconfidence or to other causes.

[2] Purchasing reinsurance is an important mechanism for insurers to limit their risk (Wang et al., 2008).

Our sample consists of 28 U.S. publicly traded property-liability insurance companies over the period 1996-2011.[3] Our findings can be summarized as follows. First, we find that the two proxies for CEO overconfidence are negatively related to insurer's risk-taking behavior, including total risk, underwriting risk, and leverage risk. More importantly, our evidence shows that the two CEO overconfidence measures are positively associated with insurer's reinsurance demand, implying that overconfident CEOs[4] may purchase more reinsurance to protect themselves against unexpected losses, which could harm their job security as well as their personal portfolio. We also find that firms with overconfident CEOs purchase more reinsurance than the industry average by 4.7 percent and 3.3 percent for option holdings-based and net stock purchase-based measure, respectively. These results are different from those in previous studies (e.g., Banerjee et al., 2015) which find that firms with overconfident CEOs tend to have higher risk-taking behavior.

For performance measures, the evidence shows that the two proxies for CEO overconfidence are consistently found to be positively related to Tobin's Q, return on assets (ROA), return on equity (ROE), and stock return. Our evidence also shows that, on average, the stock returns of firms with CEOs classified as overconfident using the option holding-based and net stock purchased-based measure do beat the industry returns by 8.7 percent and 4.0 percent, respectively.

In summary, our overall results show that overconfident CEOs tend to take lower risk (such as purchasing more reinsurance and taking lower underwriting risk) and achieve higher firm performance. These results are different from the traditional finance paradigm: high risk and high

[3] Due to the limited number of publicly traded property-liability insurance companies, our sample size is relatively small. The small sample size is common in the insurance literature studying publicly traded property-liability insurers (e.g., Eckles and Halek, 2010; Huang et al., 2011; Miller, 2011; Ma and Wang, 2014).

[4] 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.

expected return. One possible explanation of these results is that CEOs delay their option exercise and buy additional shares of their firm's stock because they intend to lower their company's risk and improve firm performance to benefit from future high stock prices. The results imply that private information about the firm's future profitability or the intention to control the company's risk may motivate CEOs to maintain high personal exposure to company-specific risk.

We also examine the impact of Sarbanes-Oxley Acts (SOX) and recent financial crisis on the relationship between two CEO overconfidence measures and insurer's risk-taking behavior. With respect to the impact of SOX on the relationship between two CEO overconfidence measures and insurer's risk-taking behavior, we find mixed results. Our results show that the two proxies for CEO overconfidence are negatively related to total risk, underwriting risk, and leverage risk, but positively associated with investment risk after the enactment of SOX, implying that overconfident CEOs may reduce their firm's total risk through management of underwriting, investment, and leverage risks that determine an insurer's risk profile after SOX. We also find that the two CEO overconfidence measures are associated with lower risk-taking during the 2008-2009 financial crisis relative to the period before the crisis.

This study potentially contributes to the literature in several ways. First, we provide the first empirical evidence on the alternative explanations of two conventional CEO overconfidence measures by investigating the impact of CEOs who maintain high personal exposure to the firm-specific risk on risk-taking and firm performance in the insurance sector. Second, our study distinguishes itself from the previous literature by utilizing a direct measure of CEO's risk-taking behavior. Unlike the prior literature in the non-financial and banking industry, we examine how overconfident CEOs affect insurer's reinsurance, underwriting, investment, and leverage risk-

taking decisions over which CEOs of insurance companies have total or partial control. Previous studies mainly use market-based risk-taking measures, such as systematic risk, unsystematic risk and stock return volatility (e.g., Niu, 2010; Suntheim and Sirini, 2012; Banerjee et al., 2015). While these 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 firms' stock returns.

Third, since this study specifically focuses on the publicly traded property-liability insurance companies, we can efficiently control for a variety of potential omitted variables that may confound the interpretation of inter-industry studies**.** Fourth, this study explores the effects of major external shocks, such as SOX and financial crisis in 2008-2009 on managerial risk-taking. Thus, this paper helps enhance our understanding of how overconfident CEOs react to changes in the regulatory and economic environments. Finally, our overall findings provide an alternative explanation of two CEO overconfidence measures. Our results suggest that it may not be CEO overconfidence but the private information about the company's future profitability or the intention to control the firm's risk that drives our results.

The reminder of the paper is structured as follows. Section 2 overviews the alternative explanations of our CEO overconfidence measures, and formulates our main hypotheses. Data, sample selection criteria, and empirical methodology are discussed in Section 3. Section 4 presents the empirical results, and Section 5 concludes with a summary of our main findings.

2. Background and Hypotheses Development

2.1. Alternative Explanations of CEO Overconfidence Measures

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). CEO overconfidence is defined as the systematically upward biased beliefs of CEOs about the future returns to their investment projects or as overestimation of the accuracy of their beliefs and underestimation of risk (Malmendier and Tate, 2005). The literature provides evidence that overconfident CEOs significantly affect corporate policies, including capital expenditures (Malmendier and Tate, 2005), Mergers and Acquisitions decisions (Malmendier and Tate, 2008), innovation (Hirshleifer et al., 2012), CEO turnover (Campbell et al., 2011), earnings management (Schrand and Zechman, 2012), dividend policy (Deshmukh et al., 2013), and corporate diversification (Andreou et al., 2016).

Although prior literature has employed different proxies for managerial overconfidence, 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).[5] The main idea behind the two CEO overconfidence measures is based on CEOs' late option exercise and additional stock purchases in spite of their high personal exposure to the firm's idiosyncratic risk. Malmendier and Tate (2005) point out that rational CEOs are likely to exercise options early or minimize their holding of their company's stock to address the under-diversification problems, 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 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; Hribar and Yang, 2015, Andreou et al., 2016; Ho et al., 2016).

[5] Previous studies have used a variety of managerial overconfidence measures, such as Longholder measure defined by the dummy variable equal to one if the CEO ever held an option until the last year prior to expiration (Malmendier and Tate, 2005; Malmendier et al., 2011), 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), an overconfidence score based on CEOs' prevalence in photographs in the annual report and their cash and non-cash pay (Schrand and Zechman, 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).

Despite their widespread use, there have been 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 buy additional shares of their company because they have positive private information about future stock prices. If private information is the true reason for CEO's late option exercise or additional stock purchases instead of CEO overconfidence, we would expect that the stock returns of firms with CEOs who are defined as overconfident using the two CEO overconfidence measures should be higher than the average stock market return.

Malmendier and Tate (2005, 2008) rule out the possibility of insider information by demonstrating that, on average, CEOs who are classified as overconfident using option holdings-based measure do not earn abnormal returns relative to the S&P 500 index. However, Bouwman (2014) examines the possibility that CEOs may exercise options late not because of optimism but because of favorable private information by classifying CEOs who are defined as optimistic using option holdings-based measure (Holders 67) into those who made gains from exercising their options late and those who did not. He shows 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 favorable insider information rather than optimistic CEOs.

Secondly, another reason why CEOs maintain high personal exposure to company-specific risk is to convey a costly signal to the capital market, indicating that their firms have better prospects than other firms, in an attempt to reduce information asymmetries between the firm and the market. Malmendier and Tate (2005) state that signaling should reduce information asymmetries, thereby removing investment-cash flows sensitivity of CEOs who hold their options. They argue that high investment-cash flow sensitivity of overconfident CEOs dispels the possibility that option holdings-based measure is a proxy for signaling motives. Thirdly, CEOs

may hold exercisable options too long because of their inertia or procrastination. Malmendier and Tate (2008) tease out the possibility of procrastination by showing that over 68 percent of CEOs under the Longholder overconfidence measure conduct other transactions on their personal portfolios in the two years before their longheld options expire.

Fourth, one may argue that risk-tolerant CEOs prefer to delay the exercise of their options, and thus appear to be overconfident. Malmendier and Tate (2005) contend that since less risk-averse managers are likely to leverage up the firm, lower risk aversion should lead to lower investment–cash flow sensitivity, which is inconsistent with the high investment-cash flow sensitivity of CEOs who hold highly in-the-money. Thus, they eliminate this alternative explanation.

Fifth, Cao (2011) documents that if firms are overvalued or have better growth opportunities, CEOs tend to postpone their options exercise because of the market's negative reaction to CEO option exercise and expected profits from high 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 stable and persistent trait over time (Hirshleifer et al., 2012). 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 contend 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 holding-based overconfidence measures. In summary, the above arguments and empirical findings cast some doubts on the argument that the two commonly used CEO overconfidence measures in the literature are good proxies for actual overconfidence.

2.2. CEO Overconfidence and Risk Taking

A firm's risk-taking behavior has aroused considerable interest from academics and policy makers because it concerns the financial interests of various corporate stakeholders (Zou et al., 2012). Managerial risk-taking is fundamental to corporate decision-making and has crucial implications for firm performance and survival (Boubakri et al., 2013). Financial scandals resulting from accounting fraud and earnings management in such large players as Enron, WorldCom and Adelphia illuminate the detrimental results of excessive risk-taking by top executives.

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 a substantial loss variability caused by the 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 risk, we are interested in how overconfident CEOs affect insurer's risk-taking behavior in the property-liability insurance industry.[6]

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 too risky projects (Malmendier and Tate, 2005).

Previous studies find that CEO overconfidence defined using the option holdings-based or net stock purchase-based measure is positively related to firm's risk-taking in non-financial and banking firms[7]. Hirshleifer et al. (2010) find that firms with overconfident CEOs tend to show higher stock return volatility. Cain and McKeon (2014) show that CEO overconfidence is

[6] We primarily focus on the CEO because CEO as an ultimate decision maker in his/her company is supposed to have some discretion on the firm's risk-taking decisions (Suntheim and Sironi, 2012).

[7] 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. (2015), which shows that firms with overconfident CEOs have higher stock price crash risk than firms with non-overconfident CEOs.

positively associated with corporate risk taking. Niu (2010) reports that banks managed by 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. Based on the literature above, we expect that if two proxies of CEO overconfidence really measure overconfidence, the two CEO overconfidence measures would be positively related to risk-taking in the property-liability insurance industry.

However, it is also possible for CEO's late option exercise and additional stock purchases to be negatively associated with insurer's risk-taking behavior. CEOs whose personal wealth and human capital are closely tied to their companies tend to be more risk-averse and avoid risky investment in order to preserve their own personal wealth (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. 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 even be detrimental to their survival (Zou et al., 2012). Thus, it is argued that CEOs who hold significant company-specific risk may reduce the company risk by adopting less risky underwriting policies, investing more in low risk projects, and choosing a lower level of leverage to protect their own personal portfolio. In light of above competing views, we suggest the following null hypothesis.

Hypothesis 1.1: The two proxies for CEO overconfidence are not related to risk-taking in property-liability insurance companies. [8]

[8] 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.

Reinsurance has been widely used as an effective risk management and hedging tools against unexpected catastrophic losses in property-liability insurance industry (Cummins and Weiss, 2000). As the insurance of insurers, reinsurance enables insurers to transfer risks among each other, enhancing the financial soundness of the insurance companies. Thus, insurance companies optimally combine the use of capital and reinsurance to manage their risk (Yan and Hong, 2014).

In addition, reinsurance companies play an important role in monitoring the primary insurers' behavior, thereby mitigating insurer's excessive risk-taking. While reinsurance has the advantage of improving insurer's financial stability and reducing insolvency risk, it can also have a negative impact on firm performance because of the substantial cost of reinsurance.[9] Since both risk-taking and firm performance are important to managerial decision-making, CEOs need to make reinsurance decisions carefully.

The relationship between CEO overconfidence measures and reinsurance demand is unclear. Alsubaie (2009) points out that overconfident CEOs underestimate risk, and therefore they may engage in less hedging behavior than non-overconfident ones. In line with this argument, we predict that if overconfident CEOs who systematically overestimate the return to their investment projects focus more on firm performance than on the riskiness of their firms, then they would choose to purchase less reinsurance. In this case, the two proxies for CEO overconfidence are negatively related to reinsurance demand.

On the other hand, CEOs who hold high levels of company-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 be harmful to their job security as well as to their personal wealth. Thus, the relationship between the two proxies for CEO overconfidence and insurer's

[9] 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.

reinsurance demand cannot be determined. These competing hypotheses lead to the following null hypothesis.

Hypothesis 1.2: The two proxies for CEO overconfidence are not related to reinsurance demand in property-liability insurance companies.

2.3. Effect of SOX on Relation between CEO Overconfidence and Risk Taking

The Sarbanes-Oxley Act (SOX) was enacted in 2002 in response to a series of high profile corporate and accounting scandals. Since the enactment, SOX has dramatically changed the accounting profession and has affected all publicly traded companies in the U. S. The main purpose of SOX is to restrict managerial excesses, increase transparency, and improve corporate governance and ethical behavior by exposing CEOs to more personal liability (Banerjee et al., 2015). Akhigbe et al. (2009) find that increased transparency and better disclosure after the introduction of SOX have reduced opacity in the insurance industry.

However, despite extensive research, there is little agreement on the impact of SOX on CEO's risk-taking behavior. Proponents of SOX argue that the stringent regulations on corporate governance, such as more independent boards, independent audit committees and mandated disclosure may cause firms to engage in less risk-taking behavior. Cohen et al. (2007) note that increased legal and political exposure after SOX have resulted in a substantial decrease in the incentives of CEOs to invest in risky projects. Banerjee et al. (2015) demonstrate that after the passage of SOX, overconfident CEOs (defined using the option holdings-based measure) tend to reduce the level of risk exposure considerably. These arguments indicate that SOX may be effective in controlling CEO's high risk-taking behavior when CEOs are overconfident.

In contrast, opponents of SOX assert that SOX may not have a mitigating effect on managerial risk-taking. John et al. (2008) find that improved investor protection is positively related to

higher managerial risk-taking. They point out that managers whose personal wealth is more closely tied to their firms have incentives to reduce firm-specific risk to protect their private benefits extracted from the corporation, but better investor protection can mitigate such behavior, resulting in higher corporate risk taking. Kim and Lu (2011) suggest that strong external governance holds CEOs accountable for firm performance by dampening the risk-reducing effect of CEO ownership. If that is the case, CEOs who hold under-diversified personal portfolios by delaying their option exercise and buying more of their company's stock are expected to take on more risk after the enactment of SOX. Given the forgoing contradictory views, we suggest a null hypothesis about the effect of SOX on the relationship between two proxies for CEO overconfidence and risk-taking.

Hypothesis 2: CEOs who maintain high personal exposure to company risk do not change their risk-taking behavior after the enactment of the Sarbanes-Oxley Act (SOX).

2.4. Effect of Financial Crisis on Relation between CEO Overconfidence and Risk Taking

The financial crisis of 2008-2009 had a devastating impact on global economy, resulting in the collapse of a number of financial institutions and government bailouts of large financial institutions. Recent studies show that firm's risk management and financial policies had a significant influence on the degree to which firms were impacted by the financial crisis (e.g., Brunnermeier, 2009). Previous studies suggest that the financial crisis may have had different impacts on the relation between the two proxies for CEO overconfidence and insurer's risk-taking (e.g., Core et al., 2003; Kim and Lu, 2011; Luo and Song, 2012).

On the one hand, CEO's late option exercise is expected to be positively associated with insurer's risk-taking during the financial crisis. CEOs who hold stock options can increase their personal wealth when the stock price increases, and experience no reduction in their wealth when

the stock price declines. Thus, CEOs with substantial stock option positions may have incentives to take on higher risk during the financial crisis because of the uncertainty in stock prices, especially when they have private information that their companies will not be affected by the economic downturn. Luo and Song (2012) present evidence that CEO's exercisable option holdings have a positive impact on a firm's risk-taking during the financial crisis.

On the other hand, increased stock ownership may lead CEOs whose personal wealth is closely linked to their firms to make conservative risk taking decisions during the financial crisis because CEOs who have high stock ownership can experience substantial losses in their personal wealth due to declining stock prices. Core et al. (2003) state that for risk-averse CEOs who hold company-specific risk, large stock holdings may induce less risk-taking behavior. Kim and Lu (2011) point out that large stock ownership can discourage CEOs whose personal portfolios are less diversified from taking more risk. Gormley and Matsa (2016) find that managers who have a large ownership stake tend to reduce their firms' stock volatility and risk of distress.

We extend these arguments and argue that it is possible that CEOs who hold too much company-specific risk would take on lower risk during the financial crisis, which is a high risk period. Overall, the prior literature suggests that the financial crisis may differently affect the relationship between the two CEO overconfidence measures and insurer's risk-taking during the financial crisis. Therefore, our hypothesis 3 is stated in the following null form.

Hypothesis 3: CEOs who maintain high personal exposure to company risk do not change their risk-taking behavior during the period of financial crisis.

2.5. CEO Overconfidence 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 show that

overconfident CEOs can reduce the value of the firm as a result of destroying overinvestment (e.g., Malmendier and Tate, 2005, 2008; Campbell et al., 2011). Malmendier and Tate (2008) find 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. (2010) reveal 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.

In addition, CEOs may postpone the exercise of their highly in-the-money options or purchase more of their company's stock because of positive private information or the intention to control the company's destiny in order to benefit from future high stock prices. If the alternative explanations for CEO overconfidence measures are valid, we expect a positive relationship between the two proxies for CEO overconfidence and firm performance. Based on the above discussions, we suggest our hypothesis 4 as the null form.

Hypothesis 4: The two proxies for CEO overconfidence are not related to firm performance

in the property-liability insurance companies.[10]

3. Data and Methodology

This section discusses data and methodology.

3.1. Data and Sample Selection

Our sample includes data on 28 U.S. publicly-traded property-liability insurance companies over the period 1996-2011. We employ panel data that contain information both across firms and over time for each firm. Each of the variables for the analysis is calculated annually for the sample firms. Our data sources are described below. We use ExecuComp database to construct two proxies for CEO overconfidence. Monthly stock returns used to estimate buy-and-hold stock return are derived from the Center for Research in Security Prices (CRSP). Data on Tobin's Q are 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). We use 3-year rolling periods of data to compute three risk-taking measures, such as total risk (i.e., standard deviation of return on assets), underwriting risk (i.e., standard deviation of loss ratios) and investment risk (i.e., standard deviation of return on investment). For example, standard deviation of the return on assets (ROA) for 1996 is calculated using ROAs from 1996 to 1998.

We initially obtained 3,589 executive-firm-year observations of option holdings and shares owned excluding options from the ExecuComp database for 52 U.S. publicly traded property-

[10] 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.

liability insurance firms over the period 1996-2013. In calculating CEO overconfidence variables, we use the data only on option holdings and shares owned by CEOs, and exclude the data on option holdings and shares owned by other executives (i.e., option holdings and shares owned by CFO, president, vice-president and CEO of subsidiaries). Similar to Malmendier and Tate (2005), we require CEOs to have at least five years of data on option holdings and shares owned excluding options.

This reduces the sample size to 467 and 472 CEO-firm-year observations for option holdings and shares owned excluding options, respectively. Calculation of risk-taking measures requires 3 years rolling data, and thus, the most recent two years of data (2012-2013) are not included in our sample. 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, we have 233 and 235 CEO-firm-year observations for option holdings-based measure and net stock purchase-based measure, respectively, for 28 U.S. publicly traded property-liability insurance companies over the period 1996-2011.

The ExecuComp database reports data on individual annual option holdings and shares owned excluding options 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 group. A limitation of this study is the relatively small sample size, but this is a common concern of all insurance literature conducted with publicly traded property-liability insurers.[11]

[11] Eckles and Halek (2010) use 348 firm-year observations over the period 1992-2000. Eckles et al. (2011) have 213 firm-year observations from 1992 to 2000. Huang et al. (2011) use 224 firm-year observations for the period 2000-2007. Ma and Wang (2014) include 247 firm-year observations from 2006 to 2010.

3.2. Methodology

We conduct regression analyses using a series of pooled, cross-sectional, and time-series data. The estimates of coefficients derived from 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.[1 2] Given the cross-sectional and time-series data structure, the functional form of the two-way fixed effects model for the relationship between CEO overconfidence measures and insurer's risk-taking has the following specification:

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

where *i* indexes the insurance company and *t* represents time (year), d_t is a vector of time fixed-effects, f_t 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 an insurer *i* at time *t*.

For testing our hypothesis 1.2 and 4, we employ the lagged-structure model to correct for potential endogeneity problems, such as the reverse causality because the two measures of CEO overconfidence are likely to be influenced by insurer's reinsurance demand and firm performance. The regression models to test the relationship between two proxies for CEO overconfidence, reinsurance demand and firm performance can be expressed as follows:

$$\begin{aligned} Reinsurance_{i,t+1} = {} & \alpha_0 + \alpha_1 Overconfidence_{i,t} + \alpha_2 Bsize_{i,t} + \alpha_3 Insider_{i,t} + \alpha_4 Busy_{i,t} \\ & + \alpha_5 Duality_{i,t} + \alpha_6 Institution_{i,t} + \alpha_7 Size_{i,t} + \alpha_8 ProdHHI_{i,t} \end{aligned}$$

[1 2] We conduct the 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 fixed effects model fits the data better.

$$+ \alpha_9\, GeoHHI_{i,t} + \alpha_{10}\, Longtail_{i,t} + \alpha_{11}\, Weak_{i,t} + \alpha_{12}\, Tax_{i,t}$$
$$+ \alpha_{13}\, Coastal\_state_{i,t} + \alpha_{14}\, 2year\_Loss\_Dev_{i,t} + d_t + f_t + \varepsilon_{i,t}$$

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

$$Performance_{i,t+1} = \alpha_0 + \alpha_1\, Overconfidence_{i,t} + \alpha_2\, Bsize_{i,t} + \alpha_3\, Insider_{i,t} + \alpha_4\, Busy_{i,t}$$
$$+ \alpha_5\, Duality_{i,t} + \alpha_6\, Institution_{i,t} + \alpha_7\, Size_{i,t} + \alpha_8\, Reinsurance_{i,t}$$
$$+ \alpha_9\, ProdHHI_{i,t} + \alpha_{10}\, GeoHHI_{i,t} + \alpha_{11}\, Longtail_{i,t} + \alpha_{12}\, Weak_{i,t}$$
$$+ d_t + f_t + \varepsilon_{i,t}$$

where $Performance_{i,t+1}$ is one of several types of profitability measures for an insurer *i* at time *t*+1.

The variables in the above equations are discussed next.

3.3. Variable Definitions

The variables we describe in this section fall into four categories: CEO overconfidence measures, risk taking measures, firm performance measures, and control variables.

3.3.1. CEO Overconfidence Measures

CEO overconfidence is measured using two conventional proxies for CEO overconfidence, which are an option holdings-based measure of overconfidence (e.g., Malmendier and Tate, 2005; Campbell et al., 2011; Hirshleifer et al., 2012; Ho et al., 2016) and a net stock purchase-based measure of overconfidence (e.g., Malmendier and Tate, 2005; Jarboui et al., 2014; Andreou et al., 2016).

As our first measure of CEO overconfidence, we employ an option holdings-based overconfidence measure using the information on CEO option holdings for U.S. publicly traded

property-liability insurance companies.[13] Following Malmendier and Tate (2005), we classify CEOs as overconfident if they keep their options too long to be considered rational. Specifically, the dummy variable (*OC67*) takes a value of one 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 as overconfident from the first time he/she has exercisable options that are 67 percent or more in the money. To be more specific, after identifying the second instance at which a CEO fails to exercise the options that are at least 67 percent in the money, we define the CEO as overconfident, starting with the first instance of the behavior.[14] Once a CEO is identified as overconfident, we assume that he/she remains overconfident for the rest of sample period because overconfidence is a persistent trait (Hirshleifer et al., 2012).

Malmendier and Tate (2005) use very detailed data on option exercise to define overconfident CEOs. However, we cannot access the detailed data on CEO's option holdings and exercise prices for each option grant as they do. Thus, we follow the method employed by Campbell et al. (2011) to compute the average moneyness of the CEO's option portfolio for each year by using ExecuComp database. Campbell et al. (2011) demonstrate that this alternative measure is valid and useful in measuring CEO overconfidence.[15] To calculate the average moneyness, 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

[13] Hall and Murphy (2002) assume that risk-averse executives generally hold undiversified portfolios, and they should exercise options early if they are rational utility maximizers. In their numerical simulations, Hall and Murphy (2002) demonstrate 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) for each year of the stock option's exercisability. Malmendier and Tate (2005) adopt this framework as a threshold level for CEO overconfidence.

[14] We obtain similar results when we define CEOs who fail to exercise the options with 67 percent or more in the money at least twice as overconfident in all periods, not just starting from the first time they crossed the 67 percent threshold.

[15] For a detailed discussion of the measure, see Campbell et al. (2011).

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 is based on the tendency of CEOs to buy more of their firm's stock despite their already high personal exposure to company-specific risk (Malmendier and Tate, 2005). Malmendier and Tate (2005) contend that while rational CEOs tend to minimize the holding of their company's stock in order to divest themselves of firm-specific risk, overconfident CEOs are likely to habitually increase their equity positions by purchasing new shares of their firm's stock or accumulating new stock grants. Similar to Malmendier and Tate (2005), we define a CEO as overconfident if there are more years in which a CEO is a net buyer of their company's stock than there are years in which a CEO is a net seller over the sample period.

Following the prior literature (e.g., Malmendier and Tate, 2005; Jarboui et al., 2014), we require that CEOs have been in their position for at least 5 years to be included in our sample. To calculate net stock purchase-based measure, we regard the increase (decrease) in shares owned by CEO in each year as the net amount of shares the CEO has bought (sold). Specifically, CEOs are classified as net buyers (net sellers) if the difference between the number of stocks held at current fiscal-year end and the number of stocks held at the prior fiscal-year end is positive (negative). Shares owned excluding options by CEO (ExecuComp variable: SHROWN_EXCL_OPTS) is used to compute the overconfidence measure. We use a dummy

variable (*Net Buyer*) that equals one if the CEO is a net buyer of company stock during the sample period, and zero otherwise.[16]

3.3.2. Risk Taking Measures

To investigate insurer's risk-taking behavior in a comprehensive way, we employ a variety of risk-taking measures, such as reinsurance demand, total risk, underwriting risk, investment risk, and leverage risk[17]. Unlike the previous studies that typically use market-based risk-taking measures, we focus mainly on observable risky-taking behavior of CEOs by utilizing insurer's reinsurance demand over which only CEOs of insurance companies have total control in order to directly examine whether two proxies for CEO overconfidence really measure overconfidence or not in the U.S property-liability insurance industry. First, we use insurer's reinsurance demand as the most important risk measure in this study. Reinsurance is an important mechanism by which an insurer manages risk (Wang et al., 2008). We measure reinsurance demand as the ratio of reinsurance ceded to the sum of direct premiums written and reinsurance assumed (Klein et al., 2002).

Second, 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 plus taxes and interest expenses divided by net admitted assets.[18] Third, 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

[16] Following, Andreou et al. (2016), we also classify CEOs as overconfident for their entire tenure if they are net buyer of their firm's stock during their first five years. The results using this alternative measure are very similar to those reported.

[17] 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.

[18] Admitted assets are the assets permitted by state laws to be included in an insurer's financial statement in determining the solvency of insurers. Admitted assets typically exclude illiquid and hard-to-value assets, such as overdue receivables and furniture and equipment.

deviation of the firm's loss ratio where the loss ratio is the ratio of loss incurred divided by premiums earned.[19]

Fourth, investment risk is related to the investment activities that may adversely affect insurer's financial stability. Since underwriting profit could be negative in many instances[20], effectively taking and managing investment risk are essential to success of insurance companies (Hoyt and Trieschmann, 1991). 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. Finally, 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.[21]

3.3.3. 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 prior literature on the relationship between CEO overconfidence and firm performance (e.g., Malmendier and Tate, 2005; Hirshleifer et al., 2010; Vitanova, 2014). Brainard and Tobin (1968) define Tobin's Q as the market value of equities to the replacement costs of the physical assets. However, since it is difficult to measure replacement costs of the physical assets due to data limitations, previous studies have used book value of assets instead of replacement costs in calculating Tobin's Q. In this study, we compute Tobin's Q by dividing market value of assets by the book value of assets where market value of assets is estimated as

[19] Browne and Hoyt (1995) find that high underwriting risk has a negative influence on insurer's financial stability in the U.S. property-liability insurance industry.

[20] According to a report by Insurance Information Institute (I.I.I), between 1980 and 2013, underwriting income for the U.S. property-casualty industry has been net positive in only five years.

[21] Carson and Hoyt (1995) provide evidence that insurers with low levels of leverage are likely to have a lower likelihood of insolvency. Leverage risk is computed as 1 minus the surplus-to-asset ratio.

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 various 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 plus taxes and interest expenses to net admitted assets. ROE is computed by dividing net income plus taxes and interest expenses 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.

3.3.4. Control Variables

We include corporate governance variables as explanatory variables in the regression analysis because the extant literature suggests that corporate governance structure may affect the insurer's reinsurance demand, risk-taking behavior, and firm performance (e.g., Garven and Lamm-Tennant, 2003; Brick and Chidambaran, 2008; Cheng, 2008). Board size is the number of all directors (*Bsize*). Insider percentage is the percentage of executive directors on the board (*Insider*). We define a busy board with the dummy variable (*Busy*) that takes the value of one if 50 percent or more independent board members hold three or more directorships, and zero otherwise. CEO duality is a dummy variable (*Duality*) that equals one if the same person is the CEO and Chairperson of the board, and zero otherwise. Institutional ownership is measured as the percentage of shares held by institutional investors (*Institution*).

In addition, we use several firm characteristics as control variables**.** The natural logarithm of total net written premiums is used as a proxy for firm size (*Size*). Lines of business Herfindahl index is calculated as the sum of the squares of the percentages of direct premium written across product lines (*ProdHHI*).[22] Geographical Herfindahl index is computed by the sum of the squares of the percentages of direct premium written across 50 states for each insurer (*GeoHHI*). The percentage of long-tail lines is defined as the ratio of premiums of long-tail lines to total net written premiums (*Longtail*).[23] Insurer financial condition is an indicator variable (*Weak*) that takes a value of one if the insurer is financially unhealthy, where unhealthy is defined as more than four unusual insurance Regulatory Information System (IRIS) ratios[24], and zero otherwise.

Prior literature has documented a variety of factors affecting insurer's reinsurance demand. Thus, we use additional control variables, such as tax effect, coastal states, and 2 year loss development in the regressions where reinsurance demand is a dependent variable. Tax effect is a proxy for the tax liability or tax-favored assets (*Tax*). We measure tax effect as the ratio of tax-exempt investment income relative to total investment income (Wang et al., 2008). Coastal States is a dummy variable (*Coastal_State*) that takes value of one 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 Development (*2year_Loss_Dev*) is computed by dividing the development in estimated losses and loss expenses incurred two years before the current year and prior year by

[22] We include approximately 30 different lines of business in calculating the lines of business Herfindahl index. The percentage of lines of business is obtained from the National Association of Insurance Commissioners' (NAIC) annual statutory filings.

[23] Long-tail lines are lines of business for which losses may not be known for some period, and it takes a long period of time for the claims to be settled (e.g., general liability, directors and officers liability (D&O) and workers' compensation).

[24] The Insurance Regulatory Information System (IRIS) is a set of financial ratios used by National Association of Insurance Commissioners (NAIC) to assess insurer's financial soundness. If an insurer has more than three unusual ratios outside of the usual range set by NAIC, it may receive more intense regulatory intervention.

policyholders' surplus (Cole and McCullough, 2006).[25] The definitions of all variables are summarized in Appendix 1.

4. Results

4.1. Descriptive Statistics

Table 1 presents the descriptive statistics for all variables. The results of *OC67* and *Net buyer* measures show that about 59 percent and 72 percent of CEO-firm-years are defined as overconfident, respectively. These percentages are comparable with those in prior studies using similar measures for CEO overconfidence.[26] Table 2 provides the Pearson correlation coefficients between all independent variables. The correlation coefficient between two different proxies for CEO overconfidence measures is 0.083, which is very similar to that of 0.063 in Malmendier and Tate (2005). Table 2 also shows that some independent variables are highly correlated. For example, the correlation coefficients on reinsurance and firm size, line of business Herfindahl index and 2 year loss development, and board size and geographical Herfindahl index are -0.491, -0.457 and -0.547, respectively, and are statistically significant at the 1 percent level. We perform the variance inflation factor (VIF) test to check for multicollinearity among independent variables in the regression design. We find that VIFs of all independent variables in the regressions are less than 4 and thus, conclude that multicollinearity does not adversely affect our regression results.

4.2. Empirical Results

[25] U.S. Property-liability insurers are required to report originally estimated losses and loss expenses as well as revised estimate (or development) of those values based on subsequent experience in later years to state insurance commissioners in Schedule P of insurers' financial statement filings following the Statutory Accounting Principles (SAP).

[26] Malmendier and Tate (2005) classify 51 percent and 61 percent of CEO-years as overconfident for the option holdings-based measure and the net stock purchase-based measure, respectively.

The estimates of the parameters from our two-way fixed effects regression of the relationship between two CEO overconfidence measures and risk-taking are presented in Table 3. We first report the results of reinsurance demand model. The coefficients on both proxies for CEO overconfidence are positively significant in reinsurance demand at the 1 percent and 5 percent level for option holdings-based measure and net stock purchase-based measure, respectively. These results imply that overconfident CEOs may increase the usage of reinsurance in order to protect themselves against unexpected losses that could harm their job security as well as their personal wealth.

As for the control variables, we find a negative relationship between firm size and insurer's reinsurance demand, implying that small insurance firms are more likely to purchase reinsurance as a way to manage unexpected losses (Mayers and Smith, 1990). Both product and geographic concentration are significantly and positively related to reinsurance demand. The results indicate that insurers with a higher concentration in a given line of business or geographic area may have a higher incentive to purchase more reinsurance in order to diversify the risks associated with the concentrations (Cole and McCullough, 2006).

The percentage of long-tail lines is significantly negative, consistent with Altuntas (2015) that insurers with a higher percentage of long-tailed line business typically hold large reserves compared with premiums, and thus less reinsurance may be required to cover future claim payments. The coefficient of weak is significantly positive, implying that financially weak insurers purchase more reinsurance to reduce insolvency risk. Tax is not related to reinsurance demand, consistent with Garven and Lamm-Tennant (2003). The coefficient on 2 year loss development is positively significant, implying that firms that underreport their loss reserves tend to purchase higher levels of reinsurance (Cole and McCullough, 2006).

The results of risk taking models (total risk, underwriting risk, investment risk, and leverage risk) in Table 3 are discussed next. The evidence shows that the coefficients on CEO overconfidence variable are negative and significant in total risk, underwriting risk, and leverage risk for option holdings-based measure and net stock purchase-based measure. However, we do not find any significant relations between CEO overconfidence and investment risk for both CEO overconfidence measures. The results imply that firms with overconfident CEOs take lower total risk, underwriting risk and leverage risk relative to non-overconfident CEOs by 4.8 percent, 2.0 percent and 3.2 percent, respectively, for the option holdings-based measure, and by 3.4 percent, 4.9 percent and 3.3 percent, respectively, for the net stock purchase-based measure.

Some possible explanations for these results are stated below. In terms of the negative relationship between CEO overconfidence measures and underwriting risk, CEOs who hold firm-specific risk may not want to harm their company's underwriting profits by taking on more 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. The negative relationship between CEO overconfidence measures and leverage risk could be explained by the fact that CEOs who maintain high personal exposure to company-specific risk may prefer to take lower levels of corporate leverage to avoid high financial risk in their personal portfolio.[27] 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 CEO overconfidence and total risk.

The findings together with the positive relation between CEO overconfidence measures and insurer's reinsurance demand imply that overconfident CEOs try to limit their risk exposures to

[27] High leverage risk results in high probability of financial distress or bankruptcy in the insurance sector (Carson and Hoyt, 1995).

protect their wealth. This result is consistent with the "playing it safe" hypothesis that managers who hold a large ownership stake undertake less risk than desired by a diversified shareholder because their personal wealth is closely related to firm's performance (Gormley and Matsa, 2016).

With regard to the control variables for all risk taking models, only important results are discussed to save space. The evidence in Table 3 shows that board size is negatively and significantly related to total risk and leverage risk, indicating that the performance of firms with large boards may be less volatile because the decisions made by large boards tend to be less extreme (Cheng, 2008). Firm size is found to be positively related to total risk, investment risk and leverage risk, implying that larger insurers tend to take more risk. We also find that the coefficients on the product concentration are significant and positive in total risk and leverage risk, whereas the coefficients on geographical concentration are negatively significant in all four risk measures. The results indicate that insurers with higher concentrations in a given line of business exhibit more risk-taking behavior, and operating over wider geographical areas may expose insurers to greater risk because the complexity of diversified firms increases the difficulty of monitoring managers' excessive risk-taking.

The results in Table 4 show that the implementation of SOX has different impacts on managerial risk-taking behavior. We find that interaction term *OC67* × SOX is significantly positively related to reinsurance demand, and the coefficients on the interaction term are significant and negative in total risk, underwriting risk and leverage risk. The coefficients on *Net buyer* × SOX are negative and statistically significant in underwriting risk and leverage risk. These results support the view that SOX may have a mitigating effect on CEO's risk-taking behavior (Banerjee et al., 2015). We also find that the interaction terms of *OC67* × SOX and *Net*

buyer × SOX are positively and significantly related to investment risk, implying that overconfident CEOs tend to take on higher investment risk after the enactment of SOX. One possible explanation for these mixed results is that overconfident CEOs may choose higher investment risk, but lower underwriting risk and leverage risk as its strategy to control the firm's total risk through management of underwriting, investment, and leverage risks that determine an insurer's risk profile.[28]

We next examine the effect of the recent financial crisis on the relationship between overconfident CEOs and insurer's risk-taking. The dependent variable is the change in risk-taking before and during the financial crisis, measured as the average of 2008-2009 risk-taking measures minus the average of 2005-2006 risk-taking measures, and CEO overconfidence measures and control variables of 2007 are used as independent variables. Table 5 reports that the coefficients on *OC67* are significant and negative in total risk, investment risk, and leverage risk, implying that CEOs who postpone their exercisable options tend to take on lower risk during the financial crisis relative to the before crisis period. We also find that the signs on *Net buyer* are significantly negative in total risk and leverage risk. The results support the argument that CEOs who hold firm-specific risk reduce the riskiness of their firms during the financial crisis in an effort to protect their personal wealth.

Table 6 presents the estimations of the parameters of the relationship between CEO overconfidence measures and firm performance. The coefficients on CEO overconfidence measured by both *OC67* and *Net Buyer* are significant and positive in all four profitability measures, indicating that insurers with overconfident CEOs tend to achieve better financial performance. These results, together with the negative relation between CEO overconfidence

[28] Please see Ho et al. (2013). It should be noted that they examine insurers' risk-taking behavior, while this study investigates CEOs' risk-taking behavior.

measures and risk-taking, suggest that overconfident CEOs improve their personal wealth as a result of both higher firm performance and lower risk.

There are some interesting results with respect to several control variables. Table 6 reports that a busy board is positively related to firm performance, implying that busy directors help firms improve performance by bringing in more experience and knowledge, and providing better advising and monitoring functions (Elyasiani and Zhang, 2015). Institutional ownership is found to have a positive impact on firm performance, suggesting that monitoring by institutional investors helps managers focus more on firm's performance and less on opportunistic or self-serving behaviors (Del Guercio and Hawkins, 1999).

We also find that firm size is positively associated with firm performance. The result implies that large insurers may achieve higher performance due to economics of scale. Reinsurance demand is negatively related to insurer's financial performance, consistent with the finding of Lee and Lee (2012) that insurers with higher reinsurance ratios tend to have lower firm performance. We also find that product and geographical concentration are positively associated with firm performance, indicating that diversified firms have a lower performance. Lastly, insurer's financial weakness is found to be negatively related to firm performance.

4.3. CEO Overconfidence or Private Information

Prior literature suggests that CEOs may decide not to reduce their personal exposure to firm-specific risk because they have private information about future stock prices, thereby keeping their exercisable options longer and increasing their equity holdings (e.g., Bouwman, 2014). In order to examine this possibility, we calculate the average returns of CEOs who are defined as overconfident by the option holdings-based measure for each five-year window, starting from the first year when they hold unexercised exercisable options that are at least 67 percent in the

money. We compare those returns to the industry average return (average return of full sample) over the same period.

Panel A of Table 7 (top left) shows that, on average, the returns of companies with CEOs classified as overconfident using the option holdings-based measure do beat the industry returns by 8.7 percent, and the return differentials are statistically significant. The result is consistent with the finding of Bouwman (2014) that CEOs who are defined as optimistic by the option holdings-based measure may actually be rational CEOs with favorable inside information about the future stock prices rather than optimistic CEOs. We find similar results for the net stock purchase-based measure. The average stock returns of firms with overconfident CEOs who are defined as net buyers of their firm's stock are significantly higher than those for the industry by 4.0 percent over a five-year window.

Also, we conduct a similar analysis using the insurer's reinsurance demand. The results in panel A (top right) show that firms with overconfident CEOs purchase more reinsurance than the industry average by 4.7 percent and 3.3 percent for option holdings-based and net stock purchase-based measure, respectively, and the differentials are both statistically significant. To check the robustness of the results of stock returns and reinsurance demand, we perform the same test for CEOs who hold the options that are at least 75 percent in the money and are net buyers of their company's stock over at least 80 percent of years that they are in the CEO position. As seen in panel B of Table 7, firms with these CEOs earn higher abnormal returns and buy more reinsurance relative to those with CEOs who hold the options that are at least 67 percent in the money and are net buyers in more than 50 percent of the sample period. Overall, the results indicate that CEOs who maintain high exposure to firm-specific risk intend to lower their company's risk by purchasing more reinsurance in order to maximize benefits from future

high stock prices, suggesting that private information instead of CEO overconfidence may motivate CEOs to hold their deep-in-the-money options and to buy more of their company's stock in U.S. property-liability insurance companies.

4.4. Robustness Check and Additional Tests

In this section, we report the results of a series of robustness checks of our main findings. First**,** CEO's late option exercise or additional stock purchase behavior may be jointly determined with firm's risk-taking behavior, and thus the feedback effect between dependent and independent variables may violate the consistency of the OLS estimator, leading to the problem of endogeneity. For example, boards of insurance companies that want to maintain lower levels of firm risk might take CEO's willingness to tie their personal wealth to performance of the firm into account when selecting a CEO because they recognize that these CEOs tend to reduce the riskiness of firm in order to protect their own portfolio.

Thus, we conduct a further robustness check with the two-stage least squares (2SLS) method to determine whether our regression results are robust to endogeneity. In the 2SLS model, we treat CEO overconfidence variables as endogenous variables for which we use instrumental variables that are correlated with the two proxies for CEO overconfidence, but are uncorrelated with the error term of the regression. The lagged or historically averaged measures of firm characteristics, industry growth, and general economic growth are commonly used instrumental variables (Campa and Kedia, 2002). We also use age of the CEO as an instrument of CEO overconfidence. Therefore, we initially employ 3-year average of firm size, 3-year average of industry premium growth rate, 3-year average of real GDP growth, CEO age, and lagged values of the firm characteristics included in our regressions as the potential instrumental variables for

the two CEO overconfidence variables. Our test results show that only 3-year average firm size and 3-year average of real GDP growth fulfill the two requirements.[29]

The estimated results using 2SLS are presented in Table 8. The coefficients on CEO overconfidence measures are positively significant in reinsurance demand, and negatively significant in total risk, underwriting risk, and leverage risk for net stock purchase-based measure. For the option holdings-based measure, we find the similar results, except for leverage risk. Thus, we conclude that our findings are robust to the endogeneity issue. Although not reported here[30], the results of the effect of SOX and the financial crisis on the relation between the two proxies for CEO overconfidence and insurer's risk taking confirm our previous findings.

Second, we examine the robustness of our results to an alternative risk-taking measure by using 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 (Boyd and Runkle, 1993). Z-score is calculated by dividing the sum of ROA and capital to asset ratio by standard deviation of ROA. Untabulated results show that both CEO overconfidence measures are significantly positively related to the Z-score, implying that overconfident CEOs tend to achieve higher financial stability, consistent with our previous findings that CEO who hold their options long and buy more of their firm's stock tend to take lower risk.

Third, Andreou et al. (2016) point out that changes in the shares owned by CEOs may be driven not only by stocks that CEOs purchase from the open market but also stocks that CEOs retain after exercising their vested options. Ofek and Yermack (2000) show that managers tend

[29] To check whether our instrumental variables satisfy the two conditions mentioned above, we use an *F*-test of the joint significance of the excluded instruments and Hansen's *J* test of over-identifying restrictions to examine whether the instruments are valid, and are uncorrelated with the error term, respectively. We find that the *F*-test of excluded instruments rejects the null hypothesis of weak instruments at the 1 percent level (P-value is 0.0001), and Hansen's J-test does not reject the null hypothesis that the instruments are uncorrelated with the error term (P-value is 0.2571), indicating that our two instrumental variables (3-year average firm size and 3-year average of real GDP growth) are valid.

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

to sell almost all stocks acquired through the exercise of vested options. Thus, if we do not exclude the changes in the percentage of stock due to the exercise of vested stock options, we may incorrectly attribute increase in CEO stock holdings due to the exercise of vested stock options to overconfidence. We address this concern by using an alternative net stock purchased-based measure based on CEO's open market stock purchases. Following Andreou et al. (2016), we redefine the net buyer measure after subtracting the number of shares acquired on option exercise (ExecuComp item: OPT_EXER_NUM) from shares owned excluding options (ExecuComp item: SHROWN_EXCL_OPTS). We find that our main results are robust to using the alternative net buyer measure of overconfidence (untabulated).

Fourth, Kim and Lu (2011) find that large stock ownership can discourage CEOs who are highly exposed to the idiosyncratic risk of their company from taking more risk. It is possible that CEOs with late option exercise and additional stock purchases could also have a high level of stock ownership, and thus the negative relationship between two CEO overconfidence measures and risk-taking may be due to CEO's large holdings of equity that lead them to reduce riskiness of their firms in an effort to protect their personal portfolios.

To disentangle wealth effects of CEO ownership from the effect of CEO's high exposure to firm-specific risk on insurer's risk-taking, we rerun the regressions in Table 3 by adding CEO equity ownership (measured by the proportion of the number of shares owned by CEO) as an additional control variable. The results are reported in Table 9. The coefficients of CEO ownership are positively significant in reinsurance demand, and negatively significant in total risk, underwriting risk, investment and leverage risk in both specifications of CEO overconfidence measures. The results are consistent with the "playing it safe" hypothesis (Gormley and Matsa, 2016) that managers whose personal wealth is closely linked to their firm

tend to take on less risk or undertake value-destroying actions that reduce the firm's risk. More importantly, we find that the negative relationship between CEO overconfidence and firm's risk-taking is still present after controlling for CEO equity ownership. Thus, we conclude that our main findings are robust to the wealth effects from CEO's stock holdings.

Fifth, 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; Ma and Wang, 2014). 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 control variables in the regressions in order to control for the impact of CEO compensation on insurer's risk-taking. All variable are scaled by total compensation. Untabulated results report that our main results remain consistent and robust when we control for CEO compensation variables. As a 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, we find that our results remain robust (untabulated).

5. Conclusion

Despite their prominence, alternative explanations have been suggested for the two conventional CEO overconfidence measures. This study revisits this issue by examining the impact of CEOs who maintain high personal exposure to company-specific risk on insurer's risk-taking behavior and firm performance in U.S. publicly traded property-liability insurance companies. We focus on the insurance industry because of the availability of more accurate measurement of risk-taking, such as insurer's reinsurance demand that can be totally controlled by CEOs.

Interestingly, we find that the two CEO overconfidence measures are positively related to insurer's reinsurance demand and negatively associated with insurer's risk-taking behavior, including total risk, underwriting risk, and leverage risk. We also find a positive relationship between the two CEO overconfidence measures and firm performance, indicating that overconfident CEOs may lead to greater firm profitability and higher stock returns. The evidence also shows that firms with overconfident CEOs earn positive abnormal returns and purchase more reinsurance compared to the industry average.

Taken together, our overall results suggest that overconfident CEOs try to control the overall risk of the firm through increased use of reinsurance and lower underwriting and leverage risk-taking, achieving higher firm performance. One alternative explanation for the results is that it is not CEO overconfidence but the private information or the intention to control the company's risk that drives our results. Our results are robust to the endogeneity issue, using the Z-score as a proxy for the insurer insolvency risk, using the alternative net stock purchase-based measure, adding CEO ownership, executive compensation and A.M. Best ratings as control variables.

Appendix

Prior literature in non-financial industries has provided evidence that CEO overconfidence is positively related to corporate risk taking. Thus, we replicate previous studies using market-based risk-taking measures. Following Banerjee et al. (2015), we employ two market-based risk-taking measures, such as systematic risk (i.e., exposure to market risk) and unsystematic risk (i.e., firm-specific risk). To measure systematic risk, we estimate the annual beta (β) by using daily stock return data for each firm. We employ the following a single-index market model to estimate the beta for each insurer *i* in each year t.

$$R_{it} = \alpha + \beta R_{mt} + \mu_{it}$$

where R_{it} is the daily return on the insurer's stock, R_{mt} is the daily return on the CRSP equal weighted index, and μ_{it} is the error term.

In addition, we compute the mean squared error (MSE) from the estimation of the single index model over the year to measure unsystematic risk. We take a natural logarithm of MSE to mitigate concerns about skewness. Our results show that there are no statistically significant relationships between two CEO overconfidence measures and market-based risk-taking measures (not tabulated). The results are different from those for non-financial firms and banks. One possible explanation is that the reinsurance decision is one of the risk-taking mechanisms in the insurance industry, while there is no reinsurance in non-financial and banking industry. For example, insurance companies optimally combine the use of capital and reinsurance to manage their risk (Yan and Hong, 2014).

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Appendix 1: Variable Definitions

Variable	Definition
CEO Overconfidence	
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 more than 67 percent in the money
Net Buyer	Dummy is 1 if years of change in shares owned > 0 is greater than years of change in shares owned < 0, 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 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 plus taxes and interest expenses to net admitted assets
ROE	Ratio of net income plus taxes and interest expenses to the insurer's equity capital
Stock return	Buy-and-hold return from compounding monthly stock returns over the fiscal year

Appendix 1. (Continued)

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 direct premium written across product lines
GeoHHI	Sum of the squares of the percentages of direct premium written across 50 states
Longtail	Premiums of long-tail lines divided by total net written premiums
Weak	Dummy is 1 if insurer has more than four unusual Insurance Regulatory Information System (IRIS) ratios, and zero otherwise
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	Development in estimated losses and loss expenses incurred two years before the current year and prior year scaled by policyholders' surplus

Table 1. Descriptive Statistics

Variables	N	Mean	Median	Std. Dev	Min	Max
CEO Overconfidence						
OC67	233	0.588	1.000	0.493	0.000	1.000
Net Buyer	235	0.719	1.000	0.450	0.000	1.000
Risk Taking						
Reinsurance Demand	235	0.206	0.108	0.234	0.000	1.000
Total Risk	235	0.033	0.022	0.062	0.003	0.575
Underwritng Risk	235	0.063	0.052	0.043	0.008	0.261
Investment Risk	235	0.022	0.008	0.084	0.001	0.752
Leverage Risk	235	0.662	0.685	0.126	0.049	0.827
Performance						
Tobin's Q	232	1.066	1.073	0.188	0.335	2.149
ROA	235	0.038	0.037	0.028	-0.064	0.126
ROE	235	0.117	0.113	0.091	-0.257	0.541
Stock Return	232	0.118	0.093	0.266	-0.568	1.261
Corporate Governance						
Bsize	235	10.617	11.000	2.260	5.000	17.000
Insider	235	0.165	0.133	0.083	0.063	0.445
Busy	235	0.268	0.000	0.443	0.000	1.000
Duality	235	0.689	1.000	0.464	0.000	1.000
Institution	229	0.726	0.737	0.162	0.326	1.000
CEO Ownership	232	0.035	0.014	0.057	0.000	0.383
Control Variables						
Size	234	20.832	20.550	1.828	12.391	24.008
ProdHHI	231	0.330	0.242	0.263	0.093	1.000
GeoHHI	230	0.195	0.070	0.271	0.038	1.000
Longtail	229	0.772	0.774	0.143	0.261	1.000
Weak	235	0.022	0.000	0.147	0.000	1.000
Tax	235	0.461	0.445	0.246	-0.504	1.059
Coastal_state	231	0.560	1.000	0.498	0.000	1.000
2year_Loss_Dev	225	-0.037	-0.044	0.133	-0.455	0.554

Table 2. Correlation Matrix

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.
1. OC67	1																								
2. Net Buyer	0.083 0.022	1																							
3. Reinsurance	0.196 0.004	0.082 0.230	1																						
4. Total Risk	-0.042 0.538	-0.205 0.002	0.260 <0.0001	1																					
5. Underwriting Risk	-0.379 <0.0001	-0.147 0.029	0.151 0.026	0.368 <0.0001	1																				
6. Investment Risk	-0.017 0.806	-0.192 0.004	0.276 <0.0001	0.577 <0.0001	0.261 <0.0001	1																			
7. Leverage Risk	-0.007 0.914	-0.048 0.480	-0.352 <0.0001	-0.019 0.782	-0.075 0.267	0.013 0.850	1																		
8. Tobins's Q	0.207 0.002	0.040 0.559	-0.163 0.017	-0.125 0.069	-0.090 0.185	-0.172 0.011	0.057 0.396	1																	
9. ROA	0.030 0.662	0.001 0.924	-0.352 <0.0001	-0.044 0.516	0.l24 0.068	-0.116 0.086	-0.076 0.263	0.298 <0.0001	1																
10. ROE	0.068 0.321	0.016 0.813	-0.387 <0.0001	-0.039 0.571	0.117 0.084	-0.104 0.126	0.200 0.003	0.343 <0.0001	0.815 <0.0001	1															
11. Return	0.191 0.015	0.025 0.750	0.015 0.848	0.014 0.859	-0.039 0.619	0.008 0.917	0.120 0.128	0.314 <0.0001	0.003 0.971	0.047 0.553	1														
12. Bsize	-0.147 0.029	0.262 <0.0001	-0.030 0.664	-0.034 0.616	-0.227 0.001	0.023 0.732	0.064 0.341	-0.045 0.511	-0.134 0.048	-0.068 0.317	-0.070 0.372	1													
13. Insider	0.138 0.040	-0.020 0.762	0.105 0.125	0.032 0.639	0.100 0.140	0.030 0.654	-0.312 <0.0001	0.113 0.094	0.107 0.115	0.054 0.424	0.058 0.465	0.301 <0.0001	1												
14. Busy	-0.196 0.003	0.091 0.175	-0.316 <0.0001	-0.070 0.298	-0.062 0.362	-0.107 0.113	0.125 0.067	0.273 <0.0001	0.136 0.045	0.170 0.012	0.059 0.457	0.061 0.366	-0.311 <0.0001	1											
15.Duality	-0.160 0.017	-0.149 0.027	-0.462 <0.0001	-0.182 0.007	-0.186 0.006	-0.161 0.017	0.401 <0.0001	-0.126 0.069	0.051 0.451	0.143 0.035	0.051 0.518	-0.038 0.578	-0.142 0.034	0.119 0.077	1										
16. Institution	0.094 0.190	0.133 0.063	0.002 0.977	0.073 0.310	0.165 0.021	-0.121 0.092	0.333 <0.0001	-0.013 0.856	0.159 0.028	0.190 0.008	-0.022 0.794	-0.238 0.001	-0.125 0.082	0.072 0.315	0.117 0.102	1									
17. CEO Ownership	0.177 0.008	0.262 <0.0001	0.099 0.146	-0.047 0.488	-0.104 0.012	-0.006 0.931	-0.019 0.008	0.112 0.073	0.101 0.133	0.098 0.147	0.155 0.048	-0.139 0.039	0.299 <0.0001	-0.177 0.008	0.175 0.010	-0.165 0.020	1								
18. Size	-0.089 0.190	0.233 0.001	-0.491 <0.0001	-0.113 0.097	-0.311 <0.0001	-0.128 0.060	0.407 <0.0001	0.188 0.006	0.174 0.010	0.264 <0.0001	0.044 0.577	0.364 <0.0001	-0.393 <0.0001	0.472 <0.0001	0.346 <0.0001	0.009 0.904	0.126 0.062	1							
19. ProdHHI	-0.172 0.012	-0.087 0.206	-0.321 <0.0001	0.029 0.669	0.301 <0.0001	-0.013 0.849	0.040 0.558	0.185 0.007	0.196 0.004	0.258 0.000	-0.066 0.411	-0.361 <0.0001	0.196 0.004	-0.024 0.725	-0.043 0.535	0.109 0.135	-0.049 0.473	-0.268 <0.0001	1						
20. GeoHHI	-0.156 0.022	-0.307 <0.0001	0.031 0.654	0.017 0.808	0.156 0.022	-0.039 0.575	-0.376 <0.0001	-0.052 0.451	0.095 0.167	0.053 0.442	-0.010 0.903	-0.547 <0.0001	0.296 <0.0001	0.130 0.057	-0.010 0.885	-0.236 0.001	-0.065 0.344	-0.395 <0.0001	0.300 <0.0001	1					
21. Longtail	-0.347 <0.0001	-0.238 0.001	-0.205 0.003	-0.028 0.685	0.180 0.008	-0.003 0.968	0.440 <0.0001	-0.096 0.163	0.020 0.771	0.158 0.020	-0.035 0.664	-0.066 0.334	0.070 0.308	-0.125 0.066	0.172 0.011	0.165 0.023	0.224 0.000	-0.047 0.497	0.456 <0.0001	-0.065 0.348	1				
22. Weak	-0.129 0.057	-0.108 0.103	0.003 0.962	0.013 0.846	0.169 0.012	0.026 0.705	0.078 0.248	-0.070 0.301	-0.069 0.312	-0.030 0.658	-0.007 0.932	-0.065 0.337	-0.014 0.838	-0.053 0.429	0.062 0.354	-0.069 0.338	0.095 0.158	-0.038 0.578	0.096 0.161	-0.003 0.964	0.159 0.020	1			
23. Tax	-0.149 0.027	0.050 0.460	0.005 0.923	-0.103 0.127	0.030 0.652	-0.087 0.195	-0.289 <0.0001	-0.094 0.167	0.285 <0.0001	0.201 0.003	0.022 0.778	0.115 0.088	-0.032 0.640	0.174 0.009	-0.024 0.718	-0.342 <0.0001	0.002 0.473	0.129 0.057	-0.122 0.075	0.037 0.590	-0.025 0.713	0.144 0.032	1		
24. Coast_state	0.164 0.016	0.058 0.390	0.268 <0.0001	0.042 0.541	-0.213 0.002	0.086 0.204	0.109 0.105	-0.098 0.152	-0.151 0.027	-0.072 0.290	0.060 0.449	-0.129 0.057	0.349 <0.0001	-0.078 0.253	0.010 0.887	0.202 0.005	-0.069 0.315	-0.226 0.001	-0.088 0.197	0.175 0.010	0.249 0.002	-0.089 0.190	-0.020 0.765	1	
25. 2year_loss_Dev	0.014 0.844	-0.182 0.008	0.206 0.003	0.086 0.214	0.172 0.012	0.068 0.321	0.170 0.013	0.051 0.460	-0.234 0.001	-0.197 0.004	0.176 0.028	-0.058 0.411	-0.050 0.466	-0.108 0.117	0.023 0.734	-0.095 0.190	0.160 0.019	0.040 0.564	-0.457 <0.0001	-0.081 0.242	-0.027 0.699	0.295 <0.0001	0.039 0.574	-0.057 0.409	1

The table presents the Pearson correlation matrix for all variables. See Table 1 for variable definitions.

Table 3. Regression Results of Risk Taking on CEO Overconfidence Measures

Dependent Variable:	Reinsurance Demand		Total Risk		Underwriting Risk		Investment Risk		Leverage Risk	
	OC67	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*
	(1)	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*
Intercept	3.561***	3.612***	0.042**	0.012***	0.081**	0.082**	-0.312	-0.208**	-1.595***	-1.704***
	(0.000)	(0.000)	(0.039)	(0.000)	(0.046)	(0.042)	(0.241)	(0.038)	(0.000)	(0.000)
OC67(1)	0.053***		-0.048***		-0.020**		-0.024		-0.032***	
	(0.000)		(0.007)		(0.041)		(0.298)		(0.001)	
Net Buyer(2)		0.045**		-0.034***		-0.049**		-0.008		-0.033***
		(0.034)		(0.000)		(0.025)		(0.126)		(0.000)
Bsize	-0.001	-0.002	-0.005	-0.002***	-0.001	-0.006	-0.006	-0.001	-0.002	-0.004***
	(0.853)	(0.674)	(0.115)	(0.000)	(0.543)	(0.106)	(0.267)	(0.150)	(0.759)	(0.005)
Insider	-0.001	-0.001	0.001	0.001	0.002	-0.003*	0.005***	0.002	-0.001	-0.005
	(0.231)	(0.392)	(0.618)	(0.764)	(0.886)	(0.084)	(0.003)	(0.503)	(0.543)	(0.721)
Busy	-0.011	-0.013	-0.012	-0.004	-0.014	-0.005	-0.040	-0.002	-0.009	-0.043**
	(0.707)	(0.642)	(0.188)	(0.184)	(0.163)	(0.802)	(0.122)	(0.675)	(0.796)	(0.025)
Duality	-0.009	-0.017	-0.001	-0.002	-0.003	-0.019	0.010	0.001	0.022	0.005
	(0.625)	(0.367)	(0.868)	(0.505)	(0.733)	(0.198)	(0.279)	(0.244)	(0.410)	(0.175)
Institution	0.056	0.069	-0.007	-0.002	0.065**	0.152***	-0.009	-0.014	-0.061	-0.015
	(0.193)	(0.199)	(0.485)	(0.816)	(0.027)	(0.003)	(0.615)	(0.264)	(0.536)	(0.761)
Size	-0.184***	-0.165***	0.003*	0.003***	0.001	0.006	0.013	0.004	0.005*	0.020***
	(0.000)	(0.000)	(0.084)	(0.002)	(0.920)	(0.206)	(0.260)	(0.447)	(0.088)	(0.009)
Reinsurance			0.004	0.002	0.018	0.133**	0.001	0.003	0.058	0.121**
			(0.241)	(0.772)	(0.267)	(0.027)	(0.154)	(0.764)	(0.623)	(0.033)
ProdHHI	0.213***	0.231***	0.007**	0.034***	0.016***	0.056***	0.043	0.002	0.067	0.013
	(0.000)	(0.001)	(0.012)	(0.000)	(0.009)	(0.002)	(0.475)	(0.108)	(0.459)	(0.775)
GeoHHI	0.455***	0.426***	-0.020**	-0.002	-0.025***	-0.039***	-0.040	-0.099***	-0.032**	-0.067***
	(0.003)	(0.001)	(0.010)	(0.735)	(0.000)	(0.000)	(0.598)	(0.000)	(0.031)	(0.001)
Longtail	-0.615***	-0.593***	-0.032	-0.034***	-0.0533	-0.065	-0.079	-0.037	-0.070	-0.038
	(0.000)	(0.000)	(0.655)	(0.000)	(0.194)	(0.537)	(0.148)	(0.159)	(0.608)	(0.702)
Weak	0.042**	0.045	0.012**	0.009*	0.036*	0.005	-0.065	0.012**	0.065*	0.046**
	(0.032)	(0.129)	(0.039)	(0.079)	(0.081)	(0.791)	(0.170)	(0.017)	(0.064)	(0.015)
Tax	-0.002	-0.007								
	(0.719)	(0.795)								
Coastal_state	0.003	0.006***								
	(0.226)	(0.002)								
2year_Loss_Dev	0.203***	0.187***								
	(0.000)	(0.001)								
Observations	226	228	233	235	233	235	233	235	233	235
Adjusted R-square	0.636	0.652	0.494	0.486	0.668	0.473	0.491	0.501	0.750	0.792

Note: The table reports the results of two-way fixed effects regressions. See Table 1 for variable definitions. Standard errors are adjusted for heteroskedasticity and within-panel serial correlation. P-values are reported in parentheses. ***, ** and * represent statistical significance at 0.01, 0.05, and 0.10 level, respectively.

Table 4. Regression Results of Effect of SOX on CEO Overconfidence Measures and Risk Taking

Dependent Variable:	Reinsurance Demand		Total Risk		Underwriting Risk		Investment Risk		Leverage Risk	
	OC67	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*
	(1)	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*
Intercept	3.709***	3.880***	0.035**	0.013**	0.068***	0.076**	-0.398	-0.223***	-1.761***	-1.362***
	(0.000)	(0.000)	(0.026)	(0.025)	(0.000)	(0.045)	(0.177)	(0.008)	(0.000)	(0.000)
OC67(1)	0.048**		-0.050***		-0.017***		-0.031		-0.036***	
	(0.026)		(0.004)		(0.000)		(0.217)		(0.000)	
SOX (1)	0.039		-0.048**		-0.009		0.031*		-0.012	
	(0.157)		(0.028)		(0.195)		(0.058)		(0.699)	
SOX×OC67(1)	0.048**		-0.031**		-0.020**		0.015**		-0.054**	
	(0.022)		(0.018)		(0.040)		(0.011)		(0.025)	
Net Buyer(2)		0.054**		-0.031***		-0.052**		-0.007		-0.032***
		(0.019)		(0.000)		(0.020)		(0.179)		(0.000)
SOX (2)		0.048		-0.007		-0.005		0.028		-0.006
		(0.118)		(0.178)		(0.165)		(0.121)		(0.117)
SOX ×Net Buyer(2)		0.029		-0.012		-0.048***		0.014***		-0.098***
		(0.318)		(0.109)		(0.002)		(0.010)		(0.000)
Bsize	-0.010	-0.007	-0.006	-0.002	-0.002	-0.006	-0.004	-0.002	-0.003	-0.003***
	(0.133)	(0.212)	(0.132)	(0.173)	(0.515)	(0.144)	(0.154)	(0.135)	(0.610)	(0.005)
Insider	-0.003	-0.002	0.004	0.002	0.001	-0.003*	0.005	0.001	-0.002	-0.006
	(0.471)	(0.235)	(0.183)	(0.617)	(0.801)	(0.064)	(0.109)	(0.739)	(0.241)	(0.259)
Busy	-0.026	-0.019	-0.013	-0.005	-0.016	-0.065**	-0.038	-0.003	-0.010	-0.042**
	(0.461)	(0.312)	(0.290)	(0.385)	(0.160)	(0.030)	(0.125)	(0.155)	(0.221)	(0.021)
Duality	-0.013**	-0.016	-0.009	-0.001	-0.004	-0.020	0.010	0.004	0.023	0.004
	(0.047)	(0.428)	(0.199)	(0.520)	(0.618)	(0.163)	(0.201)	(0.184)	(0.369)	(0.169)
Institution	0.053	0.089	-0.010	-0.002	0.079**	0.137***	-0.006	-0.017	-0.058	-0.014
	(0.179)	(0.216)	(0.207)	(0.342)	(0.023)	(0.007)	(0.195)	(0.120)	(0.145)	(0.581)
Size	-0.190***	-0.175***	0.004**	0.003**	0.010	0.003	0.013**	0.004	0.007***	0.032***
	(0.000)	(0.000)	(0.029)	(0.012)	(0.182)	(0.141)	(0.012)	(0.306)	(0.000)	(0.000)
Reinsurance			0.005	0.003	0.016	0.134**	0.001	0.006**	0.074	0.117***
			(0.208)	(0.147)	(0.214)	(0.023)	(0.150)	(0.035)	(0.282)	(0.000)
ProdHHI	0.269***	0.257***	0.010***	0.040**	0.015**	0.089***	0.046*	0.002	0.067	0.015
	(0.000)	(0.003)	(0.000)	(0.021)	(0.021)	(0.002)	(0.069)	(0.125)	(0.184)	(0.108)
GeoHHI	0.498***	0.379***	-0.021**	-0.003**	-0.014***	-0.024***	-0.034***	-0.090***	-0.043***	-0.059***
	(0.000)	(0.005)	(0.045)	(0.034)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Longtail	-0.665***	-0.563***	-0.032	-0.041**	-0.050	-0.062	-0.080	-0.034	-0.062	-0.038
	(0.000)	(0.000)	(0.124)	(0.049)	(0.227)	(0.556)	(0.110)	(0.141)	(0.215)	(0.688)
Weak	0.050**	0.046	0.016***	0.010*	0.037*	0.006	-0.067	0.0178**	0.068	0.049***
	(0.028)	(0.132)	(0.002)	(0.086)	(0.076)	(0.228)	(0.105)	(0.014)	(0.261)	(0.007)
Tax	-0.006	-0.004								
	(0.302)	(0.190)								
Coastal_state	0.003	0.005								
	(0.238)	(0.143)								
2year_Loss_Dev	0.286***	0.186***								
	(0.001)	(0.002)								
Observations	226	228	233	235	233	235	233	235	233	235
Adjusted R-square	0.671	0.635	0.490	0.474	0.669	0.696	0.501	0.477	0.672	0.605

Note: The table reports the results of two-way fixed effects regressions. See Table 1 for variable definitions. Standard errors are adjusted for heteroskedasticity and within-panel serial correlation. P-values are reported in parentheses. ***, ** and * represent statistical significance at 0.01, 0.05, and 0.10 level, respectively.

Table 5. Regression Results of Financial Crisis on CEO Overconfidence Measures and Risk Taking

Dependent Variable:	**Δ Reinsurance Demand**		**Δ Total Risk**		**Δ Underwriting Risk**		**Δ Investment Risk**		**Δ Leverage Risk**	
	OC67	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*
	(1)	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*
Intercept	3.174***	2.406***	-0.132	-0.381	0.398	0.735	0.207	0.043	3.002**	2.751***
	(0.000)	(0.000)	(0.219)	(0.161)	(0.422)	(0.171)	(0.175)	(0.528)	(0.048)	(0.008)
OC67(1)	0.134		-0.019***		-0.025		-0.026**		-0.233**	
	(0.115)		(0.004)		(0.409)		(0.018)		(0.013)	
Net Buyer(2)		0.272		-0.051**		-0.044		-0.003		-0.407***
		(0.119)		(0.011)		(0.365)		(0.715)		(0.000)
Bsize	-0.016**	-0.012	-0.004	-0.016	-0.010	-0.030	-0.003	-0.005	-0.027	-0.013
	(0.013)	(0.207)	(0.417)	(0.281)	(0.730)	(0.155)	(0.285)	(0.304)	(0.341)	(0.276)
Insider	-0.007	-0.004	0.009	0.006	0.006	0.004*	0.008	0.004	-0.004	-0.011
	(0.244)	(0.306)	(0.231)	(0.541)	(0.645)	(0.083)	(0.258)	(0.424)	(0.584)	(0.722)
Busy	-0.019	-0.007	-0.004	-0.007	-0.047	-0.043	-0.013	-0.010	-0.014	-0.135***
	(0.292)	(0.390)	(0.657)	(0.255)	(0.271)	(0.344)	(0.357)	(0.178)	(0.301)	(0.003)
Duality	-0.047	-0.022	-0.005	-0.019	-0.042	-0.013***	0.009	0.007	0.108	0.362***
	(0.401)	(0.598)	(0.572)	(0.459)	(0.221)	(0.000)	(0.489)	(0.187)	(0.318)	(0.000)
Institution	0.044	0.158	-0.041	-0.016	0.262**	0.019	-0.015***	-0.012***	-0.067***	-0.083
	(0.178)	(0.280)	(0.126)	(0.187)	(0.031)	(0.136)	(0.000)	(0.000)	(0.000)	(0.505)
Size	-0.135***	-0.132***	0.004***	0.002***	0.005	0.028	0.006	0.003	0.084**	0.017
	(0.000)	(0.000)	(0.000)	(0.000)	(0.198)	(0.147)	(0.174)	(0.172)	(0.048)	(0.158)
Reinsurance			0.005	0.020	0.036	0.127	0.008	0.011	0.139	0.147**
			(0.119)	(0.385)	(0.211)	(0.158)	(0.176)	(0.305)	(0.191)	(0.048)
ProdHHI	0.463***	0.395**	0.027*	0.008***	0.031***	0.045**	0.007	0.019	0.305	0.454*
	(0.004)	(0.000)	(0.097)	(0.009)	(0.000)	(0.032)	(0.121)	(0.154)	(0.198)	(0.098)
GeoHHI	0.611**	0.710***	-0.050***	-0.028	-0.021	-0.083***	-0.022***	-0.031	-0.131	-0.123
	(0.018)	(0.000)	(0.007)	(0.759)	(0.102)	(0.000)	(0.000)	(0.169)	(0.222)	(0.260)
Longtail	-0.159***	-0.290**	-0.093***	-0.015*	-0.107	-0.081	-0.038	-0.045**	-0.330	-0.437
	(0.000)	(0.011)	(0.003)	(0.084)	(0.464)	(0.549)	(0.406)	(0.040)	(0.463)	(0.547)
Weak	0.047	0.036	0.007***	0.005	0.026	0.028**	0.036**	0.012	0.025**	0.045*
	(0.137)	(0.206)	(0.000)	(0.178)	(0.732)	(0.016)	(0.015)	(0.798)	(0.029)	(0.060)
Tax	-0.154	-0.156								
	(0.168)	(0.290)								
Coastal_state	0.012**	0.025**								
	(0.027)	(0.021)								
2year_Loss_Dev	0.392***	0.260***								
	(0.000)	(0.000)								
Observations	24	26	24	26	24	26	24	26	24	26
Adjusted R-square	0.727	0.789	0.643	0.641	0.503	0.495	0.597	0.587	0.771	0.724

Note: The table reports the results of cross-sectional regressions. See Table 1 for variable definitions. Standard errors are adjusted for heteroskedasticity and within-panel serial correlation. P-values 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 CEO Overconfidence Measures

Dependent Variable:	**Tobin's Q**		**ROA**		**ROE**		**Stock Return**	
	OC67	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*
	(1)	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*
Intercept	0.353**	0.271***	0.059	0.110	-0.014	-0.273**	-1.124	-1.963**
	(0.000)	(0.000)	(0.305)	(0.211)	(0.714)	(0.045)	(0.139)	(0.011)
OC67(1)	0.071**		0.014**		0.035**		0.165**	
	(0.013)		(0.042)		(0.043)		(0.038)	
Net Buyer(2)		0.127***		0.020**		0.072**		0.292***
		(0.000)		(0.047)		(0.040)		(0.001)
Bsize	0.003	0.004	0.002	0.001	0.004	0.002	-0.018**	-0.026***
	(0.198)	(0218)	(0.920)	(0.154)	(0.121)	(0.227)	(0.015)	(0.000)
Insider	-0.008**	-0.004	0.003	0.001	0.001*	0.008	-0.002	0.003
	(0.025)	(0.125)	(0.184)	(0.154)	(0.097)	(0.617)	(0.800)	(0.160)
Busy	0.015	0.126***	0.004	0.016*	0.034	0.032	0.060***	0.029*
	(0.793)	(0.000)	(0.294)	(0.095)	(0.142)	(0.168)	(0.000)	(0.085)
Duality	0.016	0.015	0.003	0.004	0.015	0.027	0.021*	0.038***
	(0.695)	(0.199)	(0.764)	(0.187)	(0.391)	(0.240)	(0.094)	(0.002)
Institution	0.067	0.157**	0.019	0.019	0.017	0.108	0.043**	0.370***
	(0.634)	(0.035)	(0.247)	(0.169)	(0.779)	(0.184)	(0.023)	(0.002)
Size	0.020**	0.020	0.002	0.005	0.006	0.052**	0.065*	0.064**
	(0.029)	(0.245)	(0.108)	(0.535)	(0.132)	(0.039)	(0.097)	(0.046)
Reinsurance	-0.162	-0.118	-0.010**	-0.064**	-0.037***	-0.139	-0.191	-0.435
	(0.362)	(0.178)	(0.024)	(0.023)	(0.000)	(0.148)	(0.974)	(0.162)
ProdHHI	0.054	0.211***	0.014	0.068***	0.030**	0.307***	0.196***	0.318
	(0.103)	(0.003)	(0.235)	(0.003)	(0.047)	(0.000)	(0.004)	(0.160)
GeoHHI	0.107	0.024	0.005	0.077**	0.028	0.273**	0.438*	0.115***
	(0.209)	(0.852)	(0.198)	(0.013)	(0.145)	(0.041)	(0.071)	(0.000)
Longtail	-0.166	-0.004	-0.013	-0.063	-0.049	-0.188	-0.177	-0.185***
	(0.428)	(0.979)	(0.426)	(0.201)	(0.567)	(0.263)	(0.787)	(0.000)
Weak	0.016	0.006	-0.037***	-0.012	-0.013***	-0.040	-0.051***	-0.065
	(0.450)	(0.106)	(0.008)	(0.223)	(0.000)	(0.218)	(0.000)	(0.104)
Observations	226	228	226	228	226	228	226	228
Adjusted R-square	0.343	0.431	0.570	0.591	0.602	0.592	0.401	0.517

Note: The table reports the results of two-way fixed effects regressions. See Table 1 for variable definitions. Standard errors are adjusted for heteroskedasticity and within-panel serial correlation. P-values are reported in parentheses. ***, ** and * represent statistical significance at 0.01, 0.05, and 0.10 level, respectively.

Table 7. Comparison of Returns and Reinsurance Demand between Firms with Overconfident CEOs and Industry Average

Panel A:	**Return**		**Reinsurance Demand**
	Mean		Mean
CEOs (OC 67)	0.228	CEOs (OC 67)	0.249
Industry Average	0.141	Industry Average	0.202
Difference	0.087**	Difference	0.047**
(t-statistic)	(2.21)	(t-statistic)	(2.13)
CEOs (Net Buyer)	0.172	CEOs (Net Buyer)	0.231
Industry Average	0.132	Industry Average	0.198
Difference	0.040**	Difference	0.033**
(t-statistic)	(2.16)	(t-statistic)	(2.11)
Panel B:	**Return**		**Reinsurance Demand**
	Mean		Mean
CEOs (OC75)	0.254	CEOs (OC75)	0.277
Industry Average	0.135	Industry Average	0.205
Difference	0.119**	Difference	0.072***
(t-statistic)	(2.42)	(t-statistic)	(2.73)
CEOs (Net Buyer 80%)	0.210	CEOs (Net Buyer 80%)	0.263
Industry Average	0.128	Industry Average	0.206
Difference	0.082**	Difference	0.057**
(t-statistic)	(2.20)	(t-statistic)	(2.44)

***, ** and * represent statistical significance at 0.01, 0.05, and 0.10 level, respectively.

Table 8. 2SLS Regression Results of Risk Taking on CEO Overconfidence Measures

Dependent Variable:	Reinsurance Demand		Total Risk		Underwriting Risk		Investment Risk		Leverage Risk	
	OC67	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*
	(1)	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*
Intercept	0.598***	2.060***	0.029***	0.037**	0.101***	0.085**	0.043***	0.044***	-0.762***	-0.223***
	(0.000)	(0.000)	(0.003)	(0.008)	(0.007)	(0.025)	(0.005)	(0.000)	(0.000)	(0.003)
OC67(1)	0.151***		-0.112**		-0.031***		-0.111		-0.005	
	(0.001)		(0.033)		(0.000)		(0.267)		(0.742)	
Net Buyer(2)		0.153**		-0.066**		-0.040**		-0.051		-0.031**
		(0.036)		(0.031)		(0.024)		(0.292)		(0.029)
Bsize	-0.010***	-0.010	-0.001	-0.003	-0.001	-0.005	-0.005	-0.002	-0.001	-0.011
	(0.006)	(0.155)	(0.886)	(0.189)	(0.631)	(0.210)	(0.289)	(0.195)	(0.703)	(0.227)
Insider	-0.016	-0.006***	0.001	0.001***	0.001	-0.001	0.003	0.083	-0.001	-0.002
	(0.304)	(0.000)	(0.184)	(0.000)	(0.110)	(0.267)	(0.205)	(0.109)	(0.784)	(0.454)
Busy	-0.114	-0.029	-0.010	-0.005	-0.002	-0.018	-0.060**	-0.009**	-0.019	-0.016**
	(0.650)	(0.407)	(0.405)	(0.433)	(0.240)	(0.441)	(0.046)	(0.029)	(0.228)	(0.047)
Duality	-0.098	-0.056	-0.017	-0.018	-0.002	-0.010	0.028	0.020	0.020**	0.015
	(0.660)	(0.114)	(0.421)	(0.129)	(0.176)	(0.706)	(0.478)	(0.143)	(0.044)	(0.337)
Institution	0.062	0.113	-0.141***	-0.023	0.030**	0.281***	-0.056	-0.077***	-0.073**	-0.123
	(0.265)	(0.254)	(0.007)	(0.425)	(0.037)	(0.000)	(0.437)	(0.003)	(0.025)	(0.159)
Size	-0.033***	-0.099	0.035	0.041***	0.001	0.002	0.028	0.033	0.003	0.048**
	(0.000)	(0.196)	(0.199)	(0.043)	(0.505)	(0.720)	(0.195)	(0.207)	(0.630)	(0.037)
Reinsurance			0.052	0.058	0.014	0.215***	0.054	0.030	0.011	0.108
			(0.210)	(0.142)	(0.281)	(0.000)	(0.276)	(0.289)	(0.660)	(0.167)
ProdHHI	0.690	0.247***	0.073***	0.037***	0.027	0.172	0.107	0.034***	0.015	0.047
	(0.158)	(0.000)	(0.000)	(0.002)	(0200)	(0.781)	(0.116)	(0.000)	(0.122)	(0.274)
GeoHHI	0.353***	0.189**	-0.069**	-0.031	-0.001**	-0.363***	-0.068	-0.022	-0.155	-0.099***
	(0.000)	(0.050)	(0.012)	(0.251)	(0.012)	(0.000)	(0.265)	(0.217)	(0.745)	(0.004)
Longtail	-0.234	-0.007	-0.100	-0.109***	-0.091**	-0.065	-0.042	-0.038	-0.067	-0.003
	(0.358)	(0.186)	(0.154)	(0.005)	(0.037)	(0.620)	(0.657)	(0.887)	(0.253)	(0.787)
Weak	0.152	0.053	0.034	0.006	0.019	0.048**	-0.004	-0.013	0.020	0.018
	(0.655)	(0.126)	(0.118)	(0.106)	(0.135)	(0.039)	(0.487)	(0.178)	(0.304)	(0.471)
Tax	-0.416	-0.038								
	(0.316)	(0.424)								
Coastal_state	0.0208	0.048**								
	(0.507)	(0.025)								
2year_Loss_Dev	0.451***	0.098**								
	(0.000)	(0.039)								
Observations	226	228	233	235	233	235	233	235	233	235
Adjusted R-square	0.432	0.549	0.491	0.478	0.563	0.493	0.482	0.532	0.487	0.449

Note: The table reports the results of 2SLS regressions. See Table 1 for variable definitions. Standard errors are adjusted for heteroskedasticity and within-panel serial correlation. P-values are reported in parentheses. ***, ** and * represent statistical significance at 0.01, 0.05, and 0.10 level, respectively.

Table 9. Regression Results of Risk Taking on CEO Overconfidence Measures (with CEO equity ownership)

Dependent Variable:	**Reinsurance Demand**		**Total Risk**		**Underwriting Risk**		**Investment Risk**		**Leverage Risk**	
	OC67	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*	*OC67*	*Net Buyer*
	(1)	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*	*(1)*	*(2)*
Intercept	3.155*** (0.000)	3.221*** (0.000)	0.032** (0.022)	0.015** (0.000)	0.076*** (0.000)	0.089*** (0.000)	-0.151 (0.505)	-0.363** (0.041)	-2.388*** (0.005)	-1.718*** (0.000)
OC67(1)	0.057** (0.012)		-0.045** (0.0003)		-0.031** (0.024)		-0.028 (0.450)		-0.043*** (0.002)	
Net Buyer(2)		0.0 32** (0.038)		-0.031*** (0.000)		-0.054** (0.0125)		-0.006 (0.480)		-0.037*** (0.000)
CEO Ownership	-0.004** (0.015)	-0.003*** (0.007)	-0.005*** (0.000)	-0.007*** (0.002)	-0.004** (0.029)	-0.010** (0.025)	-0.002** (0.043)	-0.009*** (0.003)	-0.015*** (0.000)	-0.012*** (0.000)
Board-related controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Firm-related controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	226	228	233	235	233	235	233	235	233	235
Adjusted R-square	0.647	0.681	0.499	0.492	0.683	0.495	0.504	0.537	0.805	0.839

Note: The table reports the results of two-way fixed effects regressions. See Table 1 for variable definitions. Standard errors are adjusted for heteroskedasticity and within-panel serial correlation. P-values are reported in parentheses. ***, ** and * represent statistical significance at 0.01, 0.05, and 0.10 level, respectively.