CEO Confidence or Overconfidence? The Impact of CEO overconfidence on Risk Taking and Firm Performance in the U.S. Property-Liability Insurance Companies

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July 15, 2015

ABSTRACT

This study investigates the impact of CEO overconfidence on insurer's risk-taking behavior and firm performance in the U.S. publicly traded property-liability insurance companies over the period 1996-2013. Insurance industry provides a good testing ground to examine the effect of CEO overconfidence on risk-taking because we can directly observe the riskiness of projects by looking at insurer's demand for reinsurance. We find that CEO overconfidence is negatively associated with insurer's risk-taking and insurers with overconfident CEOs tend to increase the usage of reinsurance to limit their risk. We also find that overconfident CEOs change their risk-taking behavior differently in accordance with the changes in the regulatory and economic environments. CEO overconfidence has a positive impact on the firm performance, implying that overconfident CEOs may benefit shareholders through higher stock returns, greater profitability, and lower risk. Our results show that overconfident CEOs do a better job managing underwriting risk, leading to higher underwriting returns and, consequently, better firm performance. The overall results seem to be more consistent with CEO confidence rather than CEO overconfidence, suggesting that CEO confidence is supported by CEO's own actions, such as low risk-taking, high reinsurance demand, and achievement of superior firm performance.

JEL Classification: G22, G30, G32

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

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1. Introduction

This paper examines the relation between CEO overconfidence, risk-taking and performance of U.S. property-liability insurance companies. A firm's risk-taking behavior has aroused considerable interests to academics and policy makers alike because it concerns the financial interests of various corporate stakeholders (Zou et al., 2012). Especially, managerial risk-taking has important implications for firm performance and survival since it is fundamental to corporate decision-making (Boubakri et al., 2013). Financial scandals resulting from accounting frauds and fraudulent earnings management in 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 because excessive risk-taking may lead to high likelihood of insolvency. In particular, risk-taking behavior is a crucial issue in the property-liability insurance industry because of a substantial loss variability caused by the environmental challenges, such as major natural disasters, more intense competition, and increasing regulatory requirement (Ho et al. 2013). Leverty and Grace (2012) state that property-liability insurers are in the business of taking risk and financial distress resulting from excessive risk-taking is relatively frequent and severe. There have been substantial studies to explore important factors that may affect insurer's risk-taking behavior in the insurance literature[1].

In recent years, a substantial body of literature on managerial overconfidence has received much attention in an effort to understand important patterns of corporate decision-making that have not yet been fully explained by traditional finance theory (Baker et al., 2007). Existing empirical researches on managerial overconfidence have focused mainly on the important role of CEO overconfidence in

[1] Prior studies have demonstrated that a variety of factors, such as competition (Harrington and Danzon, 1994), macroeconomic factors (Browne and Hoyt, 1995), organizational structure (Lamm-Tennant and Starks, 1993; Downs and Sommer, 1999), underwriting cycle (Ren et al., 2011), and board structure (Ho, et al., 2013) have a significant impact on insurer's risk-taking.

a wide range of corporate decisions, such as investment, innovation, M&A decisions, financial contracting, capital structure, payout policies, and cash holdings (Malmendier and Tate, 2005, 2008; Galasso and Simcoe, 2011; Hirshleifer, et al., 2012; Malmendier et al., 2011; Ben-David et al., 2013; Deshmukh et al., 2015).

Some papers have examined the effect of managerial overconfidence on risk-taking and firm performance in non-financial industries. The literature finds the positive relationship between CEO overconfidence and risk-taking, suggesting 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 (Malmendier and Tate, 2008; Goel and Thakor, 2008; Campbell et al., 2011; Hirshleifer et al., 2012). 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 the sufficient risk on behalf of principals (Goel and Thakor, 2008). On the other hand, CEO overconfidence is found to have a negative impact on firm performance due to overinvestment or underinvestment (Heaton, 2002).

This paper seeks to provide new evidence on the impact of CEO overconfidence on insurer's risk-taking behavior and firm performance in U.S. publicly traded property-liability insurance companies. We are interested in the relationship between CEO overconfidence, risk-taking and firm performance because managers tend to overestimate the precision of their private signal about expected loss (Ligon, and Thistle, 2007), overestimate the precision of exogenous noisy signals (Gervais et al., 2011), and underestimate the riskiness of future cash flows (Hackbarth, 2008)[2].

Our sample consists of 28 U.S. publicly traded property-liability insurance companies over the period 1996-2013. Unlike many previous studies that use only market-based risk-taking measures

[2] We primarily focus on the CEO overconfidence 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).

with which we cannot directly observe overconfident CEO's risk-taking behavior[3], we focus mainly on observable risky-taking behavior in this study. We employ a variety of risk-taking measures, such as total risk, underwriting risk, investment risk, leverage risk, and reinsurance demand in order to investigate insurer's risk-taking behavior in a comprehensive way[4]. In particular, we utilize the reinsurance demand to directly examine how CEO overconfidence affects insurer's risk-taking because reinsurance decision is related to risk-taking behavior. Following Malmendier and Tate (2005, 2008), we measure CEO overconfidence using two different measures, which are option holdings-based measure and net stock purchase-based measure.

Interestingly, and in contrast to prior literature, we find that CEO overconfidence is negatively related to risk-taking behavior, including total risk, underwriting risk, and leverage risk. With regard to the underwriting risk, overconfident CEOs who have a substantial amount of unexercised exercisable options or are net buyer of the firm's stocks may not want to harm the company's underwriting profits by taking more risk on underwriting activity because high underwriting risk may result in high losses. The negative relationship between CEO overconfidence and leverage risk may be explained by the fact that managerial overconfidence may lead to lower debt level if the firm has sufficient internal finance because overconfident managers prefer to retain cash for future investment (Ataullah et al., 2013). Considering that total risk reflects a combination of underwriting risk, investment risk, and leverage risk (Ho et al. 2013), it seems reasonable to have the negative relation between CEO overconfidence and total risk. Our evidence shows that CEO overconfidence is positively associated with insurer's reinsurance demand, implying that overconfident CEOs purchase more reinsurance to protect themselves against unexpected losses that could harm their job security as well as their financial gains. The result along with the negative relationship between CEO

[3] Existing studies on the impact of overconfident CEO on risk-taking typically use market-based risk measures, such as systematic risk, unsystematic risk and stock return volatility (Niu, 2010; Suntheim and Sirini, 2012; Banerjee et al., 2014).

[4] 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.

overconfidence and risk-taking indicates that insurers with overconfident CEOs may limit their risk by increasing the usage of reinsurance.

We also examine the effects of the enactment of SOX and recent financial crisis in 2008-2009 on the relationship between CEO overconfidence and insurer's risk-taking**.** As for the impact of SOX on overconfident CEO's risk-taking behavior, we find mixed results. Our results show that overconfident CEOs tend to take lower total risk, underwriting risk, and leverage risk, but higher investment risk after introduction of SOX. The result is consistent with finding of Ho et al. (2013) that an insurer may control its total risk through management of underwriting, investment, and leverage risk that determines an insurer's risk profile. We also find that overconfident CEOs appear to take greater total risk, investment risk, and leverage risk during the financial crisis in 2008-2009.

For performance measures, our results show that CEO overconfidence is positively related to Tobin's Q, return on assets (ROA), return on equity (ROE), and stock return, implying that insurers with overconfident CEOs achieve higher firm performance relative to those with non-overconfident CEOs. The result combined with the negative relationship between CEO overconfidence and risk-taking indicate that shareholders of insurance companies with overconfident CEOs earn higher returns as a result of both higher firm performance and lower risk. Our evidence also suggests that overconfident CEOs do a better job managing underwriting risk, leading to higher underwriting returns and, consequently, better firm performance.

This study contributes to the literature in several ways. First, we provide the first empirical evidence on the effect of managerial overconfidence on risk-taking and firm performance in the insurance sector. Second, this study provides new insight into the effect of CEO overconfidence on insurer's risk-taking behavior and firm performance by utilizing a variety of risk-taking and profitability measures. Unlike prior literature in non-financial and banking industry, we examine how CEO overconfidence affects insurance-specific risks which only concern insurers and do not appear in non-insurance companies by employing underwriting risk and reinsurance demand. The important

advantage of using reinsurance demand as a risk-taking measure is that we can directly observe the riskiness of projects in insurance companies by looking at the firm's demand for reinsurance because purchasing reinsurance is the important mechanism for insurers to limit their risk (Wang et al., 2008). Thus our study provides additional evidence and sheds more lights on the issue. Prior insurance literature has investigated the factors affecting the demand for reinsurance in insurance industry[5]. To our knowledge, no studies to date have explored the relationship between CEO overconfidence and reinsurance demand. Therefore, we advance previous studies by incorporating the behavioral aspect into the analysis on the factors influencing reinsurance demand.

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 influences, such as SOX and financial crisis in 2008-2009 on managerial risk-taking. We reveal that overconfident CEOs change their risk-taking behavior differently in accordance with SOX and financial crisis. Thus, this paper helps enhance our understanding of how overconfident CEOs react to changes in the regulatory and economic environments.

Finally, our results indicate that two measures of CEO overconfidence may actually measure CEO confidence in U.S. property-liability insurance companies. Our overall findings show that insurers with overconfident CEOs are likely to take lower risk, use more reinsurance and achieve better firm performance. While confidence can motivate CEOs to push their limits and help them achieve higher firm performance more than they otherwise might have done, too much confidence (i.e., overconfidence) can be detrimental to firm performance because overconfident CEOs tend to underestimate the risks, and as a result, they engage in more risky projects. Therefore, our results seem to be more consistent with CEO confidence rather than CEO overconfidence, suggesting that

[5] The factors include tax effect, expected costs of financial distress, ownership structure, investment incentives, information asymmetry, comparative advantages in real service production, capital structure, and leverage (Mayers and Smith, 1982, 1990; Garven and Lamm-Tennant, 2003; Cole and McCullough, 2006; Plantin, 2006; Shiu, 2011).

CEO confidence is supported by CEO's own actions, such as low risk-taking, high reinsurance demand and achievement of superior firm performance.

The reminder of the paper is structured as follows. Section 2 overviews the related literature on overconfidence 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 main findings.

2. Background and Hypotheses Development

2.1 Overview of Overconfidence

Overconfidence has been a widely used term in psychology since the 1960s and researchers in other fields, including economics and finance have extended their meaning to account for many phenomena that the standard theory does not explain (Skata, 2008). Overconfidence is divided into two main categories in psychology: miscalibration and positive illusions. According to Ben-Davis et al. (2013), miscalibration is the systematic underestimation of the range of potential outcomes. Miscalibrated people tend to overestimate the precision of their knowledge and underestimate the risks they are actually taking. Experimental evidence from psychology shows that surveyed subjects who display a miscalibration typically provide confidence intervals for their predictions that are too narrow (Alpert and Raiffa, 1982).

Positive illusions include three behavioral biases, such as unrealistic optimism, better-than-average effect and illusion of control. Weinstein (1980) defined an unrealistic optimism as the belief that favorable future events are more likely to occur than they are in reality. Kahneman and Tversky (2000) point out that overoptimistic people underestimate the likelihood of hazards affecting them, but entertain the belief that the future will be especially great for them. Heaton (2002) find that optimistic people tend to put too much probability to good outcomes and too little probability to bad outcomes. Better-than-average effect means that people feel superior to others by believing

themselves as above average on a number of skills (Kruger and Dunning, 1999). Illusion of control is the tendency for people to believe that they are able to influence events that are governed mainly by chance (Taylor and Brown, 1988). Skata (2008) notes that people obsessed with illusion of control are likely to assign certain outcomes to their doing than luck, reinforcing their belief in control over a situation where the only factor is probability.

2.2. CEO Overconfidence and Risk Taking

The extant literature has provided evidence that CEO overconfidence is positively related to risk-taking in non-financial industries. Kahneman and Lovallo (1993) argue that overoptimistic managers may willingly expose themselves to a substantial degree of risk because they misjudge the odds or rely on overly optimistic forecasts. Heaton (2002) states that overoptimistic managers show an upward bias in their cash flow forecasts for investment projects and thus, the upward bias may cause managers to undertake risky projects. Malmendier and Tate (2008) assert that overconfident CEOs are more prone to engage in riskier projects because they overestimate the returns on risky investments, but underestimate the possibility of failure. Kim et al. (2014) find that firms with overconfident CEOs have higher stock price crash risk than firms with non-overconfident CEOs. Niu (2010) shows that banks with overconfident CEOs tend to take on more risk. Suntheim and Sironi (2012) provide evidence that CEO overconfidence results in higher risk-taking and higher levels of bank fragility in banking industry. Cain and McKeon (2014) find that CEO overconfidence is positively related to corporate risk-taking.

However, it is also possible for CEO overconfidence to be negatively associated with risk-taking behavior. Malmendier and Tate (2005) posit that rational CEOs tend to minimize their holding of the company stock in order to divest themselves from idiosyncratic risk, whereas overconfident CEOs are prone to buy additional company stocks despite their already high exposure to the company risk. Given overconfident CEOs' high exposure to firm-specific risk, they may want to reduce the

investment risk by underinvesting in risky projects and overinvesting in risk-reducing activities (Jensen et al., 2004). In addition, if overconfident CEOs who have a substantial amount of unexercised exercisable options or net buyer of their firm's stock are confident about the firm's future returns, they may feel less need to take higher risk and thus are likely to reduce the riskiness of the firm by adopting less risky underwriting policies and choosing lower leverage in order to reduce the riskiness of their own financial gains. In light of these counter arguments, the relationship between CEO overconfidence and insurer's risk-taking is inconclusive. Thus, we suggest null hypothesis.

Hypothesis 1.1: CEO overconfidence is not related to risk-taking in the property-liability insurance companies[6].

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. While reinsurance has an advantage of improving insurer's financial stability by reducing the insolvency risk, it may have negative impact on firm performance because insurers have to pay a substantial amount of costs to purchase the reinsurance. Since both risk management policies and factors in determining firm performance are closely related to the managerial decisions by top management, CEO overconfidence could significantly affect the corporate decisions to use the reinsurance.

For example, overconfident CEOs tend to undertake risky projects due to their upwardly biased beliefs toward the future returns of their investment projects and thus, they may focus more on the firm performance than on the riskiness of their firms, resulting in lower demand for reinsurance. In this case, reinsurance demand would decrease in response to overconfident CEO's higher risk-taking.

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

On the other hand, overconfident CEOs who have a substantial amount of unexercised options or net buyer of their companies' stock may protect themselves from unexpected losses that could cause harmful effect on their job security as well as their own financial gains by increasing the usage of reinsurance. Based on above arguments, the relationship between CEO overconfidence and reinsurance demand remains ambiguous. This leads to the null hypothesis shown below.

Hypothesis 1.2: CEO overconfidence is not related to the reinsurance demand in the property-liability insurance companies.

2.3. SOX and Overconfident CEO's Risk Taking

Sarbanes-Oxley Act (SOX) was enacted in 2002 in response to a series of high profiles of corporate and accounting scandals. Since the enactment, SOX has virtually changed the accounting profession and affected all publicly traded companies in the U. S. The main purpose of SOX is to restrict the managerial excesses, increase the transparency, and improve the corporate governance and ethical behavior by exposing CEOs to more personal liability (Banerjee et al., 2014). Akhigbe et al. (2009) find that increased transparency and better disclosures after enactment of SOX have reduced the opacity in the insurance industry.

However, despite the extensive researches, there is little agreement on the impact of SOX on corporate risk-taking. Proponents of SOX argue that the stringent regulations on corporate governance may reduce insider misconduct and mismanagement (Hochberg, et al., 2009). Zhou (2008) reports a decrease in managerial discretion and an increase in conservatism after implementation of SOX. Cohen et al. (2007) note that increased legal and political exposure after SOX may lead firms to favor lower risk projects over higher risk projects, resulting in a substantial decrease in incentives of CEOs to invest in risky projects. Banerjee et al. (2014) find that after the passage of SOX, a relatively more independent board, independent audit committee and a mandate disclosure have led to an environment in which it is less feasible for overconfident CEOs to take on

high levels of risk. The above arguments indicate that SOX may be effective in tackling high risk-taking behavior of overconfident CEO**.**

On the contrary, opponents of SOX argue that SOX may not have a chilling effect on corporate risk-taking. Prior literature shows that increased personal liability of managers under SOX could provide managers with more incentives to make discretionary choices that are not clearly prohibited by SOX (Graham et al., 2005; Romano, 2005; Cohen et al, 2008). John et al. (2008) contend that improved investor protections may lead to higher managerial risk-taking. They point out that since better investor protections reduce the opportunity for perks, managers are likely to engage in more risk-taking behavior. Albuquerque and Zhu (2012) find that firms complying with section 404 of SOX tend to increase investment because firms benefit from lower cost of capital due to improved disclosure mandated by SOX. They argue that SOX could induce CEOs take on higher levels of investment risk, casting doubt on the notion that SOX increased the level of risk-aversion among executives and directors. Given the forgoing arguments, we suggest null hypothesis about the effect of SOX on overconfident CEO's risk-taking. We use the indicator variable (*SOX*) to define Sarbanes-Oxley Act (SOX). Specifically, if the observation occurs in 2002 or later, it takes value of one, and zero otherwise.

Hypothesis 2: Overconfident CEOs do not change their risk-taking behavior after enactment of the Sarbanes-Oxley Act (SOX).

2.4. Financial Crisis and Overconfident CEO's Risk Taking

Financial crisis in 2008-2009 had a devastating impact on global economy, resulting in the collapse of a number of financial institutions and government bailouts of the large financial institutions. Recent studies show that firm's risk management and financial policies had a significant influence on degree to which the firm is impacted by financial crisis (Brunnermeier, 2009). Prior literature offers two competing views on how overconfident CEOs could change their risk-taking

behavior during the financial crisis in 2008-2009. Suntheim and Sironi (2012) argue that high levels of risk-taking behaviors in the banking sector during the financial crisis may be attributable to value-destroying risky projects undertaken by overconfident CEOs who have systematically upward biased beliefs in the future return of their investment projects. Chen and Chen (2015) find that overconfident CEOs tend to take higher credit risk and insolvency risk in the recession periods because they believe that they have superior abilities to achieve success during the periods of recession.

In contrast, Kaniel et al. (2010) find that the financial crisis in 2008-2009 corresponded with a significant drop in individual's dispositional optimism. They argue that although dispositional optimism is a fixed personality trait, it still subjects to situational influences. Malmendier and Nagel (2011) provide evidence that individuals who have experienced the macroeconomic shocks tend to be more risk-averse and deter risky investment decisions. Overall, the above arguments indicate that overconfident CEOs may change their risk-taking behavior during the financial crisis in 2008-2009, but the sign is not predictable. Thus, our hypothesis 3 follows, stated in the null form. We define financial crisis with the indicate variable (*Crisis*) that equals one if the observation is in 2008 and 2009, and zero otherwise.

Hypothesis 3: Overconfident CEOs do not change their risk-taking behavior during the financial crisis in 2008-2009.

2.5. CEO Overconfidence and Firm Performance

The impact of CEO on firm performance has been a topic of growing interest in academics and popular literature because CEO plays a major role in determining firm's strategy and performance. Crossland and Hambrick (2007) find that CEO explains a significant portion of variance in firm profitability for U.S. firms. The relationship between CEO overconfidence and firm performance has been extensively studied in the prior literature. The existing studies have provided mixed results on the effect of CEO overconfidence on firm performance. Fairchild (2005) finds that CEO

overconfidence has a negative impact on the firm value because overconfident CEOs tend to have high levels of leverage that could lead to higher financial distress costs and discounts on risky debt and equity. Heaton (2002) argues that managerial overconfidence may reduce the value of the firm as a result of overinvestment or underinvestment. Malmendier and Tate (2008) show that overconfident CEOs have a negative influence on the firm performance because they tend to engage in more value-destroying mergers and acquisitions. Chen et al. (2010) find that positive long-run abnormal stock returns and operating performance for non-overconfident CEOs are significantly greater than those for overconfident CEOs.

However, Goel and Thakor (2008) point out that CEO overconfidence could help overcome the problem of underinvestment by leading risk-averse CEOs to take the sufficient risk on behalf of principals, thereby increasing firm value. Gervais et al. (2003) note that since CEO overconfidence not only aligns the decision of managers with the interests of shareholders, but also motivates managers to exert higher levels of effort, it helps firms achieve higher profitability. Gervais et al. (2009) find that managerial overconfidence increases firm value by reducing moral hazard and aligning incentives. Hirshleifer et al. (2010) show that CEO overconfidence is positively related to firm performance measured by sales, ROA, and Tobin's Q. Vitanova (2014) report that operational performance, firm value, and stock performance are significantly higher for firms with overconfident CEOs than similar firms with rational CEOs. The above arguments indicate that the relationship between CEO overconfidence and firm performance remains an open question. This leads to our hypothesis 4 as the null form.

Hypothesis 4: CEO overconfidence does not affect firm performance in the property-liability insurance companies[7].

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

3. Data and Methodology

3.1. Data and Sample Selection

Our sample includes the data on 28 U.S. publicly-traded property-liability insurance companies over the period 1996-2013. We employ panel data that contain information both across firms and over the time for each firm. Each of variables for the analysis is calculated annually for the sample firms. Our data come from various sources described as follows. We use ExecuComp database to construct two CEO overconfidence measures. Monthly stock returns used to estimate buy-and-hold stock return are derived from CRSP. Data on Tobin's Q are obtained from Compustat database. We manually collect the data on corporate governance variables from SEC-filed annual proxy statement (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 National Association of Insurance Commissioners (NAIC). Following Ho et al. (2013), we use five-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 2000 is calculated using ROAs from 1996 to 2000.

We initially obtained 3,607 executive-firm-year observations of option holdings and shares owned excluding options from the ExecuComp database for 52 U.S. publicly traded property-liability insurance firms over the period 1996-2013. In calculating CEO overconfidence variables, we only use the data on option holdings and shares owned excluding options by CEO and exclude the data on option holdings and shares owned excluding options by other executives (e.g., option holdings and shares owned by CFO, president, vice-president and CEO of subsidiaries). In addition, following Malmendier and Tate (2005), we require CEOs to have at least five years of data on option holdings

and shares owned excluding options. It reduces the sample size to 489 and 494 CEO-firm-year observations for option holdings and shares owned excluding options, respectively. After merging the data set used to construct two CEO overconfidence measures with the data required to calculate risk-taking, firm performance and control variables, we finally have 252 and 257 CEO-firm-year observations for option holdings-based and net stock purchase-based measure, respectively, for 28 U.S. publicly traded property-liability insurance companies.

ExecuComp reports data on individual annual option holdings and shares owned excluding options for CEO at the holding level, but NAIC provides firm-specific as well as consolidated data for insurers who are comprised of several insurance companies. Since 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 that has been conducted with publicly traded property-liability insurers[8]. Since there are only a limited number of publicly traded property-liability insurance companies, there is only so much data available.

3.2. Methodology

In order to examine the relationship between CEO overconfidence, insurer's risk-taking and firm performance, we conduct regressions using cross-sectional and time-series data on 28 U.S. publicly traded property-liability insurance companies over the period 1996-2013. The regressions are based on the unbalanced panel data to maximize the number of observations included in analysis and to avoid survivor bias. We employ two-way fixed effects model to control for unobserved heterogeneity problems because 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

[8] 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.

variable (Greene, 2003).[9] Given the cross-sectional and time-series data structure, the functional form of two-way fixed effects model for the relationship between CEO overconfidence and insurer's risk-taking has the following specification:

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

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.

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

$$\begin{aligned} Reinsurance_{i,t+1} = {} & \alpha_0 + \alpha_1 Overconfidence_{i,t} + \alpha_2 BSize_{i,t} + \alpha_3 Insider_{i,t} + \alpha_4 Busy_{i,t} \\ & + \alpha_5 Duality_{i,t} + \alpha_6 Institution_{i,t} + \alpha_7 Size_{i,t} + \alpha_8 ProdHHI_{i,t} \\ & + \alpha_9 GeoHHI_{i,t} + \alpha_{10} Long\ tail_{i,t} + \alpha_{11} Weak_{i,t} + \alpha_{12} Tax_{i,t} \\ & + \alpha_{13} Coastal\_states_{i,t} + \alpha_{14} 2yearLossDevelpment_{i,t} + d_t + f_t + \varepsilon_{i,t} \end{aligned}$$

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

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

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

[9] We performed the Hausman test to investigate correlation between observable regressors and unobservable effects. The Hausman test rejects the null hypothesis of non-fixed effects and shows that two-way fixed effects model fits better to the data.

3.3. Variable Definitions

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

3.3.1. CEO Overconfidence Measures

The main objective of this study is to examine the relationship between CEO overconfidence, risk-taking and firm performance of U.S. publicly traded property-liability insurance companies. In this study, CEO overconfidence is measured using two different measures, such as option holdings-based measure of overconfidence (Malmendier, 2005, 2008; Campbell et al., 2011; Hirshleifer et al., 2012) and net stock purchase-based measure of overconfidence (Malmendier and Tate, 2005; Jarboui et al., 2014; Hribar and Yang, 2015). As our first measure of CEO overconfidence, we employ an option holdings-based overconfidence measure by using the information on CEO option holdings for the U.S. publicly traded property-liability insurance companies.

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 simulation, Hall and Murphy (2002) demonstrate that rational CEOs should exercise their options packages once their options are 67% in the money (i.e., stock price exceeds the exercise price by more than 67%) for each year of stock option's exercisability. Malmendier and Tate (2005) adopt this framework as a threshold level of CEO overconfidence. Following Malmendier and Tate (2005), we classify CEOs as overconfident if they keep their options too long to be considered rational. Specifically, we define a CEO as overconfident if a CEO postpones the exercise of vested options that are at least 67% in the money in two different years over the sample period.

We classify a CEO as overconfident as of the first time he/she has exercisable options that are 67% or more in the money. That is, after identifying the second instance at which a CEO fails to exercise the options that are at least 67% in the money, we define the CEO as overconfident, starting

with the first instance of the behavior. Since overconfidence is a persistent trait (Hirshleifer et al., 2012), if a CEO is identified as overconfident, we assume that he/she remains overconfident for the rest of sample period. The dummy variable (*OC67*) takes a value one if a CEO delays the exercise of options that are 67% or more in the money at least twice over the sample period and zero otherwise.

In their paper, 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 Malmendier and Tate 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 also a valid and useful in measuring CEO overconfidence[10]. To calculate the average moneyness, we first compute the average realizable value for option by dividing the total realizable value of the exercisable options (ExecuComp variable: OPT_UNEX_EXER_EST_VAL*)* by the number of exercisable options held by the CEO (ExecuComp variable: OPT_UNEX_EXER_NUM) for each year. Next, we subtract the per-option average realizable value from the stock price at the fiscal year end (ExecuComp variable: PRCCF) to obtain an estimate of 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 additional company stocks despite their already high exposure to the company risk (Malmendier and Tate, 2005). Malmendier and Tate (2005) contend that while rational CEOs tend to minimize their holding of the company stock in order to divest themselves from idiosyncratic risk, overconfident CEOs are likely to habitually increase their equity positions by purchasing new shares of their firm's stock or

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

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 company stock than there are years in which a CEO is a net seller over the sample period. Following previous literature (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 this overconfidence 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). 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 for the measure. We use dummy variable (*Net Buyer*) that equals one if the CEO is a net buyer of company stock during the sample period and zero otherwise.

3.3.2. Risk Taking measures

To examine the relationship between CEO overconfidence and insurer's different risk-taking behaviors from different perspectives, we employ a variety of risk-taking measures, such as total risk, underwriting risk, investment risk, leverage risk, and reinsurance demand. First of all, total risk is the most important 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. Second, managing underwriting risk is especially important for insurers because it is closely associated with the uncertainty of insurance contract losses. 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. Underwriting risk is measured by the standard deviation of the firm's loss ratio where loss ratio is defined as the ratio of loss incurred divided by premiums earned.

Third, investment risk is related to the investment activities that may adversely affect insurer's financial soundness. Since underwriting profit could be negative in many instances[11], effectively taking and managing investment risk are essential to success of insurance companies. We measure investment risk by the standard deviation of return on investment (ROI) where ROI is measured by the ratio of net investment gain divided by investment assets. Fourth, leverage risk is crucial to insurers because the insurance company having relatively lower levels of surplus is more likely to become insolvent than firm with high levels of surplus. 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.

Lastly, as an additional risk-taking measure, we use the reinsurance demand. Purchasing reinsurance represents an important mechanism for insurers to limit their risk (Wang et al., 2008). We can directly examine insurer's risk-taking behavior by observing insurer's demand for reinsurance. We measure reinsurance demand as the ratio of reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed for insurer (Klein et al., 2002).

3.3.3. Performance Measures

The key performance measures used in this study are identified from a through literature review. We first employ Tobin's Q as a market-based measure of firm performance. Tobin's Q is a widely used measure in CEO overconfidence-firm performance literature (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 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 in place of replacement costs in calculating Tobin's Q. In this study, we compute

[11] According to 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.

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

Following 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 insurer's firm performance. We defined 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 measured as the buy-and-hold return by compounding monthly stock returns over the fiscal year.

3.3.4. Control Variables

Corporate governance variables are included as explanatory variables because extant literature suggests that corporate governance structure may affect the insurer's risk-taking behavior, reinsurance demand and firm performance (Brick and Chidambaran, 2008; Garven and Lamm-Tennant, 2003; Cheng, 2008). Board size is measured by the number of all directors (*Bsize*). Insider percentage is computed by the percentage of executive directors on the board (*Insider*). We define busy board with dummy variable (*Busy*) that takes the value of one if 50% or more independent board members hold three or more directorships and zero otherwise. CEO duality is a dummy variable (*Duality*) that equals one if 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 include several firm characteristics variables that are known to influence insurer's risk-taking, financial performance and reinsurance demand**.** The natural logarithm of total net written

premiums is used as a proxy for firm size (*Size*). Reinsurance ratio is measured by the ratio of reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed (*Reinsurance*). Lines of business Herfindahl index is calculated as the sum of the squares of the value of net written premiums in line *i* divided by insurer's total net written premiums (*ProdHHI*)[12]. Geographical Herfindahl index is computed by the sum of the squares of the value of net written premiums in state *i* divided by insurer's total net written premiums (*GeoHHI*). The percentage of long-tail lines is defined as the ratio of premiums of long-tail lines to total net written premiums (*Longtail*). Insurer financial condition is the indicator variable (*Weak*) that takes a value of one if the insurer is financially unhealthy, where unhealthy firm is defined as more than four unusual insurance Regulatory Information System (IRIS) ratios, and 0 otherwise. Note that we use reinsurance ratio as a control variable when risk-taking or firm performance is a dependent variable.

Previous literature has documented a variety of factors affecting demand for insurance. Thus, we include additional control variables, such as tax effect, coastal states, and 2 year loss development in the regressions when reinsurance demand is a dependent variable. Tax effect is a proxy for the tax liability or tax-favored assts (*Tax*). We measure Tax effect as the ratio of tax-exempt investment income to total investment income (D'Arcy and Garven, 1990). Coastal States is a dummy variable ($Coastal\_states$) 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 0 otherwise (Chen and Yan, 2012). 2 year Loss Development is measured by dividing the development in estimated losses and loss expenses incurred two years before the current year and prior year by policyholders' surplus (Cole and McCullough, 2006). The definitions of all variables are summarized in Table 1.

[12] 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.

4. Results

4.1. Descriptive Statistics

Table 2 presents the descriptive statistics for all variables. *OC67* and *Net buyer* measures define about 59 percent and 73 percent of CEO-firm-years as overconfident, respectively. These percentages are comparable with those in prior studies using similar CEO overconfidence measures[13]. Table 3 provides the Pearson correlation coefficients between all independent variables. The correlation coefficient between two different CEO overconfidence measures is 0.082, which is very similar to that of 0.063 in Malmendier and Tate (2005). The result suggests that even though the correlation is relatively weak, these measures capture the same effect. Table 3 also shows that some independent variables are highly correlated. For example, the correlation coefficients on reinsurance and firm size, long tail and business line Herfindahl index, and board size and geographical Herfindahl index are -0.485, 0.469 and -0.549, respectively, and statistically significant at the 1% level. Thus, 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 lower than 4 and thus, conclude that multicollinearity may not adversely affect our regression results.

Table 4 provides univariate comparisons between insurers with CEOs overconfidence and those with non-overconfident CEOs. Differences in means and median tests show that insurers with overconfident CEOs tend to have significant lower total risk, underwriting risk, investment risk and leverage risk, but higher Tobin's Q and stock return than insurers with non-overconfident CEO. We also find that overconfident CEOs are not likely to hold dual positions relative to non-overconfident CEOs, and insurers with overconfident CEO purchase more reinsurance, are more geographically diversified and have a lower percentage of premiums written in long-tailed lines than those with non-

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

overconfident CEOs. It also appears that insurers with overconfident CEOs tend to be more financially healthy, have more income generated from tax-exempt assets, and have overstated reserves.

4.2. Empirical Results

The estimates of the parameters from our two-way fixed effects regression of the relationship between CEO overconfidence and risk-taking are reported in Table 5 and 6 where CEO overconfidence is measured using option holdings-based and net stock purchase-based measure, respectively. The results show that the coefficients on CEO overconfidence for total risk, underwriting risk are both negative and significant at the 1% level, and the coefficient on CEO overconfidence for leverage risk is also negative and significant at the 5% level, implying that CEO overconfidence is inversely related to the insurer's risk-taking behavior. We find that there is no significant relationship between CEO overconfidence and investment risk. The results indicate that overconfident CEOs are less likely to take total risk, underwriting risk and leverage risk relative to non-overconfident CEOs by 1.13%, 4.62% and 2.47%, respectively, for the option holdings-based measure and 1.29%, 3.71% and 2.31%, respectively, for the net stock purchase-based measure.

Some potential explanations on these results can be stated as follows. In terms of underwriting risk, overconfident CEO who has a large amount of unexercised excisable options or is a net buyer of the firm's stocks may not want to harm his/her company's underwriting profits by taking more risk on underwriting activity because high underwriting risk may result in high losses. Another possible reason is that unlike other risks, high levels of uncertainty in underwriting activities are not always associated with high potential returns. High underwriting risk may reduce insurer's operating income and increase operating costs, resulting in poor firm performance. Since risk-return trade-off does not apply to insurer's underwriting risk-taking behavior, there may be no incentive for overconfident CEOs to take more underwriting risk.

The negative relationship between CEO overconfidence and leverage could possibly result from the fact that the effect of CEO overconfidence on leverage depends on the relations between overinvested investment returns, cash holdings, and perceived financial costs (Malmendier et al., 2011). Ataullah et al. (2013) posit that managerial overconfidence may lead to lower debt level if the firm has a sufficient internal finance because overconfident managers tend to retain cash for future investment. According to the 2014 report by Insurance Information Institute (I.I.I), U.S. property-casualty insurance industry has accumulated increasing surplus in recent years, enhancing insurer's capacity to deal with the risks. Figure 1 shows that the ratio of net premiums written to policyholder surplus in U.S. property-casualty insurance industry has decreased over the period 1985-2014. Therefore, increased internal capital in U.S property-liability insurance industry may enable overconfident CEOs to use less debt, resulting in lower leverage risk. Considering that total risk reflects 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.

With regard to the control variables, the results in Table 5 and 6 show that board size is negatively and significantly related to total risk, implying that the performance of firm with the 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 and leverage risk, indicating that larger insurers tend to take more risk. We also find that the coefficients on the lines of business Herfindahl index are significant and positive in total risk and underwriting risk whereas the coefficients on geographical Herfindahl index are negatively significant in underwriting risk, investment risk, and leverage risk. The results indicate that insurers with higher concentration in a given line of business exhibit more risk-taking behaviors, and insurers are likely to reduce their risks through geographic diversification. Weak is positively related to risk-taking, implying that financial unhealthy insurers tend to take higher risk.

Table 5 and 6 also presents the results of the relationship between CEO overconfidence and insurer's reinsurance demand. The coefficients on both CEO overconfidence measures are positively significant, indicating that overconfident CEOs tend to purchase more reinsurance. The result suggests that overconfident CEOs may increase the usage of reinsurance to protect themselves against unexpected losses that could harm their job security as well as their financial gains. The finding together with the negative relationship between CEO overconfidence and risk-taking imply that insurers with overconfident CEOs may limit their risk by increasing the usage of reinsurance.

As for the control variables, busy board is found to have negative impact on reinsurance demand, suggesting that since busy board may lead to less monitoring and poor governance (Jiraporn et al., 2009), it may allow managers to engage in higher risk-taking, resulting in a low demand for reinsurance. We also find the negative relationship between firm size and insurer's reinsurance demand, indicating that small insurance firms are more likely to purchase reinsurance as a way to manage unexpected losses. Both product diversification and geographic diversity are significantly positively related to reinsurance demand, implying that insurers with 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. Tax is not related to reinsurance demand, consistent with Garven and Lamm-Tennant (2003). The coefficients on 2 year loss development is positively significant, suggesting that firms which under-reserve tend to purchase higher level of reinsurance, consistent with the finding of Cole and McCullough (2006).

To examine the effects of enactment of SOX and financial crisis in 2008-2009 on the relationship between CEO overconfidence and insurer's risk-taking, we include interaction term of CEO overconfidence with SOX or financial crisis in the regressions. The results in Table 7 show that the implementation of SOX has different impacts on insurer's risk-taking behavior. We find that *OC67* × SOX is significantly negatively related to underwriting risk whereas the coefficient on the interaction term is significant and positive in investment risk. This result suggests that insurers with

overconfident CEOs tend to take more investment risk, but they appear to take less underwriting risk after introduction of SOX. In Table 8, the coefficients on *Net buyer* × SOX are negative and statistically significant in total risk, underwriting risk and leverage risk, while the interaction terms are positively and significantly related to investment risk and reinsurance demand. Overall, the results partially support the view that SOX may have a chilling effect on overconfident CEO's risk-taking behavior (Banerjee et al., 2014). However, the positive relation between the interaction term and investment risk implies that overconfident CEOs may take higher investment risk after SOX because they want to take advantage of the opportunities to earn higher return through lower cost of capital due to improved disclosure (Albuquerque and Zhu, 2012). The result is also consistent with finding of Ho et al. (2013) that an insurer may choose high investment risk, but lower leverage risk as its strategy in order to control its total risk through management of underwriting, investment, and leverage risk that determines an insurer's risk profile.

In terms of the effect of financial crisis in 2008-2009 on the relationship between CEO overconfidence and insurer's risk-taking, Table 9 reports that the coefficients on the interaction term of *OC67* × *Crisis* are significant and positive in investment risk and leverage risk, whereas the interaction term is significantly negatively related to the reinsurance demand. The signs on *Net buyer* × *Crisis* in Table 10 are significantly positive in total risk, investment risk and leverage risk. The results indicate that overconfident CEOs may take more risk by increasing investment in riskier projects and selling more policies during the financial crisis. The results suggest that overconfident CEOs tend to take higher risk in the periods of recession because they feel that they have superior abilities to achieve success during the periods of recession (Chen and Chen, 2015).

Table 11 reports the estimations of the parameters of the relationship between CEO overconfidence and firm performance. The coefficients on CEO overconfidence measured by both *OC67* and *Net Buyer* are significant and positive in all four profitability measures, implying that insurers with overconfident CEOs achieve better financial performance. The positive relationship

between CEO overconfidence and firm performance supports the findings of Hirshleifer et al. (2010) and Vitanova (2014). The results together with the negative relation between CEO overconfidence and risk-taking suggests that shareholders of insurance companies with overconfident CEOs may earn higher returns on their investment as a result of both higher firm performance and lower risk.

There are other interesting results with respect to several control variables. The evidence in Table 11 show that the busy board is positively related to firm performance, implying that since busy directors bring in more experience, knowledge and provide better advising (Elyasiani and Zhang, 2012), they could help improve firm performance. 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 purchases are negatively related to insurer's financial performance, consistent with finding of Lee and Lee (2012) that insurers with higher reinsurance ratio tend to have a lower level of firm performance. Product diversification is positively associated with firm performance, implying that higher levels of product diversification may increase firm performance through economies of scope and efficiency gains (Cole and Karl, 2014). The percentage of long-tail lines is found to be negatively related to firm performance (Cummins et al., 2009).

4.3. Robustness Check and Additional Test

In this section, we conduct a series of robustness checks of our main findings and perform an additional test to examine the source of better firm performance with overconfident CEOs.

First of all**,** previous literature suggests that CEO overconfidence may be jointly determined with insurer's risk-taking behavior and the feedback effect between dependent and independent variables may lead to the problem of endogeneity. Boles et al. (2014) argue that selection bias may be present

regarding CEO selection and firm risk and thus, riskier firms may match with overconfident CEOs. To address the possibility, we conduct further robustness check with the two-stage least squares (2SLS) method using instrument variables. The lagged or historically averaged measures of firm characteristics, industry growth, and general economic growth are suggested as commonly used instrumental variables (Campa and Kedia, 2002). Therefore, we employ average firm size for prior three years, three-year average of industry premium growth rate, and three-year average of real GDP growth as our instrumental variables for CEO overconfidence.

The results in Table 12 and 13 show that coefficients on both CEO overconfidence measures are significant and negative in total risk, underwriting risk and leverage risk, and the coefficients are positive and significant in reinsurance demand. As a result, our main results remain unchanged. Thus, we rule out the possibility that our main findings may be driven by endogeneity. Although not reported here[14], the results of the effect of SOX or financial crisis on the relationship between CEO overconfidence and insurer's risk-taking generally confirm our previous findings.

Second, CEOs may have inside information about future stock prices, thereby increasing their equity holdings. This possibility raises the question about the validity of our net stock purchase-based overconfidence measure. To address the concern, Malmendier and Tate (2005) classify CEOs as overconfident based on their first five years in the sample, but eliminate the five years from the regressions because any insider information to affect corporate decisions is likely to realize during the gap between the periods. Following the paper, we define a CEO as overconfident using the data on shares owned excluding options by CEO for the first five years and then exclude the five years from the regression specification. After running regressions without the first five years, we find that our main results are still unchanged, implying that our results are not driven by insider information (not tabulated).

[14] For untabulated results, the authors would be happy to provide the results upon requests.

Third, 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 likelihood of insolvency, with 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 associated with the Z-score, indicating that overconfident CEOs tend to achieve higher financial stability, consistent with our findings that overconfident CEOs tend to take lower risk and achieve better firm performance.

Fourth, prior literature has shown that executive compensation is closely linked to 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 incentives, such as bonus, long-term incentive pay, stock options awarded, stock options exercised, and restricted stocks as control variables in the regressions in order to control for the impact of CEO compensation on risk-taking. All variable are scaled by total compensation. Untabulated results report that our main results remain consistent and robust even if we control for CEO compensation variables. As a last robustness check, we use A.M. Best ratings as additional explanatory variable because credit rating may have a significant impact on corporate risk-taking decisions (Graham and Harvey, 2001). Again, we find that our results remain unchanged (untabulated).

From our analysis, we find the positive relationship between CEO overconfidence and firm performance, but how does firm performance improve? To answer this question, we investigate the determinants of firm performance by regressing firm performance on underwriting return and investment return because underwriting performance and investment return are the two most important factors of insurer's financial profitability. We define underwriting return (UROA) as net underwriting gain divided by total assets (Powell et al., 2008) and investment return (ROI) is measured by net investment gain scaled by investment assets (Ho et al., 2013). We also include

various control variables, including firm characteristics and macroeconomic factors in the regressions. We split our sample into two subsamples based on whether CEO is overconfident or not and then perform separate regressions for full sample, subsample of overconfident CEOs, and subsample of non-overconfident CEOs.

The results of Table 14 report that for the full sample, underwriting return is positively and significantly related to ROA at the 5% level for both overconfidence measures, but there is no significant relationship between investment return and ROA. Partitioning the sample shows that the full sample results are generated by the overconfident CEO subsample. We only find a significant positive relationship between underwriting return and ROA in overconfident CEO subsample[15]. These subsample results indicate that better performance achieved by overconfidence CEOs is mainly driven by improved underwriting returns. The result, combined with the negative relationship between CEO overconfidence and underwriting risk suggest that insurers with overconfident CEOs do a better job managing their underwriting risk and thus, they can achieve higher underwriting returns, resulting in better firm performance.

5. Conclusion

Although **t**he impact of managerial overconfidence on various corporate decisions may be of interest from the perspective of various stakeholders, the specific relationship between the managerial overconfidence, risk-taking behavior and firm performance has yet to be conducted in the insurance literature. To fill this gap, this paper seeks to provide new evidence on how CEO overconfidence impacts insurer's risk-taking behavior and firm performance in U.S. publicly traded property-liability insurance companies over the period 1996-2013. Insurance industry provides a good testing ground to examine the effect of CEO overconfidence on risk-taking behavior because

[15] We repeat our regression analysis using other performance measures, such as ROE, Tobin's Q, and stock return as a dependent variable. The results for other performance measures generally follow those reported in Table 14.

we can directly observe the riskiness of projects by looking at the insurer's demand for reinsurance. By jointly considering risk-taking behavior and reinsurance demand of insurance firms, we are able to examine the effect of CEO overconfidence on insurer's risk-taking in a more accurate manner.

Interestingly, and in contrast to prior literature, we find that CEO overconfidence is negatively associated with insurer's risk-taking, including total risk, underwriting risk, and leverage risk while it is positively related to insurer's reinsurance demand. The results suggest that insurers with overconfident CEOs may limit their risk by increasing the usage of reinsurance.

We find mixed results on the effect of SOX on the relation between CEO overconfidence and insurer's risk-taking. The results partially support the view that SOX may be effective in tackling high risk-taking of the overconfident CEO. The evidence also shows that insurers with overconfident CEOs were engaged in high risk activities during the financial crisis in 2008-2009. The results imply that overconfident CEOs may change their risk-taking behaviors differently in accordance with the changes in the regulatory and economic environments.

We provide evidence supporting for a positive effect of CEO overconfidence on firm performance, indicating that shareholders of insurance companies with overconfident CEOs may benefit through higher stock returns, greater firm profitability, and lower risk. Other evidence shows that overconfident CEOs appear to do a better job managing underwriting risk, leading to higher underwriting returns and, consequently, better firm performance.

Taken together, our overall findings indicate that two measures of CEO overconfidence may actually measure CEO confidence in U.S. property-liability insurance companies. Considering the fact that confidence can motivate CEOs to push their limits and help them achieve higher firm performance more than they otherwise might have done, our results seem to be more consistent with CEO confidence rather than CEO overconfidence, suggesting that CEO confidence is supported by CEO's own actions, such as low risk-taking, high reinsurance demand and achievement of superior firm performance.

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. (2014), 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 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 mean squared error (MSE) from the estimation of the single index model over the year to measure the unsystematic risk. We take a natural logarithm of MSE to mitigate concerns about skewness. Our results show that there is no statistically significant relationship between CEO overconfidence and market-based risk-taking measures (not tabulated). The results are different from those of non-financial firms and banks. One possible explanation is that reinsurance decision is one of the risk-taking behaviors 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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Table 1. Variable Definitions

Variable	Definition
CEO Overconfidence	
OC67	Dummy is 1 if CEO holds unexercised excisable options that are more than 67% in the money 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% 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	
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 divided by 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 by compounding monthly stock returns over the fiscal year

Table 1. Continued

Variable	Definition
Corporate Governance	
Board Size	Number of all directors
Insider percentage	Percentage of executive directors on the board
CEO duality	Dummy is one if same person is the CEO and Chairperson and zero otherwise
Busy Board	Dummy is one if 50% or more independent board members hold three or more directorships and zero otherwise
Institutional Ownership	Percentage of shares held by institutional investors
Firm characteristics	
Firm Size	Natural log of total net written premiums
Reinsurance ratio	Ratio of reinsurance ceded divided by the sum of direct premiums written plus reinsurance assumed
Lines of business Herfindahl index	Sum of the squares of the value of net written premiums in line *i* divided by insurer's total net written premiums
Geographical Herfindahl index	Sum of the squares of the value of net written premiums in state *i* divided by insurer's total net written premiums
Long-tail lines	Premiums of long-tail lines divided by total net written premiums
Weak	One 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 States	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	Development in estimated losses and loss expenses incurred two years before the current year and prior year scaled by policyholders' surplus

Table 2. Descriptive Statistics

Variables	N	Mean	Median	Std. Dev	Minimum	Maximum
Overconfidence						
OC67	252	0.5913	1.0000	0.4926	0.0000	1.0000
Net Buyer	257	0.7351	1.0000	0.4419	0.0000	1.0000
Risk Taking						
Total Risk	255	0.0318	0.0214	0.0597	0.0029	0.5745
Underwritng Risk	255	0.0615	0.0517	0.0417	0.0084	0.2605
Investment Risk	255	0.0213	0.0080	0.0808	0.0006	0.7519
Leverage Risk	257	0.6613	0.6853	0.1249	0.0490	0.8274
Performance						
Tobin's Q	255	1.1152	1.0771	0.1801	0.8165	2.1488
ROA	253	0.0416	0.0395	0.0284	-0.0642	0.1378
ROE	253	0.1260	0.1240	0.0917	-0.2315	0.5747
Stock Return	255	0.1148	0.0974	0.2524	-0.5682	1.2605
Corporate Governance						
Bsize	257	10.5564	11.0000	2.2408	5.0000	17.0000
Insider	257	0.1629	0.1330	0.0829	0.0630	0.4443
Busy	257	0.2646	0.0000	1.0736	0.0000	1.0000
Duality	257	0.6965	1.0000	0.4607	0.0000	1.0000
Institution	231	0.7324	0.7399	0.1606	0.3257	1.0000
Control Variables						
Size	253	20.8693	20.5474	1.8079	12.3909	24.0075
Reinsurance	251	0.2048	0.1078	0.2334	0.0000	1.0000
ProdHHI	249	0.3296	0.2419	0.2643	0.0933	1.0000
GeoHHI	250	0.1924	0.0665	0.2709	0.0374	1.0000
Longtail	249	0.7728	0.7749	0.1414	0.2608	1.0000
Weak	257	0.0272	0.0000	0.1631	0.0000	1.0000
Tax	257	0.4519	0.4340	0.2631	-0.5040	2.0757
Coastal States	254	0.5236	1.0000	0.5004	0.0000	1.0000
2yearloss Development	248	-0.0362	-0.0432	0.1367	-0.4679	0.5535

Table 3. Correlation Matrix

	NetBuyer	OC67	Bsize	Insider	Busy	Duality	Institution	Size	Reinsurance	ProdHHD	GeoHHD	Longtail	Weak	Tax	Coastal State	2year Loss Dev
NetBuyer	1															
OC67	0.0816	1														
	0.2067															
Bsize	0.2562	-0.1889	1													
	<0.001	0.0032														
Insider	-0.0232	0.1835	-0.3123	1												
	0.7200	0.0043	<.0001													
Busy	0.0694	-0.1739	0.0579	-0.3039	1											
	0.2833	0.0068	0.3712	<.0001												
Duality	-0.1422	-0.1539	-0.0331	-0.1510	0.1056	1										
	0.0272	0.0167	0.6095	0.0190	0.1019											
Institution	0.1202	0.1949	-0.2474	-0.1393	0.0801	0.1497	1									
	0.0786	0.0041	0.0002	0.0413	0.2423	0.0282										
Size	0.2396	-0.0911	0.3654	-0.4027	0.4394	0.3326	0.0019	1								
	0.0002	0.1621	<.0001	<.0001	<.0001	<.0001	0.9784									
Reinsurance	-0.0917	0.1950	-0.0255	0.1344	-0.3086	-0.4531	-0.0548	-0.4854	1							
	0.1613	0.0027	0.6979	0.0396	<.0001	<.0001	0.4307	<.0001								
ProdHHD	-0.0697	-0.1290	-0.3649	0.1761	-0.0175	-0.0599	0.1198	-0.2704	-0.3277	1						
	0.2889	0.0492	<.0001	0.0070	0.7906	0.3628	0.0855	<.0001	<.0001							
GeoHHD	-0.3077	-0.1655	-0.5492	0.3201	0.1460	-0.0363	-0.2296	-0.3881	0.0686	0.2881	1					
	<0.001	0.0113	<.0001	<.0001	0.0255	0.5807	0.0009	<.0001	0.2962	<.0001						
Longtail	-0.2199	-0.3388	-0.0674	0.0513	-0.1020	0.1558	0.1608	-0.0564	-0.2027	0.4692	-0.0626	1				
	0.0001	<.0001	0.3060	0.4360	0.1205	0.0174	0.0206	0.3915	0.0020	<.0001	0.3448					
Weak	-0.1112	-0.1116	-0.0591	-0.0113	-0.0494	0.0576	-0.0710	-0.0404	0.0047	0.0908	-0.0032	0.1539	1			
	0.085	0.0838	0.3608	0.8615	0.4449	0.3735	0.2998	0.5364	0.9431	0.1670	0.9612	0.0188				
Tax	0.0595	-0.1478	0.1016	-0.0107	0.1620	-0.0218	-0.3244	0.1157	0.0307	-0.1235	0.0537	-0.0380	0.1341	1		
	0.3577	0.0217	0.1157	0.8690	0.0118	0.7360	<.0001	0.0756	0.6392	0.0598	0.4137	0.5637	0.0375			
Coastal State	0.0469	0.0876	-0.1356	0.3408	-0.0650	0.0218	0.2074	-0.2141	0.2599	-0.0904	0.1802	0.2566	-0.0880	0.0037	1	
	0.4707	0.1778	0.0366	<.0001	0.3180	0.7376	0.0024	0.0010	<.0001	0.1692	0.0057	<.0001	0.1759	0.9553		
2year Loss Dev	-0.1855	0.0116	-0.0506	-0.0288	-0.1076	0.0168	-0.1056	0.0464	0.2104	-0.3120	-0.0708	-0.0551	0.2920	0.0382	-0.0637	1
	0.0046	0.8602	0.4429	0.6624	0.1020	0.7991	0.1264	0.4854	0.0014	<.0001	0.2879	0.4116	<.0001	0.5632	0.3376	

Table 4. Univariate Differences

Variables	(1) Net Buyer =1		(2) Net Buyer=0		(3) OC67 =1		(4) OC67 =0		(1)-(2)		(3)-(4)	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Total Risk	0.0242	0.0209	0.0529	0.0255	0.0317	0.0214	0.0339	0.0226	-0.0287**	-0.0044**	-0.0022	0.0012
Underwritng Risk	0.0575	0.0513	0.0725	0.0552	0.0508	0.0421	0.0796	0.0708	-0.0149**	-0.0037	-0.0288**	-0.0287***
Investment Risk	0.0120	0.0086	0.0470	0.0075	0.0220	0.0087	0.0219	0.0074	-0.0351*	0.0011	0.0001	0.0013
Leverage Risk	0.6564	0.6822	0.6749	0.7052	0.6569	0.6712	0.6714	0.7139	-0.0185	-0.0230	-0.0114	-0.0427***
Tobin's Q	1.1127	1.0799	1.1220	1.0522	1.1396	1.0924	1.0581	1.0485	-0.0093	0.0277	0.0815***	0.0439***
ROA	0.0422	0.0395	0.0400	0.0376	0.0407	0.0426	0.0398	0.0371	0.0022	0.0019	0.0009	0.0055
ROE	0.1272	0.1301	0.1231	0.1090	0.1293	0.1301	0.1226	0.1061	0.0041	0.0211	0.0067	0.0240
Stock Return	0.1268	0.1614	0.1112	0.0900	0.1570	0.1233	0.0776	0.0614	0.0157	0.0714	0.0794***	0.0619**
Bsize	10.8624	11.0000	9.7059	9.0000	10. 3197	10.0000	11.2353	11.0000	1.1566***	2.0000***	-0.9156**	-1.0000***
Insider	0.1628	0.1250	0.163	0.1429	0.1719	0.1818	0.1447	0.1111	-0.0002	-0.0179	0.0271	0.0707**
Busy	0.2804	0.0000	0.2206	0.0000	0.2041	0.0000	0.3529	0.0000	0.0598	0.0000	-0.1489**	0.0000
Duality	0.6561	1.0000	0.8088	1.0000	0.6531	1.0000	0.7941	1.0000	-0.1527**	0.0000	-0.1411**	0.0000
Institution	0.7434	0.7529	0.7004	0.7186	0.7489	0.7396	0.6909	0.7215	0.0430	0.0343	0.0580***	0.0481**
Size	21.0382	20.8659	20.4097	20.214	20.8963	20.6562	21.2138	20.6712	0.6285***	0.6519***	-0.3175	-0.0150**
Reinsurance	0.2435	0.1157	0.1912	0.1033	0.2447	0.1641	0.1545	0.0892	0.0523	0.0124	0.0902***	0.0749***
ProdHHI	0.3174	0.2198	0.364	0.3052	0.3038	0.2516	0.3733	0.1378	-0.0466	-0.0854	-0.0695*	0.1138*
GeoHHI	0.1531	0.0596	0.3065	0.0971	0.1454	0.0641	0.2288	0.0855	-0.1533***	-0.0375***	-0.0834**	-0.0214**
Longtail	0.7544	0.7623	0.8223	0.8222	0.7375	0.6937	0.8275	0.8189	-0.0670	-0.0599***	-0.0900***	-0.1252***
Weak	0.0159	0.0000	0.0588	1.0000	0.0136	0.0000	0.0500	0.0000	-0.0430*	-1.0000**	-0.0364*	0.0000
Tax	0.4599	0.4440	0.4296	0.4178	0.4943	0.4506	0.4251	0.4126	0.0304	0.0261*	0.0692**	0.0380*
Coast State	0.5319	1.0000	0.5000	0.0000	0.5655	1.0000	0.4747	0.0000	0.0319	1.0000*	0.0908	1.0000**
2year Loss Dev	-0.0512	-0.0492	0.0042	-0.0227	-0.0360	-0.0461	-0.0375	-0.0226	-0.0554	-0.0265***	0.0016	-0.0235

Table 5. Regression Results of Risk Taking on CEO Overconfidence (Option holdings-based measure)

Dependent Variables:	**Risk Taking**				
	Total Risk	**Underwriting Risk**	**Investment Risk**	**Leverage risk**	**Reinsurance Demand**
Intercept	-0.0017	0.2222***	0.1377	-1.5720***	3.9294***
	(0.0236)	(0.0612)	(0.0996)	(0.3493)	(0.4854)
OC67	-0.0113***	-0.0462***	-0.0010	-0.0247**	0.0396***
	(0.0019)	(0.0051)	(0.0037)	(0.0129)	(0.0172)
Bsize	-0.0027***	-0.0059***	-0.0007	0.0062**	-0.0088**
	(0.0005)	(0.0013)	(0.0009)	(0.0031)	(0.0037)
Insider	0.0002	0.0003	0.0004	0.0020*	-0.0019
	(0.0001)	(0.0004)	(0.0003)	(0.0010)	(0.0014)
Busy	-0.0061**	-0.0017	-0.0003	-0.0258	-0.0173***
	(0.0024)	(0.0062)	(0.0046)	(0.0163)	(0.0180)
Duality	-0.0007	-0.0168**	0.0050	0.0231**	-0.0156
	(0.0021)	(0.0055)	(0.0032)	(0.0111)	(0.0158)
Institution	-0.0010	0.0867***	-0.0967***	-0.0256	0.0491
	(0.0075)	(0.0195)	(0.0119)	(0.0419)	(0.0633)
Size	0.0039***	-0.0039	0.0014	0.1088***	-0.1887***
	(0.0009)	(0.0023)	(0.0046)	(0.0161)	(0.0311)
Reinsurance	0.0129	0.0276*	-0.0028	0.1429***	
	(0.0062)	(0.0160)	(0.0140)	(0.0491)	
ProdHHI	0.0031***	0.0302***	0.0075	-0.0037	0.1585**
	(0.0041)	(0.0106)	(0.0117)	(0.0412)	(0.0803)
GeoHHI	0.0009	-0.0253*	-0.0826***	-0.0226***	0.4785***
	(0.0057)	(0.0148)	(0.0215)	(0.0754)	(0.1096)
Longtail	-0.0452***	-0.0591	0.0318	-0.0127	-0.4577
	(0.0275)	(0.0183)	(0.0233)	(0.0817)	(0.1539)
Weak	0.0071***	0.0275***	0.0128**	-0.0186	0.04886
	(0.0047)	(0.0120)	(0.0050)	(0.0177)	(0.0218)
Tax					-0.0025
					(0.0306)
Coastal State					-0.0134
					(0.0186)
2yeaLossDevelopment					0.1523***
					(0.0558)
Adjusted R-square	0.538	0.550	0.658	0.896	0.831
Observations	252	252	252	252	248

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

Table 6. Regression Results of Risk Taking on CEO Overconfidence (Net stock purchase-based measure)

Dependent Variables:	**Risk Taking**				
	Total Risk	**Underwriting Risk**	**Investment Risk**	**Leverage risk**	**Reinsurance Demand**
Intercept	-0.0851	-0.1622	0.1344**	-1.4230***	3.8876***
	(0.0819)	(0.0612)	(0.0083)	(0.3036)	(0.3750)
Netbuyer	-0.0129***	-0.0371***	-0.0048	-0.0231**	0.0592***
	(0.0041)	(0.0103)	(0.0041)	(0.0113)	(0.0179)
Bsize	-0.0018**	-0.0044***	-0.0008	0.0052	-0.0027
	(0.0008)	(0.0021)	(0.0008)	(0.0058)	(0.0049)
Insider	0.0004	0.0004	0.0004	0.0008	-0.0014
	(0.0003)	(0.0007)	(0.0003)	(0.0015)	(0.0016)
Busy	-0.0039	-0.0061	0.0012	-0.0352***	-0.0217***
	(0.0037)	(0.0093)	(0.0039)	(0.0105)	(0.0209)
Duality	-0.0028	-0.0212***	0.0041	0.0149**	-0.0264*
	(0.0029)	(0.0074)	(0.0029)	(0.0081)	(0.0154)
Institution	-0.0165	0.0528*	-0.1029***	-0.0285	0.0559
	(0.0014)	(0.0290)	(0.0116)	(0.0339)	(0.0664)
Size	0.0068***	0.0084	-0.0008	0.1044***	-0.1954***
	(0.0037)	(0.0094)	(0.0038)	(0.0171)	(0.0185)
Reinsurance	0.0258**	0.0812**	0.0029	0.1437**	
	(0.0130)	(0.0331)	(0.0133)	(0.0621)	
ProdHHI	0.0327***	0.0614**	0.0027	-0.0084	0.2303***
	(0.0108)	(0.0275)	(0.0110)	(0.0283)	(0.0639)
GeoHHI	-0.0158	-0.0202*	-0.0894***	-0.2531***	0.5732***
	(0.0194)	(0.0493)	(0.0197)	(0.0841)	(0.1172)
Longtail	-0.0041	0.0539	0.0374	-0.0140	-0.4677
	(0.0213)	(0.0542)	(0.0217)	(0.0643)	(0.1132)
Weak	0.0059***	0.0149	0.0122*	0.0049**	0.0599
	(0.0047)	(0.0120)	(0.0047)	(0.0222)	(0.0274)
Tax					0.0060
					(0.0276)
Coastal State					-0.0040
					(0.0481)
2yeaLossDevelopment					0.1610***
					(0.0543)
Adjusted R-square	0.626	0.677	0.673	0.821	0.832
Observations	257	257	257	257	251

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

Table 7. Regression Results of Effect of SOX on Overconfident CEO's Risk Taking (Option holdings-based measure)

Dependent Variables:	**Risk Taking**				
	Total Risk	**Underwriting Risk**	**Investment Risk**	**Leverage risk**	**Reinsurance Demand**
Intercept	-0.0004	0.2136***	0.0584***	-1.5043***	2.2025***
	(0.0189)	(0.0590)	(0.0222)	(0.3489)	(0.2495)
OC67	-0.0051**	-0.0168**	-0.0135**	-0.0421**	0.0795**
	(0.0031)	(0.0091)	(0.0041)	(0.0200)	(0.0316)
SOX	0.0033	0.0062	-0.0127***	-0.1209*	0.0245
	(0.0026)	(0.0087)	(0.0046)	(0.0204)	(0.0332)
SOX ×OC67	-0.0033	-0.0369***	0.0107**	0.0309	0.0279
	(0.0032)	(0.0097)	(0.0041)	(0.0329)	(0.0337)
Bsize	-0.0013***	-0.0054***	-0.0017**	0.0041	-0.0034
	(0.0004)	(0.0012)	(0.0007)	(0.0046)	(0.0065)
Insider	0.0002	-0.0005	0.0002	0.0021	-0.0076***
	(0.0001)	(0.0003)	(0.0001)	(0.0013)	(0.0017)
Busy	-0.0055***	-0.0062	-0.0046**	-0.0276*	-0.0039***
	(0.0020)	(0.0061)	(0.0023)	(0.0154)	(0.0314)
Duality	-0.0009	-0.0189***	0.0070	0.0242***	-0.0788***
	(0.0018)	(0.0054)	(0.0019)	(0.0074)	(0.0251)
Institution	0.0038	0.0884***	-0.0369***	-0.0034	0.0651
	(0.0061)	(0.0188)	(0.0123)	(0.0355)	(0.0932)
Size	0.0023***	-0.0038	0.0003	0.1042***	-0.0817***
	(0.0007)	(0.0020)	(0.0052)	(0.0220)	(0.0087)
Reinsurance	0.0064	0.0238*	0.0023	0.1406**	
	(0.0052)	(0.0155)	(0.0052)	(0.0593)	
ProdHHI	0.0210***	0.0237**	0.0261***	0.0108	-0.0234***
	(0.0035)	(0.0104)	(0.0065)	(0.0410)	(0.0521)
GeoHHI	-0.0001	-0.0125	-0.0225***	-0.0207**	0.2707***
	(0.0048)	(0.0147)	(0.0054)	(0.0816)	(0.0682)
Longtail	-0.0314***	-0.0536	-0.0147	-0.0090	-0.1193
	(0.0059)	(0.0177)	(0.0104)	(0.0714)	(0.1035)
Weak	0.0063**	0.0317***	0.0116	-0.0023	0.0747
	(0.0037)	(0.0117)	(0.0115)	(0.0132)	(0.0578)
Tax					-0.0523
					(0.0436)
Coastal State					0.0725***
					(0.0253)
2yeaLossDevelopment					0.1993**
					(0.0969)
Adjusted R-square	0.594	0.599	0.661	0.898	0.843
Observations	252	252	252	252	248

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

Table 8. Regression Results of Effect of SOX on Overconfident CEO's Risk Taking (Net stock purchase-based measure)

Dependent Variables:	**Risk Taking**				
	Total Risk	**Underwriting Risk**	**Investment Risk**	**Leverage risk**	**Reinsurance Demand**
Intercept	-0.0276	0.2520***	0.0638	-1.0770***	2.2238***
	(0.0857)	(0.2660)	(0.0865)	(0.3104)	(0.2316)
Netbuyer	-0.0067**	-0.0229**	-0.0123**	-0.0138	0.0659*
	(0.0036)	(0.0154)	(0.0050)	(0.0180)	(0.0375)
SOX	0.0418	0.0043	-0.0139	-0.0067	0.1286***
	(0.0145)	(0.0028)	(0.0085)	(0.0078)	(0.0403)
SOX ×Netbuyer	-0.0108*	-0.0662***	0.0132**	-0.0651***	0.2081***
	(0.0056)	(0.0160)	(0.0052)	(0.0187)	(0.0437)
Bsize	-0.0018***	-0.0063**	-0.0009	0.0056	-0.0023
	(0.0008)	(0.0025)	(0.0008)	(0.0029)	(0.0059)
Insider	0.0005	-0.0029	0.0004	0.0009	-0.0061***
	(0.0004)	(0.0008)	(0.0003)	(0.0010)	(0.0015)
Busy	-0.0035	-0.0053	-0.0005	-0.0319**	-0.0141***
	(0.0046)	(0.0113)	(0.0037)	(0.0132)	(0.0278)
Duality	-0.0015	-0.0134	0.0025	0.0226	-0.0917***
	(0.0037)	(0.0091)	(0.0029)	(0.0106)	(0.0217)
Institution	-0.0019	-0.0166	-0.0992***	-0.0469	0.0934
	(0.0156)	(0.0354)	(0.0115)	(0.0414)	(0.0871)
Size	0.0044***	-0.0063	0.0021	0.0898***	-0.0189***
	(0.0043)	(0.0120)	(0.0039)	(0.0140)	(0.0076)
Reinsurance	0.0247**	0.1827**	0.0041	0.1374***	
	(0.0150)	(0.0401)	(0.0131)	(0.0468)	
ProdHHI	0.0209	0.0278	0.0172***	0.0794	-0.0148***
	(0.0183)	(0.0377)	(0.0122)	(0.0439)	(0.0445)
GeoHHI	-0.0138	-0.0412	-0.0919***	-0.2410****	0.4236***
	(0.0198)	(0.0598)	(0.0195)	(0.0698)	(0.0663)
Longtail	0.0015	0.0683	0.0305	0.0195	-0.3522
	(0.0289)	(0.0661)	(0.0215)	(0.0771)	(0.0810)
Weak	0.0075	0.0275***	0.0102**	0.0369**	0.1048**
	(0.0051)	(0.0147)	(0.0048)	(0.0171)	(0.0551)
Tax					-0.0794*
					(0.0424)
Coastal State					0.1122***
					(0.0210)
2yeaLossDevelopment					0.2339**
					(0.0896)
Adjusted R-square	0.634	0.687	0.685	0.861	0.897
Observations	257	257	257	257	251

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

Table 9. Regression Results of Effect of Financial Crisis on Overconfident CEO's Risk Taking (Option holdings-based measure)

Dependent Variables:	**Risk Taking**				
	Total Risk	**Underwriting Risk**	**Investment Risk**	**Leverage risk**	**Reinsurance Demand**
Intercept	-0.0012	-0.0773	0.0605***	-1.5186***	2.1886***
	(0.0237)	(0.0590)	(0.0227)	(0.3357)	(0.2571)
O67	-0.0117***	-0.0121**	-0.0007***	-0.0332**	0.0689***
	(0.0021)	(0.0083)	(0.0018)	(0.0128)	(0.0171)
Crisis	-0.0041	-0.0645	0.0018	0.0476**	0.0283
	(0.0034)	(0.0185)	(0.0048)	(0.0284)	(0.0194)
Crisis ×OC67	0.0017	0.0005	0.0075**	0.0508***	-0.0604***
	(0.0042)	(0.0100)	(0.0031)	(0.0154)	(0.0130)
Bsize	-0.0027***	-0.0042**	-0.0015**	0.0061	-0.0029
	(0.0005)	(0.0019)	(0.0006)	(0.0031)	(0.0094)
Insider	0.0002	0.0008	0.0002	0.0025**	-0.0077***
	(0.0001)	(0.0007)	(0.0001)	(0.0010)	(0.0023)
Busy	-0.0059**	-0.0068	-0.0052**	-0.0198	-0.0054
	(0.0024)	(0.0104)	(0.0025)	(0.0159)	(0.0220)
Duality	-0.0006	-0.0116***	0.0068***	0.0244**	-0.0786***
	(0.0022)	(0.0070)	(0.0019)	(0.0108)	(0.0265)
Institution	-0.0013	0.0740***	-0.0374***	-0.0081	0.0658
	(0.0076)	(0.0267)	(0.0128)	(0.0411)	(0.0859)
Size	0.0039***	0.0703	0.0003	0.1073***	-0.0837***
	(0.0009)	(0.0102)	(0.0008)	(0.0156)	(0.0091)
Reinsurance	0.0131**	0.0559*	0.0019	0.1519***	
	(0.0062)	(0.0311)	(0.0053)	(0.0479)	
ProdHHI	0.0334***	0.0965***	0.0252***	0.0046	0.2321***
	(0.0042)	(0.0261)	(0.0070)	(0.0401)	(0.0373)
GeoHHI	0.0005	0.0216	-0.0204***	-0.2417***	0.2660***
	(0.0058)	(0.0429)	(0.0052)	(0.0736)	(0.0776)
Longtail	-0.0457***	0.0075	-0.0150	-0.0476	-0.1189
	(0.0072)	(0.0522)	(0.0096)	(0.0803)	(0.0828)
Weak	0.0007	0.0128***	0.0131	-0.0167	0.0688
	(0.0047)	(0.0112)	(0.0113)	(0.0173)	(0.0447)
Tax					-0.0569*
					(0.0337)
Coastal State					0.0747***
					(0.0245)
2yeaLossDevelopment					0.2135**
					(0.1078)
Adjusted R-square	0.538	0.731	0.671	0.898	0.857
Observations	252	252	252	252	248

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

Table 10. Regression Results of Effect of Financial Crisis on Overconfident CEO's Risk Taking (Net purchase-based measure)

Dependent Variables:	**Risk Taking**				
	Total Risk	**Underwriting Risk**	**Investment Risk**	**Leverage risk**	**Reinsurance Demand**
Intercept	-0.0802	-0.1571***	0.1419	-1.3934***	3.7088***
	(0.0803)	(0.1041)	(0.0816)	(0.0277)	(0.0158)
Netbuyer	-0.0137***	-0.0379***	-0.0062	-0.0283**	0.0509***
	(0.0040)	(0.0104)	(0.0050)	(0.0146)	(0.0182)
Crisis	0.0864	-0.0485	0.0151	0.0150**	0.0202
	(0.0119)	(0.0285)	(0.1107)	(0.0401)	(0.0365)
Crisis ×Netbuyer	0.0107**	0.0133	0.0168***	0.0656***	-0.0032
	(0.0050)	(0.0128)	(0.0049)	(0.0181)	(0.0290)
Bsize	-0.0019**	-0.0045**	-0.0009	0.0048**	-0.0024
	(0.0008)	(0.0021)	(0.0006)	(0.0029)	(0.0050)
Insider	0.0014	0.0004	0.0004	0.0008	-0.0011
	(0.0003)	(0.0007)	(0.0002)	(0.0009)	(0.0016)
Busy	-0.0036	-0.0059	-0.0015	-0.0338**	-0.1134
	(0.0035)	(0.0093)	(0.0036)	(0.0131)	(0.0212)
Duality	-0.0032	-0.0216***	0.0075	0.0126	-0.0245***
	(0.0029)	(0.0074)	(0.0029)	(0.0104)	(0.0155)
Institution	-0.0153	-0.0542*	-0.1009***	-0.0210	0.0597
	(0.0114)	(0.0292)	(0.0113)	(0.0411)	(0.0673)
Size	0.0063**	0.0079	0.0015	0.1018***	-0.1758***
	(0.0037)	(0.0055)	(0.0037)	(0.0134)	(0.0105)
Reinsurance	0.0246**	0.0800**	0.0011	0.1365***	
	(0.0130)	(0.0333)	(0.0129)	(0.0465)	
ProdHHI	0.0344***	0.0631	0.0052***	0.0015	0.2543***
	(0.0108)	(0.0277)	(0.0108)	(0.0290)	(0.0638)
GeoHHI	-0.0152	-0.0197	-0.0886***	-0.2500****	-0.5217
	(0.0193)	(0.0495)	(0.0192)	(0.0697)	(0.1172)
Longtail	0.0006	0.0589	0.4462**	0.0146***	-0.4469
	(0.0213)	(0.0546)	(0.0212)	(0.0719)	(0.1169)
Weak	0.0051	0.0141	0.0110***	0.0519***	0.0511**
	(0.0047)	(0.0120)	(0.0047)	(0.0169)	(0.0278)
Tax					-0.0091
					(0.0263)
Coastal State					-0.0035
					(0.0491)
2yeaLossDevelopment					0.2131***
					(0.0511)
Adjusted R-square	0.637	0.678	0.694	0.896	0.859
Observations	257	257	257	257	251

Note: The table reports the results of two-way fixed effects regressions. See Table 1 for variable definitions. Standard errors are reported in parentheses.

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

Table 11. Regression Results of Firm Performance on CEO Overconfidence

Dependent Variables:	**Firm Performance**							
	Tobin's Q	**ROA**	**ROE**	**Stock Return**	**Tobin's Q**	**ROA**	**ROE**	**Stock Return**
	Option-Based Measure				**Net Purchase-Based Measure**			
Intercept	1.3518***	-0.2827***	-1.3406**	-1.6512***	0.1819***	0.0648***	-0.8637***	-2.2699***
	(0.3553)	(0.2404)	(0.6798)	(0.3331)	(0.7290)	(0.2154)	(0.7055)	(0.7480)
CEO Overconfidence	0.0578**	0.0116**	0.0510**	0.0869**	0.0634**	0.0319***	0.0721**	0.0847***
	(0.0216)	(0.0068)	(0.0288)	(0.0406)	(0.0346)	(0.0110)	(0.0361)	(0.0249)
Bsize	0.0022	0.0027	-0.0009	-0.0262**	0.0079	0.0003	0.0068	-0.0067
	(0.0068)	(0.0022)	(0.0082)	(0.0182)	(0.0067)	(0.0019)	(0.0014)	(0.0172)
Insider	0.0019	-0.0012	-0.0014	-0.0008	0.0053**	0.0008	0.0012	0.0072
	(0.0025)	(0.0008)	(0.0031)	(0.0081)	(0.0026)	(0.0007)	(0.0025)	(0.0077)
Busy	0.0583***	0.0078	0.0161	0.0540	0.0730***	0.0189**	0.0343***	0.0933
	(0.0115)	(0.0102)	(0.0334)	(0.0917)	(0.0275)	(0.0084)	(0.0267)	(0.0826)
Duality	-0.0158	-0.0058**	-0.0159	-0.1593**	0.0395	-0.0023**	-0.0105	0.0221
	(0.0436)	(0.0113)	(0.0297)	(0.0733)	(0.0253)	(0.0076)	(0.0249)	(0.0737)
Institution	-0.0609	0.0537**	0.1797*	0.4925***	0.1646**	0.0288	0.1302*	-0.0209
	(0.0941)	(0.0358)	(0.0962)	(0.2916)	(0.0907)	(0.0265)	(0.0867)	(0.1986)
Size	0.0072	0.1043	0.0498**	0.0755**	0.0081	0.0035	0.5230	0.1189**
	(0.0143)	(0.0110)	(0.0328)	(0.1106)	(0.0338)	(0.0099)	(0.0327)	(0.0676)
Reinsurance	-0.1201**	-0.0765**	-0.9904	0.0285	-0.2040	-0.0786**	-0.1916	0.1055
	(0.0639)	(0.0371)	(0.1350)	(0.4223)	(0.1272)	(0.0377)	(0.1236)	(0.4474)
ProdHHI	0.2208***	0.0742***	0.3032***	0.5076***	0.1689**	0.0647**	0.3493***	0.1874***
	(0.0545)	(0.0236)	(0.1090)	(0.3333)	(0.0926)	(0.0274)	(0.0898)	(0.2426)
GeoHHI	-0.1677***	0.1322**	0.5507***	-0.1820	-0.2911**	0.0149	0.0776	0.4054
	(0.0385)	(0.6609)	(0.1799)	(0.6213)	(0.1768)	(0.0516)	(0.0101)	(0.4435)
Longtail	-0.3727***	-0.0768	-0.0645	-0.1959	-0.0424	-0.1516**	-0.5048***	-0.4434***
	(0.0629)	(0.0712)	(0.2715)	(0.6619)	(0.2246)	(0.0677)	(0.2182)	(0.5262)
Weak	-0.0153	0.0092	0.0366	0.1237	-0.0136	0.0191	0.0597	0.0266
	(0.0059)	(0.0207)	(0.0427)	(0.1024)	(0.0391)	(0.0116)	(0.0381)	(0.0551)
Adjusted R-square	0.506	0.570	0.621	0.632	0.871	0.628	0.612	0.534
Observations	248	248	248	248	251	251	251	251

Note: The table reports the results of two-way fixed effects regressions. See Table 1 for variable definitions. Standard errors are reported in parentheses.

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

Table 12. 2SLS Regression Results of Risk Taking on CEO Overconfidence (Option holdings-based measure)

Dependent Variables:	**Risk Taking**				
	Total Risk	**Underwriting Risk**	**Investment Risk**	**Leverage risk**	**Reinsurance Demand**
Intercept	-0.0287	0.1716***	0.0435***	-0.0057***	0.5914***
	(0.0639)	(0.0783)	(0.0342)	(0.2181)	(0.5462)
OC67	-0.0543**	-0.0767**	0.0192	-0.1985***	0.6394***
	(0.0233)	(0.0303)	(0.0132)	(0.0469)	(0.1398)
Bsize	-0.0039	-0.0051**	-0.0001	-0.0143**	-0.0388***
	(0.0027)	(0.0026)	(0.0011)	(0.0056)	(0.0146)
Insider	0.00014**	0.0011	0.0004	0.0006	0.0155
	(0.0007)	(0.0008)	(0.0003)	(0.0016)	(0.0037)
Busy	-0.0018	-0.0091	-0.0025	-0.0403*	0.0452
	(0.0060)	(0.0095)	(0.0042)	(0.0229)	(0.0529)
Duality	-0.0019	-0.0078	0.0029**	0.0195	-0.0361
	(0.0065)	(0.0074)	(0.0032)	(0.0203)	(0.0499)
Institution	0.0385*	0.0579***	-0.0317***	0.1622**	-0.3198**
	(0.0218)	(0.0226)	(0.0099)	(0.0641)	(0.1795)
Size	0.0088**	0.0753	-0.0016	0.2440***	0.0595***
	(0.0039)	(0.0041)	(0.0018)	(0.0477)	(0.0171)
Reinsurance	0.0097	0.0505**	-0.0124	0.1830***	
	(0.0275)	(0.0289)	(0.0126)	(0.0684)	
ProdHHI	0.0468***	0.0419***	0.0236***	0.0593	0.2539**
	(0.0153)	(0.0148)	(0.0065)	(0.0378)	(0.0924)
GeoHHI	-0.0111	-0.0452**	-0.0070	-0.0934*	0.0754
	(0.0174)	(0.0237)	(0.0104)	(0.0549)	(0.1473)
Longtail	-0.1433***	-0.1156	0.0141	0.5202***	0.5091**
	(0.0419)	(0.0429)	(0.0188)	(0.1044)	(0.2472)
Weak	0.0205**	0.0629	0.0205***	0.0153	0.0825
	(0.1198)	(0.0171)	(0.0075)	(0.0459)	(0.1001)
Tax					-0.0543
					(0.0796)
Coastal State					0.1217**
					(0.0493)
2yeaLossDevelopment					-0.0045
					(0.1502)
Adjusted R-square	0.407	0.482	0.426	0.467	0.475
Observations	252	252	252	252	248

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

Table 13. 2SLS Regression Results of Risk Taking on CEO Overconfidence (Net stock purchase-based measure)

Dependent Variables:	**Risk Taking**				
	Total Risk	**Underwriting Risk**	**Investment Risk**	**Leverage risk**	**Reinsurance Demand**
Intercept	-0.0285	-0.4625***	0.0448***	0.4445**	2.5369***
	(0.1003)	(0.1149)	(0.0464)	(0.2443)	(0.9548)
Netbuyer	-0.0509**	-0.0978***	-0.0025	-0.1778***	1.5993***
	(0.0264)	(0.0303)	(0.0152)	(0.0645)	(0.5598)
Bsize	-0.0001	0.0009	-0.0013**	-0.0006	0.0255
	(0.0018)	(0.0027)	(0.0007)	(0.0047)	(0.0268)
Insider	-0.0002	-0.0009**	0.0001	-0.0034***	-0.0383***
	(0.0005)	(0.0006)	(0.0002)	(0.0018)	(0.0130)
Busy	-0.0131	-0.0182	-0.0054	0.0137	-0.3375***
	(0.0084)	(0.0096)	(0.0031)	(0.0204)	(0.1552)
Duality	-0.0008	-0.0245***	0.0146	-0.0201	-0.1994**
	(0.0086)	(0.0098)	(0.0038)	(0.0208)	(0.0094)
Institution	-0.0910***	0.0978***	-0.0245**	0.2332***	-0.3659
	(0.0292)	(0.0335)	(0.0134)	(0.0711)	(0.4133)
Size	0.0047***	0.0126***	0.0001	0.0097	-0.1845***
	(0.0032)	(0.0037)	(0.0013)	(0.0078)	(0.0565)
Reinsurance	-0.0183	-0.0687**	-0.0009	-0.1226**	
	(0.0295)	(0.3381)	(0.0138)	(0.7189)	
ProdHHI	0.0787***	0.0291**	0.0243***	0.0398	0.4607
	(0.0140)	(0.0161)	(0.0048)	(0.0340)	(0.2015)
GeoHHI	-0.0663	-0.0739**	-0.0195	-0.1920***	-0.4107
	(0.0409)	(0.0317)	(0.0131)	(0.0674)	(0.2683)
Longtail	-0.0066**	0.1374	-0.0082	0.1428	-0.7059**
	(0.0041)	(0.4693)	(0.0209)	(0.0998)	(0.4184)
Weak	0.0343***	0.0388	0.0155***	0.0146	0.1996
	(0.0161)	(0.1844)	(0.0056)	(0.0392)	(0.2304)
Tax					-0.6385
					(0.2855)
Coastal State					0.3886***
					(0.1406)
2yeaLossDevelopment					0.6966
					(0.4317)
Adjusted R-square	0.406	0.495	0.488	0.462	0.483
Observations	257	257	257	257	251

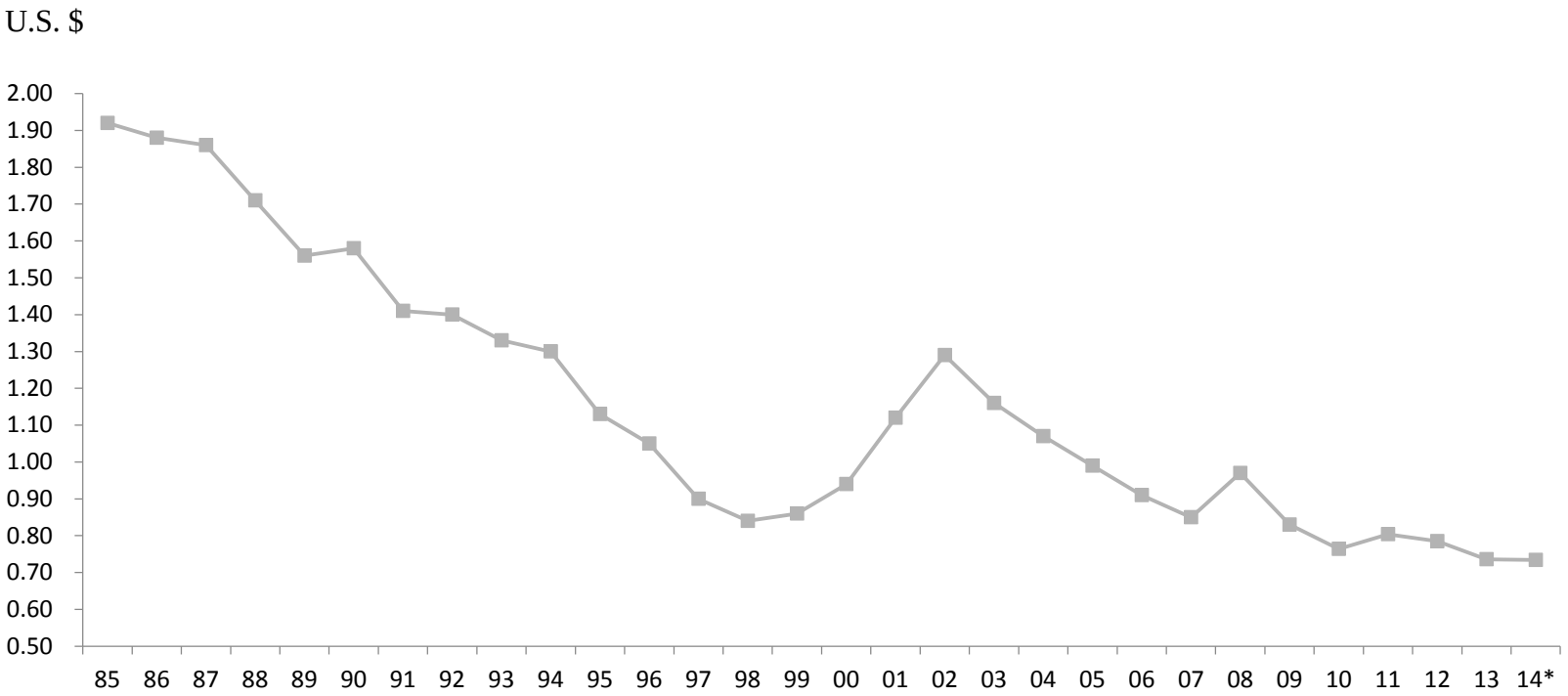
Note: The table reports the results of two-way fixed effects regressions. See Table 1 for variable definitions. Standard errors are reported in parentheses.
***, ** and * represent statistical significance at 0.01, 0.05, and 0.10 level, respectively.

Table 14. Regression Result of Firm Performance (ROA) on Underwriting Return and Investment Return

Dependent Variable:	**ROA**					
	Full sample		**Firms with overconfident CEO**		**Firms with non-overconfident CEO**	
	Option-Based	**Net Purchase**	**Option-Based**	**Net Purchase**	**Option-Based**	**Net Purchase**
Intercept	-0.0607***	-0.0658	-0.2409**	- 0.0824***	0.4344	0.4875
	(0.1192)	(0.0523)	(0.1471)	(0.0297)	(0.4068)	(0.5851)
UROA	0.0100**	0.0054**	0.1379***	0.0083***	0.0017	0.0016
	(0.0059)	(0.0029)	(0.0258)	(0.0025)	(0.0012)	(0.0087)
ROI	0.0362	0.0757	0.0423	0.0649	0.0645	0.1375
	(0.0407)	(0.1214)	(0.0435)	(0.0720)	(0.1163)	(0.3970)
Size	0.0303***	0.0084***	0.0144***	0.0035***	0.0215	0.0077
	(0.0057)	(0.0022)	(0.0065)	(0.0012)	(0.0189)	(0.0221)
Leverage	-0.1389***	-0.0881***	-0.0708***	-0.0717***	-0.0539	-0.3167**
	(0.0330)	(0.0306)	(0.0565)	(0.0172)	(0.0504)	(0.1232)
Reinsurance	-0.0482**	-0.0332**	-0.0222***	-0.0632***	-0.1899**	-0.0894
	(0.0257)	(0.0153)	(0.0263)	(0.0094)	(0.1027)	(0.0787)
ProdHHI	0.0573**	0.0385***	0.0415	0.0241***	0.0846**	0.1143**
	(0.0233)	(0.0116)	(0.0617)	(0.0057)	(0.0419)	(0.0489)
GeoHHI	0.0779**	0.0209*	0.0863	0.0128	0.0742**	0.0188*
	(0.0347)	(0.0125)	(0.0901)	(0.0107)	(0.0495)	(0.0560)
Longtail	-0.0319	-0.0128	-0.0436***	-0.0558***	-0.0071	-0.1870
	(0.0460)	(0.0227)	(0.0483)	(0.0124)	(0.1483)	(0.1444)
Weak	0.0039	-0.0202	0.0148	0.0088	0.0032	-0.0539
	(0.0098)	(0.0157)	(0.0164)	(0.0092)	(0.0127)	(0.0507)
GDP growth	0.0670	-0.2017	0.1284	-0.3133	0.4264	0.1751
	(0.0962)	(0.1354)	(0.1083)	(0.1505)	(0.1532)	(0.5500)
Interest rate	0.0045***	0.0009	0.0020**	0.0018	0.0006***	0.0001
	(0.0009)	(0.0012)	(0.0011)	(0.0013)	(0.0015)	(0.0046)
Adjusted R-square	0.430	0.419	0.510	0.461	0.403	0.387
Observations	252	257	149	189	103	68

Note: The table reports the results of two-way fixed effects regressions. ***, ** and * represent statistical significance at 0.01, 0.05, and 0.10 level, respectively

Figure1. Net Premium Written to Policyholder Surplus Ratio in U.S. property-Casualty Insurance Industry over 1985-2014



* As of 6. 30. 2014.

Source: Insurance Information Institute (III).