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Gender, risk-taking and organization form : evidence from the U.S. property-casualty insurance industry

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GENDER, RISK-TAKING AND ORGANIZATION FORM: EVIDENCE FROM THE U.S. PROPERTY-CASUALTY INSURANCE INDUSTRY

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PHD

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GENDER, RISK-TAKING AND ORGANIZATION FORM: EVIDENCE FROM THE U.S. PROPERTY-CASUALTY INSURANCE INDUSTRY

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ABSTRACT

Gender, Risk-Taking and Organization Form:
Evidence from the U.S. Property-Casualty
Insurance Industry

By

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Doctor of Philosophy

In this paper, we investigate the impact of female CEOs on firm's risk-taking for U.S. property-casualty insurance companies with differing organizational forms. We analyze the three principal organizational form types in the industry—publicly traded stocks, closely held stocks, and mutuals. Less is known about the role of female CEOs in firms with organizational forms other than publicly traded stock firms. Various ownership structures are associated with varying agency costs between owners and managers. We posit that varying firm ownership structures affect the impact of female CEOs on firm risk-taking. We do not find direct evidence of female CEOs on firm risking in mutuals, consistent with the argument that mutuals operate in less complex lines of business and require less managerial discretion. However, female CEOs affect risk-taking in stocks. Specifically, female CEOs reduce the insolvency probability in closely held stocks but not in publicly traded stocks. We also incorporate female directors' participation into the analysis. Female CEOs and female directors play different roles as managers and monitors within the corporate governance mechanisms respectively. We find that, with female directors' participation, female CEOs have an additional positive effect on firm risks and performance in publicly traded stocks.

DECLARATION

I declare that this is an original work based primarily on my own research, and I warrant that all citations of previous research, published or unpublished, have been duly acknowledged.

SIGNED

LI Jing

2021. 10. 11

CERTIFICATE OF APPROVAL OF THESIS

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1. Introduction

The number of female CEOs has been reported to reach a record high in 2019, accounting for 6.6 percent of the Fortune 500 list[1]. The percentage of female directors on boards in American companies is also at a record high of 26.1% (Catalyst, 2019)[2]. Female participation in top management is no longer a rare phenomenon but steadily exhibits its salience.

Extensive studies have been conducted to investigate the effect of gender, especially in psychology and sociology. Recently, economics and finance researchers incrementally examine the gender effect, particularly in corporate finance. They treat gender as one attribute in corporate governance and demonstrate that this finer finance factor could be fulfilled through the mechanism in the boardroom and top management. The role of gender in corporate governance is frequently analyzed in this train of thought.

Female executives' participation is evident with certain benefits. Female CEOs are thought to be more innovative than their male counterparts (Gao and Zhang, 2014). Meanwhile, female CFOs show more conservative financial reporting behavior than do their male counterparts (Francis et al., 2015). By contrast, potential disadvantages also exist. Female CEOs are possibly associated with lower efficiency of capital allocation (Faccio et al., 2016). Female executives in top management teams have slower reactions and take extra time amid changing situations (Hambrick, 1996).

With the expectation of expanding and completing the corporate governance research, we construct the U.S. property and casualty insurance company sample and first test the role of female CEOs in the insurance industry. We provide the first evidence of

[1] https://fortune.com/2019/05/16/fortune-500-female-ceos
[2] https://www.catalyst.org/research/women-on-corporate-boards

gender research in the insurance industry setting.

Jensen and Meckling (1976) point out that the principal–agent relationship implies conflicts of interest between the external owner of a firm and the manager. To mitigate managers' expropriation of resources and shirking problems, corporate governance is necessary. The existing literature on corporate governance mechanisms in the insurance industry could be partitioned into two streams: internal and external mechanisms. Internal mechanisms of corporate governance cover the board of directors (BOD), CEO duality, CEO turnover, managerial compensation, insider ownership, directors and officers insurance, debt and dividend policies, and stakeholders. External mechanisms include takeover threats, monitoring from independent auditors, rating agencies, and legal environment. By adding the gender dimension in the internal mechanism, we supplement the corporate governance literature of insurance. Given that insurance companies are the organizations that deal with risks, firm risks are of considerable importance among the main corporate outcomes. Our research focuses on the relationship between firm risks and female CEOs. In accordance with the operational activities of insurance companies, we investigate two channels associated with firm risks: underwriting and investment risks.

The female CEO, with her increased participation in modern corporations, is an unavoidable factor in analyzing top management governance. We test the role of women in insurance mainly from the female CEOs' perspective. Faccio et al. (2016) find that female CEOs are associated with less corporate risk-taking behavior. We thus generally expect that female CEOs have a negative effect on firm risk-taking in insurance companies. Moreover, although female CEOs are expected to reduce firm risk-taking, female board members can also play a role in corporate decision-making. Female directors on boards are evidenced to have fewer risk-taking policies (Bernile et al., 2018). In our setting, we take the effect of female directors as a channel on female CEOs and mainly analyze the role of

female CEOs on firm risks. Hence, we interact female CEOs with the proportion of female directors on boards to examine the risk-taking behavior of female CEOs with female directors' participation. We expect that female CEOs with female directors' participation would behave differently, as female executives and female directors could have different roles in corporate governance. Female executives in top management are monitored and advised by the BOD, whereas female directors on board are monitors and advisors for managers. Literature suggests that the monitoring function of female directors is more emphasized than the advisory function by companies (Westphal and Stern, 2007). Female directors are more likely to be appointed to monitoring-related roles in the company (Adams and Ferreira, 2009) and reveal a stronger oversight effect (Srinidhi et al., 2011). Female directors have been evidenced to have a negative effect on firm risks (Bernile et al., 2018). Accordingly, we expect that female CEOs with female directors' participation have additional fewer firm risks than female CEOs without female directors' participation. Our research supplements gender literature from the corporate governance aspects by analyzing the specific risk-taking behavior of female CEOs.

Furthermore, the particular structure of governance in the insurance industry is its organizational form. One typical organizational form of the insurance industry is mutual. The management-control mechanisms and monitoring on managers from policyholders are weak in mutual forms (Hansmann, 1985; Cheng et al., 2017). Mutual and stock companies have different organizational structures and governance mechanisms, which are suggested to undergo investigation in separate settings. Our research separately examines the stock and mutual insurance companies. The analysis of female CEO risk-taking behavior in the respective sample also contributes to the research on insurance organizational form. We find that female CEOs exhibit different risk preferences in stock and mutual companies. For stock insurance companies, female CEOs significantly reduce insolvency probability,

investment, and total risks. Nonetheless, no effect has been found on risk-taking in mutual insurance companies.

We also expect that the listing status of insurance companies affects the relationship between gender and firm risks. If a firm goes public, it will behave differently from private firms. The private board monitors managers very strictly. However, with the wide diffusion of ownership rights, the public board relatively has weaker monitoring as a result of the greater owner–manager information cost. The estimated results suggest that female CEOs reduce insolvency probability and total risk in privately held stock insurance companies. However, female CEOs just affect total risks in publicly traded stock insurance companies. We argue that publicly traded stock firms have an incentive to use the appointment of female executives as a signal for outside stakeholders (Iseke and Pull, 2019).

Previous finance studies examining female participation and their association with risk in firms mostly focus only on publicly traded stock companies (Francis et al., 2015; Sila et al., 2016; Carter et al., 2017; Bernile et al., 2018; Adhikari et al., 2019). However, less is known about organizational forms other than publicly traded stock firms. Our research includes a large number of privately held stock firms in the sample and contributes to the evidence of the main corporate outcomes including insolvency probability, firm risks, ratings and performance for privately held stock firms in finance literature.

We further investigate the results of whether state female political statuses mitigate the effect of female CEO on risk-taking in insurance. The results suggest that female CEOs would reveal more risk-loving characteristics in making corporate decisions when the public expects female CEOs to have more active roles in the female-favorable environment. In high female political status states, female CEOs have relatively more risk-taking and better ratings and firm performance in publicly traded stocks.

Our study makes three major contributions to the literature. First, it is the first paper to test the role of female CEOs on risk-taking in insurance.[3] Second, the study investigates whether the effect of female CEOs on risk-taking is enhanced or mitigated by the presence of female directors. Our evidence shows that female CEOs with female directors' participation would have additionally more risk-taking in publicly traded stock insurance companies. Third, the paper extends the literature of the effect of female CEOs on risk-taking to organizational forms in the privately held stock sample, other than publicly traded stock.

The paper is arranged as follows. Section 1 introduces. Section 2 presents the literature review and hypothesis development. Section 2 details the data and elaborates the methodology. Section 4 establishes the regression results and analysis. Section 5 provides a discussion.

2. Literature and Hypothesis Development

Female and risk

Studies on risks have not reached an agreement on the female in finance literature. Previous literature has popularly maintained that female is different from male in risk preference and shows lower risk propensity (Croson and Gneezy, 2009; Carter et al., 2017; Faccio et al., 2016; Barber and Odean, 2001; Adhikari et al., 2019). Females are more risk-averse (Eckel and Grossman, 2008) and competition averse (Niederle and Vesterlund, 2007) than males in many experiments. However, mixed evidence persists. A contextual study toward financial decision making displays that female does not show a significant difference in risk preference under certain controlled conditions. However, in the

[3] Sila et al. (2016) examines the relationship of female directors and risks using a bank-holding sample for robustness test. They find no significant relationship between boardroom gender and firm risk.

uncontrolled economic situation regarding abstract gamble decisions, the female remains more risk-averse than the male. This finding shows that contexts of different financial decision-making should be considered (Schubert et al., 1999). No evidence also proves that the appointment of female directors would result in lower firm risk after controlling for endogeneity (Sila et al., 2016), and no difference exists between girls and boys in their stated risk attitudes (Booth and Nolen, 2012). A survey study even shows that female directors reveal more risk-loving preferences (also more stimulation and less tradition) than male directors, although they would be more likely to care about benevolence and universalism (Adams and Funk, 2012).

Noteworthy, we do not simply discuss female as risk-loving or risk-averse by nature. We demonstrate that the research phenomenon may also be affected by position. In our setting, we focus on the CEO position. The female CEO, who is monitored by directors, is the key person for strategic decision-making and engaging in negotiations and communications with both internal and external stakeholders. The female director, who is the monitor for the CEO, gives advising, monitoring, and decision making within the internal board rooms.

We first discuss the role of female CEO in risk-taking. Huang and Kisgen (2013) document that female executives including female CEOs and female CFOs are associated with lower percentage growth in assets, fewer acquisitions, lower leverage, and less issued debt. Female executives are proven to be risk-averse and compensated in lower pay levels (Carter et al., 2017).[4] Female CEO is found to negatively affect corporate risk-taking and with less leverage. However, the efficiency of capital allocation is not enhanced by female

[4] The research on financial managers also shows the risk aversion of female CFOs, demonstrating that female CFOs are more conservative in their accounting practices when faced with relatively high levels of risk, such as litigation, default, systematic, and job security risks (Francis et al., 2015).

CEO for the decreasing value-added growth firm investment (Faccio et al., 2016). Female managers would like to undertake less risky policies and work for firms with a lower risk-taking culture (Adhikari et al., 2019). Generally, existing literature on the top management side suggests that female executive, including female CEO, prefers fewer risks. According to the unified discussion from literature, we come up with the first main hypothesis:

Hypothesis 1:

Female CEOs have a negative effect on firm risk-taking in insurance companies.

Next, we study whether the presence of female directors enhances or alleviates the role of female CEOs on firm risk-taking.

Literature extensively studies the role of female directors in corporate governance. On the positive side, adding a female member to the board offers new perspectives and suggestions into the board, contributing to well-rounded and mature solutions (Anderson et al., 2011). Women on boards can accelerate communication and reduce possible information asymmetry brought by the gender gap (Gul et al., 2011). Female directors accelerate collaboration among inventors (Cao et al., 2016). Female directors are more likely to be independent directors on boards (Adams and Ferreira, 2009) and less likely to be fraudulent (Cumming et al., 2015). Female directors are more likely to take monitoring-related roles in the company (Adams and Ferreira, 2009) and reflect an improved oversight effect (Srinidhi et al., 2011). On the negative side, for example, tougher and excessive monitoring under female directorship than male directors may harm firm value (Adams and Ferreira, 2009).[5]

[5] Related evidence of female members in group also exist. A female member of work units may bring with her additional conflicts during discussions, potentially lowering efficiency and cohesiveness (DiTomaso et al., 2007; Herring, 2009). In a controlled experiment, women participants are found to be less effective than men participants in competitive environments as evidenced in mixed tournaments (Gneezy et al., 2003). Randomly selected agents with female

Female directors on board could lead to more moderate policies such as less debt financing, which implies lower risks (Bernile et al., 2018). However, no evidence proves that the appointment of female directors would result in lower firm risk after controlling for endogeneity (Sila et al., 2016). Some studies even show that female directors reveal more risk-loving preferences (also more stimulation and less tradition) than do male directors, although they would be more likely to care about benevolence and universalism (Adams and Funk, 2012). Unlike that with female CEOs, the relationship between female directors and risks seems to have not shown conclusive results.

From prior literature, adding women to boards has been discovered to enhance the monitoring and advisory functions of a company (Adams and Ferreira, 2009; Srinidhi et al., 2011). Westphal and Stern (2007) maintain that women directors are appointed more due to their monitoring function than their advising function. With a good reputation for better monitoring, female directors may be appointed to increase the monitoring in a firm (Adams and Ferreira, 2009). The possible increased risk in a male-dominated industry can be monitored or curbed by a board that includes female directors, rather than a male-only BOD (Eagly & Johnson, 1990; Eagly et al., 1995; Eagly & Carli, 2007). Therefore, we suppose that the monitoring function of female directors could influence the corporate board to have fewer firm risks. In our setting, when female CEOs have close interactions with female directors on board, they are thus expected to have fewer risks. We posit the second main hypothesis:

Hypothesis 2:

With female directors' participation, female CEOs have an additional negative effect on

members in a team are related to improved ability in problem-solving decision in complex situations (Hong and Page, 2004).

firm risk-taking in insurance companies.

Typical organizational form in insurance industry: mutual and stock

For the different contracting parties, different organizational forms vary in incentives, and the cost of controlling incentive issues means that different types of organizational forms work in different circumstances. We emphasize on the costs and benefits of the alternative organizational forms of the insurance industry to better evaluate the essence of their respective characteristics.

According to Mayers and Smith (2005; 2013), three vital functions are incorporated into every organizational form in insurance: manager, owner, and customer functions. Manager function indicates that appointed managers administrate operating affairs and make corporate decisions for the firm. Owner function indicates that owners of companies offer capital, own the residual claim on firm assets, and thus bear the ultimate risk of the firm. Customer function indicates that policyholders pay premiums in exchange for stipulated indemnity from insurance companies if the specified event happens.

Stock insurance companies have completely separated the manager, owner, and customer functions (Mayers and Smith, 2005). Separation helps to specialize these functions, which decreases professionalization costs (Mayers and Smith, 1994). However, separation also brings conflicts among different parties. On one hand, the separation between shareholders and managers brings the incentive problem. Managers' interests are not aligned with those of owners. Managers of the stock company do not bear the full wealth consequences of their decisions (Mayers and Smith, 2005).

On the other hand, the separation from owner and customer function results in the conflict between shareholders and policyholders (Mayers and Smith, 2005). Policyholders face incentive problems in insurance contracts that are similar to those of bondholders in

bond contracts. Shareholders have incentives to increase the value of the stock at the expense of policyholders (Mayers and Smith, 1981). After insurance contracts are issued, shareholders may adjust the dividend, financing, and investment policies of the insurer to maximize the value of their residual claims at the expense of fixed claims of policyholders. This action results in the possible value transfer from policyholders to stockholders (Mayers and Smith, 2005). Specifically, shareholders would like to undertake higher risk in expectation of higher return. The higher firm risk could increase the value of the stockholders' equity but lower the value of the policyholders' claims.

In mutual insurance companies, the owner and customer functions are merged. That is, the policyholders are both customers and owners (Mayers and Smith, 2005; He and Sommer, 2011). The conflicts between owners and customers are internalized because of the merged function of owner and customer (Mayers and Smith, 2005).

However, mutual insurance companies have less effective control of owner-manager conflicts, which result from the inalienable shares (Mayers et al., 1997; He and Sommer, 2011). As policyholders are not allowed to trade ownership claims in mutual insurance companies (Mayers and Smith,2005), it gives the weakening effect as reflected in the following: (1) Acquiring or exchanging shares or having coalitions between block holders is unlikely, and wresting control from an existing management team is costly (Mayers and Smith,1981; 1986; 2005); (2) The management incentive schemes such as stock-based compensation plans which mitigate owner-manager conflicts are inapplicable (Mayers and Smith, 2005); (3) Traded shares are absent, mutuals lack supervision from the capital market, and the threat of a hostile takeover is non-existent (Mayers et al., 1997; Mayers and Smith, 2005).

Although both stock and mutual insurance companies have owner-manager conflict, the cost of controlling and monitoring managers of mutual insurance companies

is higher. The inalienability of shares blocks the process of ownership concentration and leads to the wide diffusion of ownership. Policyholders have difficulty monitoring managers in mutuals (Hansmann, 1985). Mutuals are expected to prevail in lines where management requires less discretion (Mayers and Smith, 1994; 2005; He and Sommer, 2011; Cummins et al., 1999; 2004). Stock insurance companies are actually expected to have additional management discretion. Greater discretion leaves the capacity of individual parties of stock insurance companies to act actively. Furthermore, stock insurance companies have extra strong corporate governance which enables managers to take a relatively effective role in the governing process, and to be more likely to exert an influence on firm risks.

Literature earlier showed that stock insurance companies have riskier policies than mutual insurance companies (Lamm-Tennant and Starks, 1993). We argue that mutual insurance companies have simple and low-risk business lines and predict that the role of managers on the mutual firms' risk would be limited.

Additionally, the board monitoring on CEO is stronger in stock insurance companies than mutual insurance companies (Cheng et al., 2017). Consequently, we postulate that the risk-taking behaviors of stock insurance companies are more likely to be influenced by female CEO than those of mutual insurance companies. Thus, we expect that female CEO in stocks has a larger impact on firms' risks than peers in mutuals. we have the following hypotheses on stocks:

Hypothesis 1a: Female CEOs have a negative effect on firm risk-taking in stock insurance companies.

We expect the monitoring function of female directors influences the corporate board to have fewer firm risks. The monitoring effect of female directors is stronger in

stocks. Thus, we posit that female CEO with female directors' participation would further reduce firm risks in stocks. We give the hypothesis on stocks below:

Hypothesis 2a: With female directors' participation, female CEOs have as an additional negative effect on firm risk-taking in stock insurance companies.

According to this discussion, with less management discretion and relatively risk-averse behavior than stock insurance companies, CEOs of mutual insurance companies are expected to have a limited effect on firm risks. Therefore, the related hypotheses of mutuals are illustrated as follows:

Hypothesis 1b: Female CEOs have a limited effect on firm risk-taking in mutual insurance companies.

Previous discussion suggests that mutual insurance companies have simple risky lines. We postulate that the monitoring function of female directors is not significantly useful in mutuals. The hypothesis of mutuals is as follows:

Hypothesis 2b: With female directors' participation, female CEOs have no additional effect on firm risk-taking in mutual insurance companies.

Listing status in insurance industry: private and public

Literature suggests that private and public firms behave differently in many aspects. We focus on the information aspect in this section. Compared with private firms, public firms completely separated the owner and manager functions and extensively disperse the ownership rights, leading to additional information asymmetry. Public firm managers share relatively fewer ownership rights on average. The personal wealth of managers of private firms is closely attached to firm value. Without pressures to meet financial targets such as earnings required by the capital market, a private firm has less incentive to disguise or

manipulate the accounting numbers in its financial reports. Public firms have incentive to manipulate information (Graham et al., 2005). Private firms typically have an insider way to obtain company information, and management plays a more evident role. The requests for financial reporting of private firms are less required (Chen et al., 2011).

Widely held stock companies are proven to have greater costs in controlling conflicts between managers and owners (Mayers and Smith, 1994). To be acquainted with the company and track the CEO activity, directors need information. The fact is that inside information exists in public firms, which block the supervisory channel.

Closely held insurance companies have more direct board monitoring on managers (Ke et al., 1999). Managers of private firms are close to owners. Boards are mostly close to owners too. Thus, the owners in closely held stocks have easier access to the inside information than public stock counterparts. The less information asymmetry between managers and owners induces closer monitoring from the private board.

The monitoring function of the director declines with the increase of information cost. The public board, with more information asymmetry, has weaker monitoring on managers. We generally argue that the information asymmetry is greater in public companies (Beatty and Harris,1999; Graham et al., 2005; Chen et al. 2011). Accordingly, we expect that the monitoring effect on CEOs is weaker in publicly traded stock insurance companies.

The different functions of executives in management and boardroom hint a profound difference in female's status. Privately held stock firms have close and strong monitoring from the private board. Hence, female CEO who has a stronger private board monitoring in a private firm is expected to reduce firm risks significantly. The hypotheses of private firms are as listed:

Hypothesis 1c: Female CEOs have a negative effect on firm risk-taking in privately held stock insurance companies.

With the strong monitoring effect from the private board, female directors of privately held stock insurance companies are expected to give more pressure on female to reduce the firm risk-taking. Thus, we present the following hypothesis of private firms:

Hypothesis 2c: With female directors' participation, female CEOs have an additional negative effect on firm risk-taking in privately held stock insurance companies.

For public firms, the CEO is monitored by directors on the public board. With less effective board monitoring due to information costs to public board members, we expect that the female CEO may not reduce risk efficiently than peers in private stocks. The risk-averse characteristic of female CEO on public firms' risk is less likely to be revealed. Moreover, publicly traded stock firms have great attention from outside shareholders and stakeholders from the capital market. Without complete and efficient information about the inside corporate governance, the outside parties may more likely to directly interpret female CEO as an indicator for safe or low-risk management. Under such expectation, female CEO would be appointed as a signal instead of a real governor in publicly traded stock firms.

The focus of signaling theory is on the deliberate transfer of positive information in order to present good organizational characteristics. The first concept of signaling is raised by Spence (1973). For explaining the signaling function of education, he developed the model from the phenomenon of the labor market. Specifically, unaware of the quality of job seekers, potential employers take education as a signal to the information gap. Moreover, Ross (1977) first introduced the signaling concept into corporate finance. Debt is utilized as the signal for firm quality as only the high-quality firms can afford to pay long-term interest. With the information asymmetry between the signaler and receiver of

the publicly traded stock firm, female CEOs are expected to be appointed as a signal to show the good quality of the firm. Accordingly, we present the following hypothesis of public firms:

Hypothesis 1d: Female CEOs have a smaller effect on firm risk-taking in publicly traded stock insurance companies than do their peers in privately held stock insurance companies.

Given that publicly traded stock companies are monitored by the board, we assume that the monitoring effect of female directors can still supervise female directors to lower firm risks. The hypothesis of public firms is thus as follows:

Hypothesis 2d: With female directors' participation, female CEOs have an additional negative effect on firm risk-taking in publicly traded stock insurance companies.

3. Data and Methodology

3.1 Data and sample selection

Our data set includes the U.S. licensed public and private property and casualty insurance companies. The financial data of insurance companies are obtained from the National Association of Insurance Commissioners (NAIC) annual statement database. To calculate the standard deviation, we use the 3-year rolling-based accounting numbers, thereby granting us all the financial data available from 1998 to 2019. Ratings data are obtained from Best's Key Rating Guide.To obtain the names of officers and directors of all the U.S. property and casualty insurance companies during 2001–2017, we manually collect the available online version of the A.M. Best's Insurance Reports (bestlink.ambest.com). Then, we extract the names from the management section of these reports. The gender of CEO, president, and directors is then judged as follows. First, we extrapolate gender information by salutation such as Mr. or Mrs. and photographs from

DEF 14A Proxy statement obtained from SEC's EDGAR filing system. For most private firms, we search the gender by the individual's first name through an online name database[6] (Palvia et al., 2015). Finally, the remaining unidentified and unisex names are checked via Google, LinkedIn, Factiva, and the companies' websites.

Companies owned by a foreign parent company are dropped to avoid inconsistent corporate conduct among countries. Owing to the relative volatile performance during the merge and acquisition, the companies experienced as the target MA are eliminated. We drop the identified reinsurer companies. As with most insurance literature, we also exclude the observations with the negative surplus, assets, and premiums. The final sample consists of 1,836 firms and 24,722 firm-year observations.

3.2 Model and variables

To investigate the role of gender in corporate risk-taking behavior, we mainly analyze female officers. For the officers' side, we choose the CEO position as the representative for officers for two reasons. First, for the CEO to control the firm at the highest level directly determines the business plan and development orientation. Second, the CEO has the most comprehensive name information contained in our collected Best's reports.

We carried out the Difference-in-Difference (DID) approach which compares the firm risk before and after the transition from male CEO to female CEO. The DID approach is often utilized in event impact evaluation studies. CEO transition could be regarded as an event. In our setting, the primary advantage of using the DID model is that it offers a relatively sensible way to tackle the endogeneity problem. Specifically, the female CEOs may self-select to the companies that have risk-averse culture, and the less risky companies

[6] http://www.genderchecker.com

are more likely to hire female CEOs. The DID approach could alleviate the endogenous concern resulting from the sample selection bias and omitted characteristic variables. We forgo the traditional fixed effect model because it only deals with the time-invariant omitted variable issue, and it has a persistently large probability for endogeneity problem. As with literature (Huang and Kisgen, 2013; Francis et al., 2015), we keep the CEO who has the consecutive appointment of at least three years. This threshold reserves time for adopted policies to take effect and avoids some possible ineffective and inefficient practices. The treatment sample of male-to-female transitions is compared with the control sample of male-to-male transitions. By restricting to pre and post three years of CEO transition including the transition year, we have the final 3,506 firm-year observations (538 firms) in the regression. The DID regression is as follows:

$$\begin{aligned} Risk_{i,t+1} = \mu + \tau_t + \beta_1 Post_{i,t+1} + \beta_2 Female_i \times Post_{i,t+1} + \beta_3 Lassets_{i,t} \\ + \beta_4 Leverage_{i,t} + \beta_5 LineHerfindahl_{i,t} + \beta_6 GeoHerfindahl_{i,t} \\ + \beta_7 Personallines_{i,t} + \beta_8 Commerciallong_{i,t} + \beta_9 Usagereins_{i,t} \\ + \beta_{10} Lboardsize_{i,t} + \beta_{11} CEOduality_{i,t} + \beta_{12} OutsideDirectorPt_{i,t} \\ + \beta_{13} Femaleproportion_{i,t} + \beta_{14} Mutual_{i,t} + \beta_{15} Privatestock_{i,t} \\ + \varepsilon_{i,t} \end{aligned} \quad (1)$$

$Female_i$ is an indicator variable if firm i has male-to-female transition. $Post_{i,t+1}$ is an indicator variable if the year t+1 is after the CEO transition. Our primary variable of interest is the $Female_i \times Post_{i,t+1}$. If the coefficient of $Female_i \times Post_{i,t+1}$ is smaller than zero, it implies that the female CEO would reduce the firm risk. τ_t is year fixed effects.

Given that both public and private insurance companies are covered in our sample, we utilize accounting risk measures in the empirical framework. The risk-taking behaviors of insurance companies are captured by insolvency probability and risk measures.

We follow Grace and Leverty (2009) to calculate the propensity of insolvency ratios. Specifically, we use 19 FAST financial ratios from the FAST system to predict the probability of insolvency. The estimated ratios are selected by principal component analysis. An insurer is defined as insolvent in the year it receives its first formal regulatory actions including conservation, rehabilitation, receivership, and liquidation (Cummins et al., 1995; Grace et al., 1998; Cummins et al., 1999; Cheng and Weiss, 2012).

For the risk measures, we first test the impacts of female CEO on firm total risk, proxied by the standard deviation of return on assets (ROA). The ROA is measured by the net income before dividends and taxes to total assets. As the rolling calculation of standard deviation may cover the CEO transition year, we separate each transition sample to pre and post three-year and calculate the standard deviation respectively. Then, we keep the nearest observations that are pre and post one year to the transition year. This approach avoids the possible measurement bias resulted from the influence of turnover on total risk. Next, we investigate two potential channels: underwriting and investment risks. The underwriting risk is measured by the proportion of premium written in risky lines. The investment risk is the investment in equities and real estate divided by total invested assets.

Apart from firm risks, we also investigate the other aspect of firm outcomes. We incorporate ratings and firm performance into the analysis. The higher rating value originally indicates a worse rating result. For an easier explanation, we take the negative value of the original ratings. Therefore, the higher rating value indicates a better rating result in our regression. As the rating results usually do not have much change over time, we measure the ratings by the averaged log value of ratings before- or after-three years of the transition. Two observations that are pre-and post-one year to the transition year are kept in the rating regression. For the firm performance measure, we use the risk-adjusted performance measure, which is given by dividing ROA by its standard deviation.

We have firm- and board-specific control variables in all the equations. Eight firm-specific control variables are identified. Firm size is proxied by Lassets, which is defined as the log of total admitted assets. We expect that firm size is negatively associated with firm risks. Because of the effect of the economy of scale, large firms are expected to have an advantage in risk diversification. Moreover, they have an incentive to control business safety to maintain reputation. Leverage is measured as written premiums to surplus. We hypothesize that the firm with higher leverage would undertake more risks. The diversification and concentration, as calculated by the Herfindahl index, is reflected by Regan and Tzeng (1999). We have two insurance-related Herfindahl index variables, for product line and geographic concentration respectively. LineHerfindahl is the Herfindahl index calculated by premiums written in lines of business. GeoHerfindahl is the Herfindahl index calculated by premiums written in geographic state location. The higher value of the Herfindahl index indicates the less diversified firm's business among different lines or states. We predict that the two Herfindahl index variables are both positively associated with firm risks. Personallines is the proportion of net premiums written in personal lines. Commerciallong is the proportion of net premiums written in long-tail commercial lines. We expect that more net premiums written in personal lines and in long-tail commercial lines may be associated with less firm risks to achieve a balanced portfolio. Usagereins is the percentage of gross premiums written, that is, ceded to reinsurers. Since particular exposures or lines of business can be transferred by reinsurance, we expect that more gross premiums written ceded to reinsurers would lead to fewer firm risks.

Six board-specific control variables are also included. Lboardsize is the measurement for board size, which is calculated by the log of the total number of directors on board. As suggested by Guest (2009), smaller boards are more effective in monitoring managers and have better firm performance than larger boards. Thus, the predicted sign for

the log of board size on firm risks is positive. CEOduality equals 1 if CEO and chairman of the board are the same person; otherwise, 0. The concentrated power own by one person reduces the degree of effective monitoring. We expect that CEO duality is positively related to firm risks. OutsideDirectorPt is the number of outside directors divided by the total number of directors. More outside directors imply less influence from insiders and more supervision and advisory from independent parties. We hypothesize that the fraction of outside directors on board is negatively associated with firm risks. Femaleproportion is the number of female directors on board. Consistent with hypothesis 2, we expect that the proportion of female directors on board is negatively related to the firm's risk-taking. Mutual equals 1 if the firm's organization type is mutual or reciprocal; otherwise, 0 if the firm's organization type is stock. Prior literature found that stock insurance companies have more risk-taking behavior than mutual insurance companies (Lamm-Tennant and Starks, 1993; Ho et al., 2013). Therefore, we expect that mutual is negatively related to firm risks. Privatestock is an indicator variable that equals 1 if the firm is a privately held stock firm; otherwise, 0. We predict that privately held stock firm is negatively associated with firm risks.

For ratings and total risk regression, we adjust all control variables by averaging the values in respective pre- and post-three years of the transition. Consistently, the nearest observations that are pre- and post-one year to the transition year are remained.

3.3 Summary statistics

Panel A of Table 1 reports the descriptive statistics of the original sample by organizational form and listing status. The panel indicates that approximately two-fifths of the full sample are mutual firms, and three-fifths are stock firms.[7] The total sample

[7] In our sample, we incorporate mutual and reciprocals insurance companies into the mutual category.

including both mutual and stock has 24,722 firm-year observations (1,836 firms), 9,519 mutual firm-year observations (697 firms), and 15,203 stock firm-year observations (1,139 firms). Stock insurance companies are further divided into publicly and privately held stock. Public and private stocks have nearly half the proportion in the total sample, with 7,389 public stock firm-year observations (673 firms) and 7,814 private stock firm-year observations (696 firms), respectively. Panel B of Table 1 reports the descriptive statistics of the DID sample by organizational form and listing status. Mutual and stock sample and publicly traded stock and privately held stock sample are almost evenly balanced.

Although the DID sample only consists of the male-to-female and male-to-male CEO transition observations, we tabulate all types of transition in Table 2. 90.71% are male-to-male transitions, followed by male-to-female transitions (4.97%) and female-to-male transitions(4.17%).

Panel A of Table 3 illustrates the summary statistics of all the variables in DID regression. The sample includes the pre- and post-three years for male-to-female CEO and male-to-female CEO transition. We observe that underwriting risk has a larger standard deviation than investment risk and total risk. All other financial variables are within a reasonable range. Panel B compares the mean and gives the t-statistic of the difference of all the variables in mutual and stock samples. Almost all the variables have a significant difference between mutual insurance companies and stock insurance companies. Panel C compares the mean and gives the t-statistic of the difference of all the variables in the privately held stock sample and publicly traded stock. Nearly all the variables are examined to have an evident difference between publicly traded stock insurance companies and privately held stock insurance companies.

4. Empirical Results

We use the DID approach to estimate female CEOs. We report the results of the

DID approach because they deal with the endogeneity issue better than does the traditional two-way fixed effect approach and are thus more credible.

The baseline results of stock and mutual sample are presented in Section 4.1. The first part provides the main analysis for female CEOs. Moreover, the role of female CEOs on risks may change with the participation of female directors on boards. In the following part, we test this possibility by treating the number of female directors on boards as a moderator in the DID specification.

To examine whether the main results of female CEOs on firm risks vary among insurance organizational forms, we test the role of different organizational forms in Section 4.2. In this section, the difference between stock and mutual samples, privately held stock and publicly traded stock samples are analyzed separately.

In Section 4.3, we also apply one state-level moderator to complete the analysis framework. We examine the effect of the female political status of the state on the relationship between female CEOs and firm risks.

Section 4.4 illustrates some robustness tests on the baseline results.

4.1 Baseline results

4.1.1 Female CEOs in risk-taking

The results of Table 4 indicate that for the baseline sample that includes both stock and mutual insurance companies, female CEOs are negatively associated with insolvency probability, total risk and investment risk. The probability of insolvency and total risk for a firm for the three years after a male-to-female CEO transition are 0.3 and 0.8 percentage points lower than it is for a firm with a male-to-male transition, respectively. The evidence is in accordance with hypothesis 1. Furthermore, the risk-adjusted performance of the baseline sample is improved after the male-to-female CEO transition. Generally, the

findings support a positive role of female CEOs in stock and mutual insurance companies.

We find that almost all the control variables of insolvency probability have the expected signs, except for the percentage of gross premiums written ceded to reinsurers. The leverage, lines and geographic Herfindahl index are positively associated with total risk. The fraction of net premium written from personal lines is negatively related to total risk. We do not find a significant relationship between firm size, the fraction of net premium written from commercial lines, board size. CEO duality, the proportion of outside or female directors on board, private stock and total risk. The estimated sign of the fraction of the percentage of gross premiums written ceded to reinsurers is positive, possibly because the reinsurance business brings other excessive risks to the original insurer.

4.1.2 Role of female directors on female CEO in risk-taking

In this section, we add the effect of female directors' participation, which is measured by the proportion of female directors on board (Adams and Ferreira, 2009; Liu et al., 2014; Sila et al., 2016; Bennouri et al., 2018). A higher proportion of female directors on board indicates better female participation in the boardroom. We conjecture that the corporate decisions would be influenced if female CEOs and female directors coexist in a management group.

$$
\begin{aligned}
Risk_{i,t+1} = \mu + \tau_t
&+ \beta_1 Female_i \times Post_{i,t+1} \times Femaleproportion_{i,t} \\
&+ \beta_2 Female_i \times Post_{i,t+1} + \beta_3 Female_i \times Femaleproportion_{i,t} \\
&+ \beta_4 Post_{i,t+1} \times Femaleproportion_{i,t} + \beta_5 Post_{i,t+1} + \beta_6 Female_i \\
&+ \beta_7 Femaleproportion_{i,t} + \beta_8 Lassets_{i,t} + \beta_9 Leverage_{i,t} \\
&+ \beta_{10} LineHerfindahl_{i,t} + \beta_{11} GeoHerfindahl_{i,t} \\
&+ \beta_{12} Personallines_{i,t} + \beta_{13} Commerciallong_{i,t} + \beta_{14} Usagereins_{i,t} \\
&+ \beta_{15} Lboardsize_{i,t} + \beta_{16} CEOduality_{i,t} + \beta_{17} OutsideDirectorPt_{i,t} \\
&+ \beta_{18} Femaleproportion_{i,t} + \beta_{19} Mutual_{i,t} + \beta_{20} Privatestock_{i,t} \\
&+ \varepsilon_{i,t} \qquad (2)
\end{aligned}
$$

Table 5 illustrates the comparative effects of female CEOs on all outcomes with more female directors' participation and less female directors' participation in the baseline sample. The results are inconsistent with hypothesis 2 because female CEOs with female directors' participation are found to have no additional effect on total risk-taking. The insignificant additional effect is found on all outcomes including insolvency probability, total risk, performance and ratings.

4.2 Different organizational forms

In this section, we further investigate the effect of female CEOs without and with female directors' participation in corporate outcomes in different organizational forms. By introducing different organizational forms, the total picture of the role of female CEOs and corporate governance mechanisms begins to take shape.

4.2.1 Female CEO's risk-taking in different organizational forms

4.2.1.1 Stock vs. mutual

Table 6 shows that female CEOs reveal an evident effect on almost all risk-taking outcomes of stock insurance companies. Female CEOs is are found to reduce insolvency probability, investment and total risks in stock insurance companies, which is in line with hypothesis 1a. Male-to-female CEO transition leads to a 0.4%, 1.8%, and 5.1% decrease in insolvency probability, investment and total risks, respectively, than male-to-male CEO transition.

As further shown in Table 5, we found that female CEOs increase firm performance and ratings in stock insurance companies. Given that the evidence shows that female CEOs would reduce firms' total risk-taking, we speculate that female CEO generally have a positive effect in stock insurance firms.

Table 7 presents the relationship between female CEOs and firms' risk-taking in the mutual sample. The estimated coefficients of female CEOs on all outcomes are all insignificant in the mutual sample. The results are consistent with hypothesis 1b. The result indicates that female CEOs do not affect firms' risk-taking in mutual insurance companies. Also, we do not find evidence of the effect of female CEOs on performance and ratings.

4.2.1.2 Private vs. public

For the privately held stock sample, female CEOs are reported to significantly reduce firm risk-taking (Table 8). Specifically, female CEOs lower the firm's insolvency probability and total risk in privately held stock insurance companies, which is generally in accordance with hypothesis 1c. Male-to-female CEO transition leads to a 0.6 and 1.2 percentage-point decline in insolvency probability and total risk, respectively, than does male-to-male CEO transition. Female CEOs are found to enhance firms' ratings in privately

held stock insurance companies. The evidence generally indicates that female CEOs also have a positive effect on privately held stock insurance companies.

Consistent with hypothesis 1d, Table 9 suggests a smaller effect of female CEOs on firm risk-taking in publicly traded stock insurance companies. Female CEOs are evidenced to not affect insolvency probability, underwriting and investment risk. However, the reduced total risk and increased performance still suggest that female CEOs have a positive role in public in publicly traded stock insurance companies. With regard to risk-taking, the appointment of a female CEO is more likely to be a signal in publicly traded stock firms. The unaffected ratings results also suggest that the market also perceive the role of female CEO in public firms is limited. Listing status matters for the role of female CEOs on the corporate outcomes.

4.2.2 Role of female directors on female CEO's risk-taking in different organizational forms

4.2.2.1 Stock vs. mutual

Panel A of Table 10 shows that female CEOs with more female directors' participation have no additional effect on insolvency probability in stock insurance companies, which is inconsistent with hypothesis 2a. Moreover, female CEOs with more female directors' participation have better ratings than do those with less female directors' participation.

For mutual insurance companies, Panel B of Table 10 indicates that female CEOs with more female directors' participation have no additional influence on all outcomes compared with those with less female directors' participation. The results are in line with hypothesis 2b.

4.2.2.2 Private vs. public

Inconsistent with hypothesis 2c, Panel C of Table 10 indicates that for privately held stock insurance companies, female CEOs with more female directors' participation have no additional influence on almost all outcomes compared with those with fewer female directors' participation, except that female CEOs with more female directors' participation have better ratings in privately held stock insurance companies.

For publicly traded stock insurance companies, female CEOs with more participation of female directors' have more firms' risk-taking and better firm performance than female CEOs with lower participation of female directors (Table 10, Panel D). Greater insolvency probability and total risk were found for female CEOs of such companies with more female directors' participation. The results are aginst hypothesis 2d, However, the additional risk-taking of publicly traded stock insurance companies enhances the firm performance and ratings. Overall. female CEOs still have a positive role in the publicly traded stock sample.

The findings show that female CEOs with female directors' participation have an additional positive effect on ratings in all stock-related samples. In both publicly traded and privately held stock insurance companies, the professional Best's rating agency gives positive feedback for female CEOs firms with more female directors' enrollment.

We notice that, with female directors' participation, female CEOs only have an additional positive effect on total risk-taking in publicly traded stock insurance companies. The increased total risk of the publicly traded stock sample could be the source of that of the stock sample. Moreover, female CEOs with female directors' participation have significantly better firm performance in publicly traded stock insurance companies.

For female CEOs with female directors' participation, listing status still matters.

Generally, female directors' participation only affects female CEOs' behavior in publicly traded stock firms. Notably, the mixed effect of female CEOs and female directors has a further beneficial effect on publicly traded stock firms' performance.

As female CEOs are appointed as signals in publicly traded stock firms, they would pay more attention to personal interests if more challenging voices are expressed from male directors on board. Market stakeholders perceive that female CEOs could represent risk-averse characteristics in corporate governance. Therefore, female CEOs take fewer risks to meet this expectation and keep their jobs secure. However, when female CEOs get more support from female directors, they are expected to have effective governance in firms. Publicly traded firms have especial pressure to pursue certain profits, thus, female CEOs would like to take risks to have a higher return. Consistently, banking literature evidenced a changed U-shaped relationship between female directors and firm performance (Owen and Temesvary,2018). Moreover, Berger et al.,(2014) documents that a positive relationship between female executives and portfolio risk.

4.3 State-level moderator

To better comprehend the mechanism behind the phenomenon, we further investigate the results by adding one state-level moderator in the basic DID regressions. We examine female political status.

For female political status, we focus on the U.S. Congress, specifically, the House of Representatives and the Senate. We collect the elected female members in both the House of Representatives and the Senate of each state during our sample period 2001–2017.[8] [9] The female political status is measured by dividing the sum of the numbers

[8] https://www.senate.gov/artandhistory/history/common/briefing/women_senators.htm
[9] https://en.wikipedia.org/wiki/Women_in_the_United_States_House_of_Representatives#Female_members_whose_service_began_between_2013_and_present

of female representatives and female senators to total congress size.[10] The higher value of the index reflects the higher female political status of the state.

The following table illustrates the comparative results of female CEOs all outcomes in the high female political status states and low female political status states[11].

$$
\begin{aligned}
Risk_{i,t+1} = \mu + \tau_t
&+ \beta_1 Female_i \times Post_{i,t+1} \times Femalepoliticalstatus_{i,t} \\
&+ \beta_2 Female_i \times Post_{i,t+1} + \beta_3 Female_i \times Femalepoliticalstatus_{i,t} \\
&+ \beta_4 Post_{i,t+1} \times Femalepoliticalstatus_{i,t} + \beta_5 Post_{i,t+1} + \beta_6 Female_i \\
&+ \beta_7 Femalepoliticalstatus_{i,t} + \beta_8 Lassets_{i,t} + \beta_9 Leverage_{i,t} \\
&+ \beta_{10} LineHerfindahl_{i,t} + \beta_{11} GeoHerfindahl_{i,t} \\
&+ \beta_{12} Personallines_{i,t} + \beta_{13} Commerciallong_{i,t} + \beta_{14} Usagereins_{i,t} \\
&+ \beta_{15} Lboardsize_{i,t} + \beta_{16} CEOduality_{i,t} + \beta_{17} OutsideDirectorPt_{i,t} \\
&+ \beta_{18} Femaleproportion_{i,t} + \beta_{19} Mutual_{i,t} + \beta_{20} Privatestock_{i,t} \\
&+ \varepsilon_{i,t} \qquad (3)
\end{aligned}
$$

For stock, mutual, and privately held stock insurance companies, female CEOs have no difference on insolvency probability in high and low female political status states (Panel A, B, and C of Table 11).

By contrast, Panel D of Table 11 illustrates that publicly traded stock sample's female CEOs would have higher insolvency probability and total risk in high female political status states than that in low female political status states.

Listing status counts in this context. The female political status of the state is found

[10] https://history.house.gov/Institution/Election-Statistics/Election-Statistics/
[11] In Appendix Table 2, the results of stock and mutual sample are attached.

to only influence female CEOs' behavior in publicly traded stock firms. Given that shareholders or stakeholders of public firms expect female CEOs to have risk-averse internal governance, female CEOs in low female political status states would prefer fewer risks to keep the public impression for the position security. Female CEOs are considered to have advantages in states with higher female political status. If women attain high political status in a state, the overall working environment is beneficial to the female group on whole. Female CEOs are expected to behave more actively under this circumstance. In the states with high female political status, female CEOs receive more public expectation on their roles in fulfilling talents, so they choose to increase firms' total risk-taking to have more returns. In publicly traded firms, female CEOs in the female-favorable environment have more pressure and incentives to meet the profit goals.

4.4. Robustness

The total risk is originally calculated by the standard deviation of return on assets in the three years before and after the transition year respectively. Only the nearest observations around the transition year are remained in the regression. As for the robustness, we carried out the three-year backward rolling standard deviation of return on assets to measure the total risk. In this approach, we do not drop any firm-year observations in DID sample. The results illustrate that the baseline results of total risk are unchanged in all samples.

In our specification, ROA is used for calculating both total risk and risk-adjusted performance. We redefine the ROA as the net income to total assets to examine the results. We find that the baseline findings of total risk and risk-adjusted performance are still unaffected in all organizational forms.

5. Discussion

The estimate results generally validate hypotheses 1. Specifically, female CEOs are evidenced to be risk-averse in corporate decisions. Inconsistent with hypothesis 2, Female CEOs with female directors' participation can have no additional effect on the risk-taking outcomes. In publicly traded stock firms, female CEOs with female directors' participation even increase the firm's insolvency probability. The real effects on firm risks are varied in the different organization mechanisms.

On one hand, we observe that female CEOs are negatively associated with firm's risk-taking in stock firms. However, we find that mutual insurance companies leave no room for female CEOs to influence firm's risk-taking. With only a few shareholders, the owners of privately held stock firms are often the managers or executives. The privately held stock has received strong monitoring from the private board, which indicates that the monitoring function on female CEOs is strong. Consequently, the results reflect that female CEOs have a negative effect on firm's risk-taking in privately held stock firms. For a publicly traded stock, greater information cost between owners and managers impedes effective board monitoring on CEOs. Accordingly, female CEOs are found to have a smaller effect on the firm's risk-taking. We demonstrate that female CEOs are appointed as signals in publicly traded stock and have a real effect on privately held stock firms.

On the other hand, we also incorporate female directors into the female CEO analysis. We find that the collaboration of female CEOs and female directors leads to more risk-taking and better performance and ratings in publicly traded stock firms, than the independent operation of female CEOs.

Investigation on the state-level moderator helps us further complete the picture about the role of female CEOs. When in the female-favorable environment, specifically in

the states of high female political status, female CEOs are found to additionally increase risk-taking, performance and ratings in publicly traded stock firms.

We argue that female CEOs are not by nature risk-averse but would adopt different degrees of risk-averse professional decisions in various organizational forms. In the publicly traded stock form, female CEOs behave conservatively to meet the expectation from the market. As signals, female CEOs of publicly traded stock firms would pursue their personal interests. In other words, by reducing firm risks, female CEOs could meet the market expectation and thus keep their jobs secure.

However, the expectation of declined risks by female CEOs diminishes in the female-favorable environment. With enough support for governance, female CEOs are expected to take an effective role in management. Thus, female CEOs take action to increase the firm performance to meet the profit goals of public firms. By taking risks, female CEOs get the greater possibility to accumulate returns.

Tables

Table 1 Descriptive Statistics of the sample by Organizational form and Listing status

Panel A gives the summary statistics of the original sample by Organizational form and Listing status. Panel B gives the summary statistics of DID sample by Organizational form and Listing status. DID sample is constructed by restricting the original sample to the pre- and post-three years (not including transition year) of the male-to-female CEO and male-to-male CEO transition.

Panel A: Original sample			
Category		**Observations**	**Firms**
Mutuals		**9,519**	**697**
Stock		**15,203**	**1,139**
	Publicly traded stock	7,389	673
	Privately held stock	7,814	696
Total		**24,722**	**1,836**
Panel B:DID sample			
Category		**Observations**	**Firms**
Mutuals		**1,723**	**262**
Stock		**1,783**	**276**
	Publicly traded stock	845	131
	Privately held stock	938	145
Total		**3,506**	**538**

Table 2 Summary Statistics of turnover of different types

The table presents the total number and percentage of male-to-female, male-to-male, female-to-male, female-to-female turnover. DID sample is constructed by the pre- and post-three years (not including transition year) of the male-to-female CEO and male-to-male CEO transition.

Transition type	Turnover	Percentage
male-to-female	31	4.97%
male-to-male	566	90.71%
female-to-male	26	4.17%
female-to-female	1	0.16%
Total	**624**	**100%**

Table 3 Summary Statistics of all variables

All the variables in the regression are given summary statistics in this table. Panel A illustrates the observations, mean, median, standard deviation, and minimum and maximum numbers of all the variables. Panel B compares the mean and gives the t-statistic of the difference of all the variables in mutual and stock samples. Panel C compares the mean and gives the t-statistic of the difference of all the variables in publicly traded stock and privately held stock samples. ***, **, and * indicate the 10%, 5%, and 1% significance levels, respectively.

Panel A: Summary statistics						
Female CEO sample						
VarName	Obs	Mean	Median	SD	Min	Max
Insolvency probability	3175	0.008	0.006	0.014	0.000	0.406
Underwriting Risk	3506	0.363	0.318	0.290	-0.067	1.008
Investment Risk	3506	0.165	0.119	0.173	0.000	0.768
Risk-adjusted performance	3490	2.760	1.801	3.629	-1.505	14.354
roasd	1195	0.025	0.018	0.024	0.000	0.203
Ratings	1127	-2.589	-2.485	0.558	-4.304	0.000
Female	3506	0.053	0.000	0.224	0.000	1.000
Femaleproportion	3506	0.111	0.100	0.117	0.000	0.800
Ln(assets)	3506	18.897	18.876	1.845	14.172	23.413
Leverage	3506	0.884	0.783	0.607	0.000	3.453
Lines of Business Herfindahl	3506	0.479	0.362	0.300	0.128	1.000
Geographic Herfindahl	3427	0.553	0.499	0.389	0.041	1.000
Fraction of NPW from personal lines	3506	0.393	0.368	0.374	0.000	1.000
Fraction of NPW from commercial long-tail lines	3506	0.404	0.395	0.321	0.000	1.000
Reinsurance	3506	0.347	0.269	0.279	0.000	1.113
ln(boardsize)	3506	2.197	2.197	0.456	0.000	3.738
CEOduality	3506	0.764	1.000	0.424	0.000	1.000

Fraction of outside directors on board	3506	0.623	0.700	0.289	0.000	1.000
Mutual	3506	0.491	0.000	0.500	0.000	1.000
Privatestock	3506	0.268	0.000	0.443	0.000	1.000

Panel B: Summary statistics between mutual and stock

Female CEO sample

VarName	Mutual		Stock		Mean-diff	
varname	obs	mean	obs	mean	mean-diff	t
Insolvency probability	1613	0.01	1562	0.01	-0.00***	-2.94
Underwriting Risk	1707	0.36	1704	0.38	-0.02**	-2.02
Investment Risk	1707	0.2	1704	0.13	0.07***	11.16
Risk-adjusted performance	1707	2.7	1704	2.88	-0.18	-1.42
Total Risk	583	0.02	612	0.03	-0.00**	-1.85
lbestsavg	561	-2.55	566	-2.63	0.08**	2.51
Female	1707	0.07	1704	0.04	0.03***	4.07
Femaleproportion	1707	0.12	1704	0.1	0.02***	4.76
Ln(assets)	1707	18.81	1704	19.04	-0.22***	-3.57
Leverage	1707	0.88	1704	0.9	-0.02	-1.1
Lines of Business Herfindahl	1707	0.45	1704	0.5	-0.04***	-4.44
Geographic Herfindahl	1707	0.65	1704	0.45	0.20***	15.67
Fraction of NPW from personal lines	1707	0.47	1704	0.32	0.15***	11.68
Fraction of NPW from commercial long-tail lines	1707	0.35	1704	0.45	-0.10***	-9.17
Reinsurance	1707	0.3	1704	0.4	-0.10***	-10.83
ln(boardsize)	1707	2.32	1704	2.08	0.25***	16.65
CEOduality	1707	0.71	1704	0.81	-0.09***	-6.48

Fraction of outside directors on board	1707	0.74	1704	0.52	0.22***	24
Mutual	1707	1	1704	0	1	.
Privatestock	1707	0	1704	0.53	-0.53***	-43.8

Panel C: Summary statistics between privately held stock and publicly traded stock

Female CEO sample

VarName	privately held stock		publicly traded stock		Mean-diff	
varname	obs	mean	obs	mean	mean-diff	t
Insolvency probability	822	0.01	740	0.01	0	0.07
Underwriting Risk	902	0.42	802	0.32	0.10***	7.04
Investment Risk	902	0.16	802	0.11	0.04***	5.44
Risk-adjusted performance	902	2.72	802	3.09	-0.37**	-1.98
Total Risk	323	0.02	289	0.03	-0.00**	-2.05
lbestsavg	299	-2.65	267	-2.61	-0.05	-1.04
Female	902	0.05	802	0.03	0.02*	1.78
Femaleproportion	902	0.12	802	0.08	0.04***	7.39
Ln(assets)	902	18.45	802	19.7	-1.26***	-15.62
Leverage	902	0.87	802	0.93	-0.05*	-1.71
Lines of Business Herfindahl	902	0.58	802	0.4	0.19***	13.4
Geographic Herfindahl	902	0.55	802	0.33	0.22***	12.64
Fraction of NPW from personal lines	902	0.34	802	0.31	0.03*	1.91
Fraction of NPW from commercial long-tail lines	902	0.45	802	0.45	0	-0.24
Reinsurance	902	0.36	802	0.46	-0.10***	-7.02
ln(boardsize)	902	2.09	802	2.06	0.02	0.82
CEOduality	902	0.8	802	0.82	-0.02	-0.79

Fraction of outside directors on board	902	0.6	802	0.42	0.18***	12.76
Privatestock	902	1	802	0	1	.

Table 4 Female CEO, insolvency probability, firm risk, ratings and risk-adjusted performance (Stock and mutual sample)

The table reports the difference-in-difference (DID) regression results from Eq. (1). The estimated sample covers stock and mutual insurance companies during 2001–2017. The dependent variables are outcome variables of interest, including insolvency probability, underwriting risk, investment risk, total risk, risk-adjusted performance and ratings. See Appendix Table 1 for the definition of variables. Financial ratios are winsorized at the 1% level to reduce the effect of outliers. Regressions in Columns (1)-(4) are estimated with original control variables. Regressions in Columns (5)-(6) are estimated with control variables with averaged values. All regressions include year fixed effects. Numbers in parentheses are robust t-statistics. ***, **, and * indicate the 10%, 5%, and 1% significance levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Independent variables	Insolvency probability	Underwriting Risk	Investment Risk	Risk-adjusted performance	Total Risk	Ratings
Femalepost	-0.0030***	-0.0652	-0.0464**	1.0720**	-0.0084**	0.0787
	(-2.722)	(-1.191)	(-2.011)	(2.138)	(-2.152)	(1.022)
Post	0.0005	0.0000	0.0067	-0.2507	0.0029**	-0.0323
	(1.062)	(0.001)	(0.819)	(-1.353)	(2.087)	(-1.102)
Ln(assets)	0.0000	0.0021	0.0212***	0.2617***	-0.0019***	0.0445***
	(0.266)	(0.267)	(4.904)	(4.344)	(-3.392)	(2.937)
Leverage	0.0098***	0.0121	-0.0608***	-0.9578***	0.0063***	-0.2438***
	(6.876)	(0.552)	(-5.831)	(-6.250)	(2.910)	(-5.242)
Lines of Business Herfindahl	0.0058***	0.1549***	-0.0521**	0.2923	0.0053	-0.4239***
	(4.510)	(2.623)	(-2.237)	(0.840)	(1.285)	(-4.529)
Geographic Herfindahl	0.0019***	-0.0584	-0.0160	-0.2691	0.0020	-0.1200
	(2.589)	(-1.413)	(-0.819)	(-0.900)	(0.779)	(-1.515)
Fraction of NPW from personal lines	-0.0019**	0.0836**	0.0625***	-0.6945**	0.0047*	0.1134
	(-2.308)	(2.023)	(3.194)	(-2.497)	(1.705)	(1.595)
Fraction of NPW from commercial long-tail lines	0.0005	-0.1850***	-0.0764***	0.6690**	-0.0120***	0.0694
	(0.532)	(-3.690)	(-4.149)	(2.105)	(-3.840)	(0.940)
Reinsurance	0.0070***	-0.0702	-0.0453*	-0.1605	-0.0047	0.0360

	(4.124)	(-1.584)	(-1.675)	(-0.444)	(-1.365)	(0.465)
ln(boardsize)	0.0013	0.0579**	-0.0098	-0.7531***	0.0043**	0.1436***
	(1.423)	(2.037)	(-0.635)	(-3.397)	(2.309)	(3.026)
CEOduality	-0.0003	-0.0072	0.0196	0.2093	0.0014	-0.0719*
	(-0.627)	(-0.305)	(1.526)	(1.114)	(0.968)	(-1.711)
Fraction of outside directors on board	-0.0003	-0.0929**	0.0283	-0.0550	-0.0068	0.0735
	(-0.254)	(-2.000)	(1.154)	(-0.143)	(-1.555)	(0.934)
mutuals	-0.0008	0.0161	0.0828***	0.1626	-0.0079***	0.0928*
	(-1.255)	(0.521)	(4.714)	(0.623)	(-3.007)	(1.758)
Fraction of female directors on board	0.0003	0.0153	-0.0122	1.0126	0.0061	-0.4359**
	(0.156)	(0.132)	(-0.264)	(1.297)	(0.665)	(-2.290)
Private stock	-0.0001	0.0925**	0.0696***	-0.1748	-0.0067**	0.0939
	(-0.104)	(2.519)	(3.318)	(-0.631)	(-2.276)	(1.633)
Constant	-0.0095**	0.2443	-0.1957**	0.2422	0.0533***	-3.3554***
	(-2.140)	(1.395)	(-2.026)	(0.188)	(4.318)	(-9.749)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,152	3,427	3,427	3,411	1,174	1,109
R-squared	0.235	0.099	0.189	0.108	0.135	0.200

Table 5 Interaction effect from the proportion of female directors on boards—Female CEO (Stock and mutual sample)

The table reports the difference-in-difference (DID) regression results from Eq. (2). The estimated sample covers stock and mutual insurance companies during 2001–2017. The dependent variables are outcome variables of interest, including insolvency probability, underwriting risk, investment risk, total risk, risk-adjusted performance and ratings. See Appendix Table 1 for the definition of variables. Financial ratios are winsorized at the 1% level to reduce the effect of outliers. Regressions in Columns (1)-(4) are estimated with original control variables. Regressions in Columns (5)-(6) are estimated with control variables with averaged values. All regressions include year fixed effects. Numbers in parentheses are robust t-statistics. ***, **, and * indicate the 10%, 5%, and 1% significance levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Independent variables	Insolvency probability	Underwriting Risk	Investment Risk	Risk-adjusted performance	Total Risk	Ratings
Female*Post*Femaleproportion	-0.0056	0.0301	-0.0559	1.9037	0.0122	2.1294
	(-0.465)	(0.042)	(-0.252)	(0.277)	(0.258)	(0.896)
Female*Post	-0.0015	0.0650	0.0105	0.6079	-0.0107	-0.2631
	(-0.564)	(0.618)	(0.324)	(0.476)	(-1.082)	(-0.718)
Female*Femaleproportion	-0.0041	-0.8254	0.2011	3.8638	-0.0378	-0.7490
	(-0.371)	(-1.025)	(0.772)	(0.559)	(-0.801)	(-0.449)
Post*Femaleproportion	-0.0079*	-0.1062	-0.0561	0.1676	0.0142	-0.0466
	(-1.690)	(-1.445)	(-1.102)	(0.124)	(1.294)	(-0.198)
Post	0.0014**	0.0092	0.0098	-0.2854	0.0013	-0.0285
	(2.163)	(0.591)	(1.138)	(-1.210)	(0.733)	(-0.704)
Female	0.0010	0.0364	-0.0850**	-0.7312	0.0064	0.0725
	(0.513)	(0.245)	(-2.138)	(-0.739)	(0.773)	(0.272)
femaleproportion	0.0048	0.1027	0.0140	0.7474	-0.0258*	0.1334
	(1.524)	(0.841)	(0.276)	(0.670)	(-1.714)	(0.290)
Ln(assets)	0.0000	0.0023	0.0213***	0.2619***	-0.0019***	0.0446***
	(0.304)	(0.299)	(4.934)	(4.330)	(-3.361)	(2.933)
Leverage	0.0098***	0.0113	-0.0607***	-0.9553***	0.0063***	-0.2458***

	(6.873)	(0.516)	(-5.831)	(-6.205)	(2.897)	(-5.377)
Lines of Business Herfindahl	0.0058***	0.1609***	-0.0487**	0.2952	0.0052	-0.4240***
	(4.440)	(2.699)	(-2.066)	(0.846)	(1.241)	(-4.509)
Geographic Herfindahl	0.0019***	-0.0591	-0.0157	-0.2637	0.0020	-0.1195
	(2.601)	(-1.434)	(-0.806)	(-0.882)	(0.773)	(-1.508)
Fraction of NPW from personal lines	-0.0019**	0.0898**	0.0610***	-0.7362***	0.0048*	0.1086
	(-2.218)	(2.155)	(3.100)	(-2.646)	(1.733)	(1.517)
Fraction of NPW from commercial long-tail lines	0.0005	-0.1823***	-0.0789***	0.6369**	-0.0116***	0.0651
	(0.531)	(-3.627)	(-4.223)	(1.995)	(-3.675)	(0.881)
Reinsurance	0.0071***	-0.0618	-0.0428	-0.1791	-0.0047	0.0317
	(4.102)	(-1.403)	(-1.561)	(-0.495)	(-1.381)	(0.419)
ln(boardsize)	0.0012	0.0596**	-0.0093	-0.7547***	0.0043**	0.1442***
	(1.394)	(2.096)	(-0.608)	(-3.403)	(2.294)	(3.028)
CEOduality	-0.0004	-0.0074	0.0199	0.2146	0.0014	-0.0714*
	(-0.755)	(-0.318)	(1.545)	(1.135)	(0.963)	(-1.704)
Fraction of outside directors on board	-0.0003	-0.0946**	0.0322	-0.0104	-0.0072	0.0837
	(-0.311)	(-2.029)	(1.298)	(-0.027)	(-1.623)	(1.049)
Mutuals	-0.0008	0.0169	0.0838***	0.1689	-0.0077***	0.0918*
	(-1.285)	(0.550)	(4.773)	(0.646)	(-2.950)	(1.740)
Fraction of female directors on board	-	-	-	-	0.0258	-0.5713
					(1.361)	(-1.304)
Private stock	-0.0001	0.0921**	0.0700***	-0.1708	-0.0064**	0.0910
	(-0.129)	(2.526)	(3.329)	(-0.616)	(-2.198)	(1.592)
Constant	-0.0100**	0.2224	-0.2041**	0.2772	0.0539***	-3.3550***
	(-2.170)	(1.270)	(-2.099)	(0.213)	(4.293)	(-9.710)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Observations	3,152	3,427	3,427	3,411	1,174	1,109
R-squared	0.236	0.104	0.192	0.109	0.138	0.203

Table 6 Female CEO, insolvency probability, firm risk, ratings and risk-adjusted performance (Stock sample)

The table reports the difference-in-difference (DID) regression results from Eq. (1). The estimated sample covers mutual insurance companies during 2001–2017. The dependent variables are outcome variables of interest, including insolvency probability, underwriting risk, investment risk, total risk, risk-adjusted performance and ratings. See Appendix Table 1 for the definition of variables. Financial ratios are winsorized at the 1% level to reduce the effect of outliers. Regressions in Columns (1)-(4) are estimated with original control variables. Regressions in Columns (5)-(6) are estimated with control variables with averaged values. All regressions include year fixed effects. Numbers in parentheses are robust t-statistics. ***, **, and * indicate the 10%, 5%, and 1% significance levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Independent variables	Insolvency probability	Underwriting Risk	Investment Risk	Risk-adjusted performance	Total Risk	Ratings
Femalepost	-0.0049**	-0.1152	-0.0515*	1.4658**	-0.0180***	0.3346***
	(-2.075)	(-1.262)	(-1.714)	(2.135)	(-3.876)	(3.016)
Post	-0.0000	0.0251	0.0109	-0.5833**	0.0043*	-0.0462
	(-0.034)	(1.199)	(1.047)	(-2.079)	(1.811)	(-1.288)
Ln(assets)	-0.0000	-0.0231**	0.0285***	0.3142***	-0.0012	0.0194
	(-0.026)	(-2.087)	(5.067)	(3.625)	(-1.247)	(0.849)
Leverage	0.0104***	0.0046	-0.0444***	-0.7026***	0.0034	-0.2039***
	(4.512)	(0.158)	(-3.415)	(-3.415)	(1.234)	(-3.327)
Lines of Business Herfindahl	0.0068***	0.0018	-0.0507*	0.1105	0.0160**	-0.5573***
	(3.550)	(0.025)	(-1.773)	(0.228)	(2.287)	(-3.775)
Geographic Herfindahl	0.0005	-0.0877	-0.0440*	-0.2696	0.0002	-0.0324
	(0.406)	(-1.476)	(-1.930)	(-0.668)	(0.040)	(-0.319)
Fraction of NPW from personal lines	-0.0010	0.2166***	0.0537**	-0.8045**	0.0084*	0.0240
	(-0.758)	(3.961)	(2.037)	(-2.285)	(1.942)	(0.280)
Fraction of NPW from commercial long-tail lines	0.0019	-0.1687**	-0.0329	0.1056	-0.0132***	-0.0254
	(1.335)	(-2.449)	(-1.462)	(0.235)	(-2.634)	(-0.224)
Reinsurance	0.0088***	-0.0565	-0.0233	-0.4523	0.0010	0.0619

	(3.144)	(-0.990)	(-0.752)	(-1.027)	(0.211)	(0.644)
ln(boardsize)	0.0034**	0.0501	0.0417**	-0.8106***	0.0060**	0.1951***
	(2.534)	(1.549)	(2.202)	(-2.878)	(2.594)	(3.506)
CEOduality	-0.0002	0.0194	0.0641***	0.1638	-0.0019	-0.0563
	(-0.167)	(0.546)	(3.074)	(0.528)	(-0.725)	(-0.825)
Fraction of outside directors on board	-0.0032**	-0.1146**	0.0278	-0.5076	-0.0091	0.0100
	(-2.283)	(-2.091)	(0.872)	(-1.005)	(-1.538)	(0.107)
Fraction of female directors on board	-0.0004	0.0159	-0.0084	-1.3367	0.0237	-0.6658**
	(-0.119)	(0.097)	(-0.143)	(-1.274)	(1.560)	(-2.420)
Private stock	0.0006	0.0974***	0.0881***	0.0907	-0.0077**	0.0838
	(0.527)	(2.727)	(3.798)	(0.303)	(-2.330)	(1.268)
Constant	-0.0137*	0.7556***	-0.5199***	0.1730	0.0342*	-2.8848***
	(-1.922)	(2.972)	(-4.442)	(0.095)	(1.705)	(-6.053)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,540	1,709	1,709	1,704	592	549
R-squared	0.223	0.149	0.226	0.109	0.134	0.250

Table 7 Female CEO, insolvency probability, firm risk, ratings and risk-adjusted performance (Mutual sample)

The table reports the difference-in-difference (DID) regression results from Eq. (1). The estimated sample covers mutual insurance companies during 2001–2017. The dependent variables are outcome variables of interest, including insolvency probability, underwriting risk, investment risk, total risk, risk-adjusted performance and ratings. See Appendix Table 1 for the definition of variables. Financial ratios are winsorized at the 1% level to reduce the effect of outliers. Regressions in Columns (1)-(4) are estimated with original control variables. Regressions in Columns (5)-(6) are estimated with control variables with averaged values. All regressions include year fixed effects. Numbers in parentheses are robust t-statistics. ***, **, and * indicate the 10%, 5%, and 1% significance levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Independent variables	Insolvency probability	Underwriting Risk	Investment Risk	Risk-adjusted performance	Total Risk	Ratings
Femalepost	-0.0006	-0.0808	-0.0339	0.7969	0.0009	-0.0811
	(-0.688)	(-1.124)	(-1.030)	(1.156)	(0.161)	(-0.902)
Post	0.0012**	-0.0107	0.0074	0.1197	0.0019	-0.0271
	(2.528)	(-0.551)	(0.639)	(0.503)	(1.202)	(-0.577)
Ln(assets)	0.0002	0.0148	0.0190***	0.2095**	-0.0021***	0.0566***
	(0.861)	(1.400)	(3.347)	(2.549)	(-3.008)	(2.803)
Leverage	0.0092***	0.0253	-0.0823***	-1.3168***	0.0094***	-0.2708***
	(7.056)	(0.748)	(-5.169)	(-6.318)	(2.629)	(-4.191)
Lines of Business Herfindahl	0.0050***	0.2485***	-0.0244	-0.2860	0.0004	-0.3632***
	(3.972)	(2.855)	(-0.614)	(-0.492)	(0.097)	(-2.712)
Geographic Herfindahl	0.0024***	-0.0967*	-0.0050	-0.1047	0.0026	-0.1885*
	(2.934)	(-1.686)	(-0.161)	(-0.243)	(0.821)	(-1.677)
Fraction of NPW from personal lines	-0.0024***	-0.0493	0.0950***	-0.7628*	0.0032	0.1753
	(-2.883)	(-0.743)	(2.942)	(-1.673)	(0.900)	(1.482)
Fraction of NPW from commercial long-tail lines	-0.0015	-0.2872***	-0.1087***	1.0914**	-0.0087**	0.1070
	(-1.522)	(-4.150)	(-3.658)	(2.546)	(-2.478)	(1.324)
Reinsurance	0.0056***	-0.0910	-0.0616	0.1577	-0.0099**	0.0131

	(3.177)	(-1.345)	(-1.438)	(0.281)	(-2.266)	(0.114)
ln(boardsize)	-0.0029***	0.1298**	-0.1316***	-0.1953	-0.0021	0.1302
	(-2.665)	(2.333)	(-4.755)	(-0.501)	(-0.573)	(1.166)
CEOduality	0.0003	-0.0216	0.0068	0.0478	0.0039**	-0.1174**
	(0.729)	(-0.723)	(0.436)	(0.190)	(2.006)	(-2.193)
Fraction of outside directors on board	0.0047***	-0.0928	0.0388	0.3214	-0.0051	0.0768
	(3.451)	(-1.317)	(1.098)	(0.582)	(-0.936)	(0.530)
Fraction of female directors on board	0.0029	-0.0140	-0.0129	3.1281***	-0.0056	-0.3746
	(1.300)	(-0.091)	(-0.171)	(2.871)	(-0.638)	(-1.571)
Constant	-0.0057	-0.0510	0.2127	-0.2708	0.0632***	-3.4292***
	(-1.419)	(-0.214)	(1.536)	(-0.161)	(4.023)	(-6.324)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,612	1,718	1,718	1,707	582	560
R-squared	0.332	0.188	0.218	0.149	0.218	0.218

Table 8 Female CEO, insolvency probability, firm risk, ratings and risk-adjusted performance (Privately held stock sample)

The table reports the difference-in-difference (DID) regression results from Eq. (1). The estimated sample covers publicly traded stock insurance companies during 2001–2017. The dependent variables are outcome variables of interest, including insolvency probability, underwriting risk, investment risk, total risk, risk-adjusted performance and ratings. See Appendix Table 1 for the definition of variables. Financial ratios are winsorized at the 1% level to reduce the effect of outliers. Regressions in Columns (1)-(4) are estimated with original control variables. Regressions in Columns (5)-(6) are estimated with control variables with averaged values. All regressions include year fixed effects. Numbers in parentheses are robust t-statistics. ***, **, and * indicate the 10%, 5%, and 1% significance levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Independent variables	Insolvency probability	Underwriting Risk	Investment Risk	Risk-adjusted performance	Total Risk	Ratings
Femalepost	-0.0060*	-0.1836	-0.0149	-0.1882	-0.0122**	0.2822*
	(-1.911)	(-1.174)	(-0.381)	(-0.251)	(-2.504)	(1.693)
Post	0.0011	0.0262	-0.0133	-0.8207***	0.0090**	-0.0786
	(1.072)	(0.786)	(-0.815)	(-2.780)	(2.269)	(-1.323)
Ln(assets)	-0.0008	0.0024	0.0319***	0.4280***	-0.0048***	0.0746
	(-1.547)	(0.121)	(2.842)	(3.198)	(-4.013)	(1.566)
Leverage	0.0142***	-0.0182	-0.0534***	-0.7357***	0.0037	-0.2261**
	(3.499)	(-0.467)	(-2.691)	(-3.708)	(1.175)	(-2.261)
Lines of Business Herfindahl	0.0029	0.2942***	-0.0409	1.4607***	0.0015	-0.2513**
	(1.357)	(2.872)	(-0.887)	(2.636)	(0.298)	(-2.040)
Geographic Herfindahl	-0.0001	-0.0927	-0.0434	-0.5290	0.0050	-0.0717
	(-0.030)	(-1.058)	(-1.284)	(-1.114)	(1.124)	(-0.449)
Fraction of NPW from personal lines	-0.0032	0.2965***	0.0359	-1.0896***	0.0097*	0.0110
	(-1.614)	(3.474)	(1.002)	(-2.688)	(1.685)	(0.082)
Fraction of NPW from commercial long-tail lines	0.0018	-0.2480***	-0.0216	-0.4237	-0.0044	-0.2842**
	(1.067)	(-2.718)	(-0.666)	(-0.890)	(-0.882)	(-2.158)
Reinsurance	0.0104**	-0.1543	-0.0065	-0.7909	0.0100*	0.2163

	(2.237)	(-1.555)	(-0.128)	(-1.450)	(1.782)	(1.458)
ln(boardsize)	0.0046**	0.0612	0.0204	-0.5372	0.0078**	0.1922*
	(2.601)	(1.143)	(0.681)	(-1.525)	(2.182)	(1.913)
CEOduality	-0.0007	0.0768	0.1080***	-0.4469	0.0023	-0.1519
	(-0.509)	(1.292)	(3.235)	(-1.169)	(0.712)	(-1.646)
Fraction of outside directors on board	-0.0030	-0.1544	0.0112	0.1282	-0.0016	-0.1298
	(-1.455)	(-1.568)	(0.219)	(0.189)	(-0.200)	(-0.713)
Fraction of female directors on board	-0.0054	0.2549	-0.0452	-0.7191	-0.0088	-0.4638
	(-1.183)	(1.623)	(-0.633)	(-0.695)	(-0.793)	(-1.543)
Constant	-0.0017	0.2027	-0.4612**	-2.4912	0.0806***	-3.7342***
	(-0.179)	(0.511)	(-2.259)	(-0.928)	(3.437)	(-4.065)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	812	906	906	902	315	292
R-squared	0.253	0.207	0.234	0.146	0.184	0.302

Table 9 Female CEO, insolvency probability, firm risk, ratings and risk-adjusted performance (Publicly traded stock sample)

The table reports the difference-in-difference (DID) regression results from Eq. (1). The estimated sample covers publicly traded stock insurance companies during 2001–2017. The dependent variables are outcome variables of interest, including insolvency probability, underwriting risk, investment risk, total risk, risk-adjusted performance and ratings. See Appendix Table 1 for the definition of variables. Financial ratios are winsorized at the 1% level to reduce the effect of outliers. Regressions in Columns (1)-(4) are estimated with original control variables. Regressions in Columns (5)-(6) are estimated with control variables with averaged values. All regressions include year fixed effects. Numbers in parentheses are robust t-statistics. ***, **, and * indicate the 10%, 5%, and 1% significance levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Independent variables	Insolvency probability	Underwriting Risk	Investment Risk	Risk-adjusted performance	Total Risk	Ratings
Femalepost	-0.0015	-0.0578	-0.0813	1.4773**	-0.0259***	-0.0075
	(-0.481)	(-1.012)	(-1.639)	(2.015)	(-2.662)	(-0.057)
Post	-0.0003	0.0362*	0.0299***	-0.1206	-0.0016	0.0170
	(-0.235)	(1.671)	(2.664)	(-0.242)	(-0.605)	(0.439)
Ln(assets)	0.0005*	-0.0257**	0.0360***	0.1283	0.0003	-0.0187
	(1.722)	(-2.603)	(5.652)	(1.181)	(0.323)	(-1.170)
Leverage	0.0061***	0.0210	-0.0393**	-0.5035	0.0001	-0.1129*
	(7.170)	(0.730)	(-2.543)	(-1.429)	(0.033)	(-1.824)
Lines of Business Herfindahl	0.0095***	-0.2910***	-0.0447	-1.9432**	0.0149*	-0.9938***
	(3.336)	(-4.550)	(-1.293)	(-2.581)	(1.853)	(-5.142)
Geographic Herfindahl	0.0014	-0.0677	-0.0249	0.1502	-0.0023	0.0452
	(0.862)	(-1.026)	(-1.002)	(0.273)	(-0.384)	(0.414)
Fraction of NPW from personal lines	-0.0021	0.2350***	0.0751**	0.6108	-0.0045	0.1244
	(-1.151)	(3.585)	(2.431)	(0.976)	(-0.566)	(1.080)
Fraction of NPW from commercial long-tail lines	-0.0001	-0.1226	-0.0199	0.4361	-0.0270***	0.4595***
	(-0.069)	(-1.452)	(-0.687)	(0.548)	(-3.006)	(3.039)
Reinsurance	0.0064***	-0.0596	-0.0178	-0.4944	-0.0001	-0.1292

	(3.260)	(-1.090)	(-0.469)	(-0.853)	(-0.012)	(-1.066)
ln(boardsize)	0.0002	0.0510	0.0580***	-1.7720***	-0.0015	0.0549
	(0.180)	(1.475)	(3.034)	(-4.157)	(-0.243)	(0.653)
CEOduality	-0.0002	-0.0357	0.0160	0.6742	-0.0046	0.1222
	(-0.152)	(-1.215)	(0.716)	(1.523)	(-0.747)	(1.196)
Fraction of outside directors on board	-0.0002	-0.1769***	0.0409	-2.5436***	-0.0001	-0.0738
	(-0.108)	(-2.785)	(1.019)	(-3.832)	(-0.008)	(-0.665)
Fraction of female directors on board	0.0101**	-0.5395***	0.0296	-2.1248	0.1284***	-0.7744
	(2.012)	(-3.039)	(0.312)	(-1.019)	(3.765)	(-1.596)
Constant	-0.0145*	0.9821***	-0.7081***	6.0542**	0.0279	-2.0890***
	(-1.830)	(3.625)	(-4.480)	(2.371)	(0.951)	(-4.578)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	728	803	803	802	277	257
R-squared	0.320	0.322	0.354	0.227	0.380	0.551

Table 10 Interaction effect from the proportion of female directors on boards—Female CEO

The table reports the difference-in-difference (DID) regression results from Eq. (2). The estimated sample covers the period 2001–2017. The dependent variables are outcome variables of interest, including insolvency probability, underwriting risk, investment risk, total risk, risk-adjusted performance and ratings. See Appendix Table 1 for the definition of variables. Panel A, Panel B, Panel C, Panel D is for stock, mutual, privately held stock and publicly traded stock sample respectively. Financial ratios are winsorized at the 1% level to reduce the effect of outliers. Regressions in Columns (1)-(4) are estimated with original control variables. Regressions in Columns (5)-(6) are estimated with control variables with averaged values. All regressions include year fixed effects. Numbers in parentheses are robust t-statistics. ***, **, and * indicate the 10%, 5%, and 1% significance levels, respectively.

	（1）	（2）	（3）	（4）	（5）	（6）
Independent variables	Insolvency probability	Underwriting Risk	Investment Risk	Risk-adjusted performance	Total Risk	Ratings
Panel A: Stock sample						
Female*Post*Femaleproportion	0.0508	1.3717	-0.1312	-5.7233	0.2117*	8.8290**
	(1.002)	(0.500)	(-0.412)	(-0.499)	(1.658)	(2.248)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,540	1,709	1,709	1,704	592	549
R-squared	0.226	0.160	0.228	0.119	0.144	0.268
Panel B: Mutual sample						
Female*Post*Femaleproportion	-0.0011	-0.5502	0.1072	-3.2110	-0.0295	-0.6168
	(-0.078)	(-0.988)	(0.413)	(-0.450)	(-0.508)	(-0.440)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,612	1,718	1,718	1,707	582	560
R-squared	0.336	0.191	0.225	0.153	0.224	0.221

Panel C: Privately held stock sample						
Female*Post*Femaleproportion	-0.0161	-0.6191	-0.0660	-6.0011	0.0978	9.2584**
	(-0.516)	(-0.252)	(-0.135)	(-1.304)	(0.853)	(2.460)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	812	906	906	735	315	292
R-squared	0.257	0.232	0.236	0.122	0.188	0.327
Panel D: Publicly traded stock sample						
Female*Post*Femaleproportion	0.0649**	2.7932***	0.7457*	10.0019***	0.3301**	7.6783***
	(2.077)	(5.280)	(1.710)	(3.601)	(2.295)	(3.993)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	728	803	803	654	277	257
R-squared	0.322	0.333	0.358	0.246	0.392	0.580

Table 11 Interaction effect from female political status of state---Female CEO

The table reports the difference-in-difference (DID) regression results from Eq. (3). The estimated sample covers stock insurance companies during 2001–2017. The dependent variables are outcome variables of interest, including underwriting risk, investment risk, total risk, risk-adjusted performance, and insolvency probability. See Appendix Table 1 for the definition of variables. . Panel A, Panel B, Panel C, Panel D is for stock, mutual, privately held stock and publicly traded stock sample respectively. Financial ratios are winsorized at the 1% level to reduce the effect of outliers. Regressions in Columns (1)-(4) are estimated with original control variables. Regressions in Columns (5)-(6) are estimated with control variables with averaged values. All regressions include year fixed effects. Numbers in parentheses are robust t-statistics. ***, **, and * indicate the 10%, 5%, and 1% significance levels, respectively.

	（1）	（2）	（3）	（4）	（5）	（6）
Independent variables	Insolvency probability	Underwriting Risk	Investment Risk	Risk-adjusted performance	Total Risk	Ratings
Panel A: Stock sample						
Female*Post*Femalepoliticalstatus	-0.0009	0.2334	0.3068***	-1.5531	0.0413**	0.9588
	(-0.081)	(0.236)	(3.693)	(-1.001)	(1.988)	(1.575)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,495	1,662	1,662	1,346	576	539
R-squared	0.229	0.166	0.239	0.111	0.144	0.261
Panel B: Mutual sample						
Female*Post*Femalepoliticalstatus	-0.0214*	0.3214	0.2232	0.8298	-0.0672	0.7887
	(-1.797)	(0.845)	(1.102)	(0.219)	(-1.164)	(1.034)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,604	1,706	1,706	1,695	578	558
R-squared	0.336	0.214	0.238	0.155	0.232	0.225

Panel C: Privately held stock sample						
Female*Post*Femalepoliticalstatus	-0.0027	0.3313	0.3430***	-6.6229	0.0600*	0.8733*
	(-0.343)	(0.446)	(3.567)	(-1.277)	(1.939)	(1.820)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	794	888	888	884	309	286
R-squared	0.257	0.221	0.253	0.149	0.197	0.316
Panel D: Publicly traded stock sample						
Female*Post*Femalepoliticalstatus	0.1294***	1.5343**	0.8128***	8.6142*	0.1506*	5.5342***
	(3.370)	(2.460)	(3.664)	(1.677)	(1.699)	(3.692)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	701	774	774	627	267	253
R-squared	0.343	0.344	0.369	0.252	0.394	0.592

Appendices

Appendix Table 1 Variable definitions

VarName	Definition
Insolvency probability	Probability of insolvency predicted from 19 FAST ratios (PCA method used)
Underwriting Risk	The proportion of premiums written in risky lines
Investment Risk	Investment in equities and real estate divided by total invested assets
Total Risk	The standard deviation of ROA. ROA is the ratio of net income before dividends and taxes to assets.
Ratings	The averaged log value of ratings before or after three years of the transition.
Risk-adjusted performance	The ratio of ROA to its standard deviation
Femaleproportion	The number of female directors divided by the board size
Female	An indicator variable if the firm has a male-to-female CEO transition
Fmaleconnectedseats	The proportion of male directors' board seats in other firms with female directors
Ln(assets)	Log of assets
Leverage	The ratio of written premiums to surplus
Lines of Business Herfindahl	Herfindahl index is calculated by premiums written in lines of business.
Geographic Herfindahl	Herfindahl index calculated by premiums written in geographic state location.
Fraction of NPW from personal lines	The proportion of net premiums written in personal lines
Fraction of NPW from commercial long-tail lines	The proportion of net premiums written in long-tail commercial lines

Reinsurance	Percentage of gross premiums written that is ceded to reinsurers
ln(boardsize)	Log of the number of directors on board
CEOduality	An indicator variable equals one if CEO and chairman of the board is the same person, equals to zero if not
Privatestock	an indicator variable that equals one if the firm is a privately held stock firm; otherwise, 0.
Fraction of outside directors on board	The ratio of outside directors to the total number of directors
Mutual	An indicator variable that equals one if the firm's organization type is mutual or reciprocal and equals zero if the firm's organization type is stock

Appendix Table 2 Interaction effect from female political status of state—Female CEO (Stock and mutual sample)

The table reports the difference-in-difference (DID) regression results from Eq. (3). The estimated sample covers stock and mutual insurance companies during 2001–2017. The dependent variables are outcome variables of interest, including underwriting risk, investment risk, total risk, risk-adjusted performance, and insolvency probability. See Appendix Table 1 for the definition of variables. Financial ratios are winsorized at the 1% level to reduce the effect of outliers. All regressions include year fixed effects. Numbers in parentheses are robust t-statistics. Regressions in Columns (1)-(4) are estimated with original control variables. Regressions in Columns (5)-(6) are estimated with control variables with averaged values. ***, **, and * indicate the 10%, 5%, and 1% significance levels, respectively.

	（1）	（2）	（3）	（4）	（5）	（6）
Independent variables	Insolvency probability	Underwriting Risk	Investment Risk	Risk-adjusted performance	Total Risk	Ratings
Female*Post*Femalepoliticalstatus	-0.0077	0.5247**	0.3840***	-3.3170	-0.0135	0.1341
	(-0.833)	(2.124)	(2.787)	(-1.012)	(-0.306)	(0.292)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,099	3,368	3,368	3,352	1,154	1,097
R-squared	0.237	0.107	0.201	0.112	0.143	0.206

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