Women in the Insurance Industry: Does Board Gender Diversity Matter to Insurers?

This version: December 10, 2018

Abstract

We document that female board representation in the U.S. property-liability insurance industry increased considerably over the period 2008 – 2017. Through empirical analysis, we find a gender diversity premium of at least 1 percent of return on assets or 3 percent of return on equity. Our results are robust to corrections for potential endogeneity bias, alternative performance and diversity measures, and alternative estimation techniques. Event study evidence shows increased performance following the appointment of a female director and subsample analysis suggests that performance gains are attributable to enhanced monitoring.

Keywords: Female Directors; Board Gender Diversity; Performance.

JEL Classification: G22; G39.

Introduction

In recent years, U.S. insurers have made significant progress in improving board gender diversity, however females remain markedly unrepresented compared to males. According to a demographic study of 100 firms in the U.S. insurance industry in 2012, 28 percent of these firms had no female board representation, and women accounted for less than 13 percent of board seats (Angelina and Sharma, 2012). A follow-up study of those same firms in 2017 reports that the percentage of the insurers without female directors decreased to 15 percent and that almost 19% of board positions are occupied by females (Angelina, Hamrick, and James, 2017). Board gender diversity around the world has been improving in recent years because firms are under increasing pressure to appoint female directors and many countries have passed legislation mandating greater female representation on boards (e.g., Adams and Ferreira, 2009; Sila, Gonzales, and Hagendorff, 2016). Despite the global attention drawn to female representation on boards, the economic impact of board gender diversity is not yet clear.

A rich literature in finance has proposed and tested three competing theories that explain the performance effects of board gender diversity. One group of studies argues that female directors are merely tokens and have little impact on firms' performance, another group argues that female directors are value-enhancing because they are more skilled than their male peers and can help improve corporate governance, while a third group suggests that female directors are value-destroying due to potential costs associated with their tougher monitoring and higher turnover. The empirical evidence regarding these theories is mixed and inconclusive (e.g., Farrell and Hersch, 2005; Adams and Ferreira, 2009; Ahern and Dittmar, 2012; Pathan and Faff, 2013; Liu, Wei, and Xie, 2014; García-Meca, García-Sánchez, and Martínez-Ferrero, 2015; Owen and Temesvary, 2018). Moreover, previous studies on the board diversity-performance relation focus entirely on public firms due to the lack of data for private firms. As a result, the board gender diversity of private firms has been under-explored in the existing literature.

In this paper, we shed some light on the diversity-performance relation in private firms by taking advantage of regulatory reporting requirements in the U.S. property-liability (P/L) insurance industry. All licensed U.S. insurers, both private and public, are required to file detailed annual statutory statements that include operational data as well as the names of all directors. Since director gender is not reported, we first identify the gender of each director on insurers' boards by using the Carnegie Mellon University (CMU) Artificial Intelligence (AI) Repository Name Corpus (Kantrowitz, 1994).[1] We then model insurer performance as a function of board gender diversity and other performance correlates. Our results suggest that, *ceteris paribus*, female directors have a significant and positive impact on insurer performance. Specifically, we find that board gender diversity is associated with a premium of at least 1 percent of return on assets or 3 percent of return on equity. Our results are robust to corrections for potential endogeneity bias, alternative performance and gender diversity measures, and alternative estimation techniques.

We also present evidence on the potential mechanisms underlying the relation between performance and board gender diversity. Our evidence shows that the diversity-performance relation is non-linear. Specifically, the marginal benefits of board gender diversity become insignificant when a threshold level of female representation on boards is achieved, implying that too much board monitoring imposed by female directors may not be value-enhancing. In addition, we find that the effects of board gender diversity on insurers' performance are context-dependent and that they mainly occur from private stock insurers. Additionally, we conduct an event study

[1] As discussed later, an out-of-sample test to benchmark against a well-known database for Standard & Poor's (S&P) firms' board demographics indicates that this gender classification approach is highly accurate and reliable.

to examine changes in insurers' performance following the arrival of a female director. Our event study shows that after an insurer with an all-male board appoints a female director, its performance improves significantly. Taken together, we find strong evidence that board gender diversity adds value to insurers.

A potential critique of the diversity-performance relation is that it might be driven by the difference in risk-taking between male and female directors. While the traditional view considers females as more risk-averse (e.g., Sundén and Surette, 1998; Croson and Gneezy, 2009; Levin, Snyder, and Chapman, 2010), a more recent study by Adams and Funk (2012) shows that female directors are actually more risk-seeking than male directors. To rule out the possibility that our findings result from more aggressive risk-taking of female directors, we control for insurers' risk level[2] in all of our analyses.

Our study contributes to both the corporate governance and insurance literature by providing initial evidence of the relation between insurers' performance and their board gender diversity. The results of this paper also help explain the observed growing trend toward greater female representation in the U.S. P/L insurance industry from the perspective of economic implications. In addition, our finding that the positive effects of the board gender diversity tend to be concentrated in private firms offers a possible explanation for the mixed evidence found by the prior research that only examines publicly traded firms.

The rest of this paper is organized as follows. The "Literature Review" section reviews the prior literature. The "Hypothesis Development and Testing" section develops our hypotheses and discusses variables included in our regression. The "Data and Sample" section introduces the

[2] We conduct separate tests to examine the effects of female directors on insurers' risk-taking. However, we do not find robust evidence that the female directors alter the insurers' risk-taking.

data and sample. The "Regression Method" section presents our baseline model and discusses the methods to address the endogeneity concern. Then the "Results" section reports the results from univariate tests and multivariate regressions. The "Robustness" section presents our results from a series of sensitivity checks. Then "Event Study" section reports the results from our event study. Finally, the "Conclusion" section concludes our study.

Literature Review

An emerging and growing finance literature has been investigating the effects of the board gender diversity on firm performance. However, the empirical evidence provided by previous studies is conflicting and thus, whether and how the board gender diversity affects firm performance remains inconclusive. The research that finds no impact of female directors on firm performance can be represented by Farrell and Hersch (2005). They show that women tend to serve on firms with better performance but there is no evidence that women can enhance firm performance. Specifically, they conduct an event study to examine the abnormal returns on the announcement of a female director. Their event study fails to detect any significant market reaction to female director appointments, implying that adding female directors does not create or destroy firm value.

Another strand of studies has documented a positive relation between firm performance and board gender diversity. For example, Carter, Simkins, and Simpson (2003) investigate the effects of board diversity on firm value for *Fortune* 1000 firms. They find that firm value increases with the fraction of women on boards. In addition, they show that female representation on boards is positively related to firm size and board size and inversely related to the number of insiders. Liu, Wei, and Xie (2014) examine the impact of female directors on firm performance in Chinese listed firms and show that female representation has positive effects on firm performance. In particular, they find evidence in support of the critical mass theory that the impact of female directors is more pronounced when critical mass is reached. Specifically, they show that a board with a sole female director exerts no significant impact on firm performance and a board with three or more female directors has a greater impact on firm performance than a board with two or fewer female directors. Pathan and Faff (2013), García-Meca, García-Sánchez, and Martínez-Ferrero (2015), and Owen and Temesvary (2018) study the effects of female directors on firm performance in the banking industry. Their results show that the positive impact of board gender diversity is more pronounced in pre-Sarbanes-Oxley Act (SOX) period, in stronger regulatory and higher investor protection environment, and in well-capitalized banks, respectively.

By contrast, some studies have found a negative relation between firm performance and board gender diversity. For example, Adams and Ferreira (2009) discover that boards with more female directors allocate more effort to monitoring and enhance corporate governance but the average effects of the board gender diversity on firm performance are negative. They argue that the negative performance effect is due to excessive monitoring imposed by female directors. Ahern and Dittmar (2012) investigate the diversity-performance relation by taking advantage of a natural experiment. Specifically, the Norwegian Parliament passed a law in 2003 requiring all public-limited firms to increase female representation on boards to at least 40 percent July 2005. Ahern and Dittmar (2012) find a significant negative impact of the mandated increase in board gender diversity on firm value. More specifically, they observe a significant decline in the stock price at the announcement of the law and a dramatic drop in firms' Tobin's Q afterwards.

Hypotheses Development and Testing

The prior literature proposes several competing theories regarding the role of female directors in firms' management. Kanter's (1977) token status theory is one of the first theoretical attempts to investigate gender diversity. She suggests that females in leadership positions are merely "tokens" and in extreme cases, "solos" (i.e., the sole representative of a specific demographic group). Since the majority of incumbent corporate leaders are males and most applicants for leadership positions are also males, the public perception is likely that males have the necessary attributes for leadership success and consequently that females are less competent than males for leadership positions (Lee and James, 2007). As a result, diversity is considered to be purely cosmetic and female directors' impact on corporate decisions (and firm performance) is limited by stakeholders (Liu, Wei, and Xie, 2014).

However, many studies have offered views that contradict the token status theory. For example, previous research suggests that compared to men, women possess better managerial skills (e.g. communication, legal, human resources, and public relations) and thus, they contribute to firm value by improving marketplace understanding, increasing creativity and innovation, producing high-quality problem-solving, enhancing leadership effectiveness, and building effective global relationships (e.g., Robinson and Dechant, 1997; Zelechowski and Bilimoriam, 2004; Pathan and Faff, 2013; García-Meca, García-Sánchez, and Martínez-Ferrero, 2015). In addition, given that the barriers to promotion are greater for women than for men (i.e., 'glass ceiling'), women on boards are considered more skilled than their male peers, and they are likely more diligent and proficient (Pathan and Faff, 2013; Eagly and Carli, 2003).

Adams and Ferreira (2009) also find that female directors can help improve corporate governance through tougher monitoring, greater participation in decision making, and more incentive alignment. Specifically, female directors are more likely to sit on monitoring-related committees (e.g., audit, nominating, and corporate governance committees) to enhance corporate monitoring. In addition, boards with more female directors are more likely to hold their chief executive officers (CEOs) accountable for poor performance, and their CEO turnover is more sensitive to their stock return performance. Also, female directors have less attendance problems than male directors and male director attendance improves as boards become more gender-diverse. Moreover, Adams and Ferreira (2009) show that the board gender diversity is positively related to the fraction of equity-based pay for directors, implying that gender-diverse boards are more aligned with their shareholders' interests. These improvements in governance due to increased female board participation are expected to reduce owner-manager agency problems and lead to better firm performance.

However, some studies argue that too much board monitoring is detrimental to firm performance (e.g., Almazon and Suarez, 2003; Adams and Ferreira, 2007; Adams and Ferreira, 2009). For example, Adams and Ferreira (2007) suggest that greater participation of board directors in decision making could lead to interference, which may cause a breakdown in communication between managers and directors, thus dampening firm performance. Besides the potential costs associated with tougher monitoring, another source of penalty linked to board gender diversity is the female directors' turnover. Robinson and Dechant (1997) also suggest that the turnover rate of women is greater than that of men at all ages and it leads to significantly higher turnover costs to their firms. Overall, the above discussion leads to three competing hypotheses as follows:

Hypothesis 1 (Diversity Neutral): Board gender diversity has no influence on performance.

Hypothesis 2 (Diversity Premium): Board gender diversity is positively related to performance.

Hypothesis 3 (Diversity Penalty): Board gender diversity is negatively related to performance.

To test these three hypotheses, we estimate a series of models that test the following relation:

Performance = f (Board Gender Diversity, Controls)

Performance Measure Selection

The most commonly used measures for insurers' performance in the prior literature are the return on assets (ROA) and return on equity (ROE) (e.g., BarNiv and McDonald, 1992; Browne, Carson, and Hoyt, 2001, Lai and Limpapahyom, 2003; Liebenberg and Sommer, 2008). ROA is calculated as the ratio of net income over total net admitted assets, and ROE is calculated as the ratio of net income to policyholder surplus. Following the prior literature, we perform our analysis on both measures. For parsimony, we only tabulate the results for ROA in our main analysis, but we discuss the results for ROE in the "Robustness" section.

It is also necessary to consider risk-adjusted performance since higher performance might simply reflect higher risk. There are two methods used in the insurance literature to adjust the performance for risk. One is to divide the performance measure by its rolling standard deviation over a previous period (e.g., 3, 5, or 10 years). The other one is to include a risk measure whenever the performance is the dependent variable. Liebenberg and Sommer (2008) recommend the latter method because it allows for direct interpretation of the magnitude of the effect of the key independent variable on the dependent variable. We therefore focus primarily on the results from model specifications with risk as an additional control[3].

[3] We also perform our analysis using the former risk-adjustment method in a robustness check, and we find that our results are robust.

Board Gender Diversity Measure Selection

In the prior literature, board gender diversity is measured by discrete or continuous variables. A simple discrete measure is a binary variable that indicates the presence of any female directors and is used to compare the performance between firms with and without female directors (e.g., Carter, Simkins, and Simpson, 2003). Our first gender diversity measure is a dummy variable (*Insurer with Female Directors*) that is equal to 1 for an insurer with female directors on the board and 0 otherwise. A richer discrete measure of gender diversity is the number of female directors on the board (e.g., Bear, Rahman, and Post, 2010). This measure reflects the extent of female board representation and allows for the measurement of marginal effects of female board appointees. Following the prior literature, we adopt this count variable (*Number of Female Directors*) as an alternative measure for the board gender diversity.

The most widely used continuous measure of board diversity is the proportion of female directors, which captures the extent of female representation while accounting for board size (e.g., Carter, Simkins, and Simpson, 2003; Adams and Ferreira, 2009; Pathan and Faff, 2013; Liu, Wei, and Xie, 2014; García-Meca, García-Sánchez, and Martínez-Ferrero, 2015). We use the proportion of female directors on boards (*Proportion of Female Directors*) as our third measure. Some studies also measure board gender diversity by the Blau Index, which is designed to measure gender equality rather than just female representation. (e.g., Bear, Rahman, and Post, 2010; Owen and Temesvary, 2018). It is calculated as follows,

$$Blau\ Index_{i,t} = 1 - \sum_{g=1}^{G} P_{i,t,g}^{2}$$

where $P_{i,t,g}$ represents the proportion of female and male directors on the board of insurer i in year t, and g indexes gender. By construction, the Blau Index is equivalent to 1 minus the Herfindahl Index of the proportions of male and female directors on a firm's board. Its maximum value is 50 percent which can be achieved when both females and males have 50 percent representation. The higher the Blau Index, the greater the gender equality. Although the Blau Index is not a monotonically increasing function of the proportion of female directors, given that females are underrepresented at present and in the past, this measure is expected to be highly correlated with the female representation. In our study, we also employ the Blau Index (*Blau Index*) as a measure for the board gender diversity.

Control Variables

It is important to control for other important board characteristics that may affect firm performance. Specifically, we control for the board size (*Board Size*), CEO/Chairperson of the board duality (*CEO/Chair Duality*), and proportion of insiders on boards (*Proportion of Insiders*). We also control for other firm-specific characteristics including firm size (*Firm Size*), capitalization (*Capitalization*), business line diversification (*Business Line Diversification*), geographic diversification (*Geographic Diversification*), market concentration (*Market Concentration*), organizational form (*Mutual*), public status (*Public*), group status (*Group*), risk (*Standard Deviation of ROA* or *Standard Deviation of ROE*), and year, state, and line fixed effects. Table 1 summarizes the variables and their descriptions in our study and predicted signs on the independent variables in the regression.

[Insert Table 1 Here]

Data and Sample

We obtain an initial sample of P/L insurers from the National Association of Insurance Commissioners (NAIC) InfoPro database for the years 2008 through 2017. The directors' demographics information (i.e., first name, middle name, last name, suffix, title, and job description) is reported in the "officer demographics file for property companies" at the firm level, and this file has been included in the NAIC InfoPro database since 2007[4]. However, the directors' genders are not disclosed in either this database or insurers' statutory statements. So we have to identify each director's gender using an appropriate approach.

Ahern and Dittmar (2012) identify the gender of a board director based on his or her first name by the First Names database from Statistics Norway. In a similar vein, we obtain the first name of each director on insurers' boards and match it with its corresponding gender provided by the Carnegie Mellon University (CMU) Artificial Intelligence (AI) Repository Name Corpus (Kantrowitz, 1994). This name corpus contains a list of several thousand male and female names. This name corpus has been widely used in the research in computer science and other related disciplines (e.g., Hiyakunmoto, Prevost, and Cassell, 1997; Waseem and Hovy, 2016) but does not appear to have been used in business research. Therefore, we use this approach with caution. First, we notice that unisex first names are included in the corpus and they will result in two different genders for the same first name. Therefore, we remove these unisex first names from the corpus. Second, we find that after we merge the director's name with the name corpus, not all directors' genders can be identified because they have either a name not included in the corpus or a unisex name. For those directors whose genders cannot be identified, they will not be a concern

[4] 2007 is the first year that the NAIC InfoPro database includes the "officer demographics file for property companies". However, the job description is not reported in that year so that we cannot distinguish directors from officers. So we exclude 2007 from our sample period.

to our research because we will later remove them and their associated insurers out of the sample. However, for those directors whose genders can be identified, it is unknown to us whether the identified genders are accurate and reliable.

To address the concern about the accuracy and reliability of this approach, we conduct an out-of-sample test. Specifically, we apply the same gender identification approach to firms that are included in the Institutional Shareholder Services (ISS) database (formerly known as RiskMetrics' Governance Data and Investor Responsibility Research Center (IRRC) Director Data), which is a well-known board demographics database for Standard & Poor's (S&P) firms and used by previous finance literature on board gender diversity (e.g., Adams and Ferreira, 2009). A unique feature of the ISS is that it reports the gender of each director. Our out-of-sample test is to compare the gender identified by the CMU name corpus with the gender reported by the ISS and determine whether the name corpus results in a sizable number of misidentifications. This test is based on the assumption that the ISS database correctly reports each director's gender.

Table 2 reports the results from the out-of-sample test. To show the consistency of our results across years over the entire time period covered by the ISS (2007-2016, as of the date that this manuscript is written), we present statistics in each year. We find that for those directors whose genders can be identified by the corpus, a vast majority of their genders are identified correctly. Specifically, the proportion of misidentifications ranges from 0.2 to 0.5 percent, and the proportion of correct identifications ranges from 99.5 to 99.8 percent. In addition, the performance of the corpus is shown to be stable across years, with the proportion of misidentifications always much less than 1 percent. After conducting this out-of-sample test, we are comfortable that our gender identification using the CMU corpus is accurate and reliable.

[Insert Table 2 Here]

Furthermore, we examine the board gender diversity observed in the entire NAIC InfoPro database and check whether it exhibits a similar time trend reported elsewhere. Figure 1 depicts the time trends of the proportion of insurers with female directors on boards and the average proportion of female directors. We find that both measures exhibit a significant upward trend over the past decade. More specifically, the proportion of insurers with female directors on boards increased to 60.2 percent in 2017 from the previous 51 percent in 2008, and the average proportion of female directors on boards increased to 15.9 percent in 2017 from the previous 12.6 percent in 2008. The time trend of the board gender diversity observed in the NAIC InfoPro database is consistent with that reported by Angelina and Sharma (2012) and Angelina, Hamrick, and James (2017).

[Insert Figure 1 Here]

For our regression analysis, we follow prior insurance literature and apply standard data screens to our sample. Specifically, we first exclude insurers under regulatory scrutiny and then exclude insurers that report non-positive assets, capital, net premiums written, or an organizational form other than stock and mutual (e.g., Liebenberg and Sommer, 2008). In addition, we remove insurers without sufficient information to calculate the variables used in our regressions. In particular, if the gender of one or more directors on an insurer's board cannot be identified, we regard the board diversity information of that insurer as missing and remove it out of the sample. Finally, outlier detection tests lead us to winsorize ROE and its rolling standard deviation (*Standard Deviation of ROE*) at the 1^{st} and 99^{th} percentile. After data screening, we obtain a final sample of 230 insurers with 13,669 insurer-director-year observations (2,210 insurer-year observations). Even though many insurers are excluded due to incomplete board gender diversity information, our sample size is comparable to other studies on insurers' corporate governance (e.g., Ho, Lai, and Lee, 2013; Hsu, Huang, and Lai, 2015).[5]

Table 3 reports the summary statistics of the variables in our study. The average ROA and ROE in our sample are 0.0240 and 0.0492, respectively, which are almost identical to the 0.02 and 0.05 reported by Liebenberg and Sommer (2008). Consistent with the prior literature and the time trend shown earlier, the summary statistics of the board gender diversity measures suggest that female directors are severely underrepresented. Specifically, only 59.3 percent of the insurers have female directors on boards and the median insurer has only 1 female board member. Female directors account for roughly 14 percent of board seats, leading to a mean *Blau Index* of 0.19 which is far below gender equality (0.5). Notably, the underrepresentation is not driven by a few insurers with a small number of female directors.[6]

In terms of the control variables, most of them have means that are very similar to those reported by other studies in the insurance literature. For example, the mean of *Firm Size* (18.5785) is very close to the 17.9088 reported by Che and Liebenberg (2017) and the mean of *Capitalization* (0.4542) is in line with the 0.49 reported by Liebenberg and Sommer (2008). However, for some variables there are notable differences between our sample summary statistics and those reported in other studies. While the average *Board Size* in our sample is 6.4476, Ho, Lai, and Lee (2013) report an average board size of 10.269 and Hsu, Huang, and Lai

[5] We also considered using other company board databases with each director's gender reported such as BoardEx and ISS to obtain a sample of P/L insurers, but we choose not to use them because these two databases have a very small number of P/L insurers. BoardEx reports data for both public and private firms. The pubic P/L insurers in the BoardEx can be identified based on their corresponding Standard Industrial Classification (SIC) codes provided by COMPUSTAT. The private P/L insurers can be identified based on their company names. Only 8 public P/L insurers and 20 private P/L insurers can be identified. The ISS reports the data for publicly traded S&P firms. Only 42 public P/L insurers can be identified.

[6] Even at the 75th percentile and 90th percentile, the proportion of female directors (0.2000 and 0.3333, respectively) is lower than the proportion of male directors and that the Blau Index (0.3200 and 0.4444, respectively) is still below its maximum value at gender equality (0.5).

(2015) report an average board size of 10.861. Similarly, the mean of *CEO/Chair Duality* is 0.2137 in our sample, which is very different from the 0.319 reported by Ho, Lai, and Lee (2013) and the 0.693 reported by Hsu, Huang, and Lai (2015). The discrepancy for these measures is likely driven by different sample composition. Specifically, as indicated by the mean of *Public* (0.2835) and *Mutual* (0.2476), our sample is dominated by privately held insurers and includes both mutual and stock insurers at the firm level, while the samples used by both Ho, Lai, and Lee (2013) and Hsu, Huang, and Lai (2015) consist of only publicly traded stock insurers at the group level.

Table 4 presents the results of Pearson's correlation matrix of the variables of interest in our study. For parsimony, the correlations associated with control variables are not tabulated. The first two columns of Table 4 provide some initial evidence of a positive diversity-performance relation as the correlations between all four gender diversity measures and both performance measures are positive and statistically significant. As expected, our two performance measurers (ROA and ROE) are highly correlated (0.8464) and our board gender diversity measures are also highly correlated.

[Insert Tables 3 & 4 Here]

Regression Method

To test the relation between board gender diversity and performance, we perform multivariate analysis with ordinary least squares (OLS) regressions. Our baseline model is as follows,

$$Performance_{i,t} = \beta_1 Diversity_{i,t} + \beta_2 Board\ Size_{i,t} + \beta_3 CEO/Chair\ Duality_{i,t} +$$

$$\beta_4 Proportion\ of\ Insiders_{i,t} + \beta_5 Firm\ Size_{i,t} + \beta_6 Capitalization_{i,t} +$$

$$\beta_7 Business\ Line\ Diversification_{i,t} + \beta_8 Geographic\ Diversification_{i,t} +$$

$$\beta_9 Market\ Concentration_{i,t} + \beta_{10} Mutual_{i,t} + \beta_{11} Public_{i,t} + \beta_{12} Group_{i,t} + \beta_{13} Risk_{i,t} + \beta_{14-22} Year_t + \beta_{23-80} State_{i,t} + \beta_{81-104} Line_{i,t} + Intercept \quad (1)$$

where $Performance_{i,t}$ refers to $ROA_{i,t}$ or $ROE_{i,t}$, $Diversity_{i,t}$ refers to *Insurers with Female* $Directors_{i,t}$, *Number of Female* $Directors_{i,t}$, *Proportion of Female* $Directors_{i,t}$, or *Blau* $Index_{i,t}$, and $Risk_{i,t}$ refers to *Standard Deviation of* $ROA_{i,t}$ or *Standard Deviation of* $ROE_{i,t}$ depending on the dependent variable used for the regression.

However, the prior literature suggests that when analyzing the effects of board gender diversity on performance, an endogeneity problem may arise due to omitted variables and reverse causality (e.g., Adams and Ferreira, 2009; Liu, Wei, and Xie, 2014). Specifically, omitted variables that affect both the appointment of female directors and performance could lead to spurious correlations between female representation and performance, and firm performance could affect both the incentives of females to join the boards and the incentives of boards to appoint female directors. To examine the exogeneity of our board gender diversity measures, we conduct a regression-based Hausman test and reject the null of exogeneity for all board gender diversity measures. To deal with the endogeneity issue, we employ two alternative model specifications.

Our first alternative model specification uses a Heckman treatment-effects approach and a two-stage least squares (2SLS) approach when regressing performance on the dummy variable for the presence of female directors (*Insurer with Female Directors*) and uses a 2SLS approach when regressing performance on the measures for the extent of female representation (*Number of Female Directors*, *Proportion of Female Directors*, and *Blau Index*). In particular, the Heckman treatment-effects model corrects the aforementioned self-selection bias through controlling for a self-selection parameter obtained from a logit regression in the first stage. Both the Heckman and

2SLS approaches require the identification of an appropriate instrumental variable. Adams and Ferreira (2009) suggest an instrument for board gender diversity: the proportion of male directors with board connections to female directors (i.e., male directors on the board who also sit on other boards on which there are female directors). We construct this measure for our sample and find that it is a successful instrument for all our board gender diversity measures.[7]

Our second alternative model specification adds a lagged performance measure to the main regression and estimates the augmented regression using the Arellano-Bond one step method. The purpose of the Arellano-Bond dynamic panel estimator is to address the endogeneity arising from past performance that could influence board gender diversity. Following Adams and Ferreira (2009), the instrument variables employed in this specification consist of two and all further period lagged performance measures and one period lags of all explanatory variables except for the year fixed effects.

Aside from these aforementioned alternative model specifications, we also consider addressing the endogeneity problem using fixed-effects regressions but are unable to do so because of insufficient within-firm variation in our key independent variables (Wooldridge, 2002). Nevertheless, to avoid bias in the standard errors due to within-firm correlation, we address the panel nature of our data by adjusting the standard errors for insurer-level clustering.

Results

Before conducting multivariate regressions, we first provide univariate evidence of the difference in performance and risk for firms with and without female directors. As reported in

[7] Wald tests, reported in our regression tables, suggest instrument relevance. With one instrument we are unable to test for instrument validity as there are no overidentifying restrictions.

Table 5, mean and median ROA and ROE is higher for insurers with female directors, and the differences are statistically and economically significant. Before controlling for other performance correlates, the average ROA (ROE) for firms with at least one female director on the board is 1.2 (3.9) percentage points higher than for those without any female board representation. The performance differential holds for the risk-adjusted measures as well. Thus, our univariate results provide initial support for the diversity premium hypothesis.

[Insert Table 5 Here]

We provide multivariate evidence of the effects of board gender diversity on insurer performance using the baseline regression model in Table 6. The coefficient estimates on our board gender diversity measures are all consistent with the diversity premium hypothesis. Specifically, the coefficient estimate on *Insurer with Female Directors* implies that *ceteris paribus*, insurers with female directors outperform their peers without female directors by 1.4 percent. The coefficient estimate on *Number of Female Directors* indicates that, on average, adding one female director to the board can increase the performance by 0.7 percent. Similarly, in the regressions with *Proportion of Female Directors* and *Blau Index* as key independent variables, we find that the insurers' performance increases with the female director representation on boards.

Some results for the control variables in our regressions are noteworthy. For instance, the positive and significant coefficient on *Firm Size* supports that argument that larger insurers are able to charge higher prices because of lower insolvency risk and greater market power (Sommer, 1996; Cummins and Nini, 2002). The coefficient estimate on *Capitalization* is also positive and significant, providing support to the viewpoint that insurers with higher capitalization obtain higher prices for their products (Sommer, 1996). In addition, we find that *Market Concentration* is negatively related to ROA. This result is consistent with the literature that shows a negative concentration-performance relation (e.g., Jacquemin, de Ghellinck, and Huveneers, 1980; Clarke, 1984; Carroll, 1993) and does not support the structure-conduct-performance (SCP) paradigm. We also find that the coefficient estimate on *Mutual* is negative and significant, consistent with the expense preference hypothesis that mutual insurers have a higher cost structure than stock insurers due to higher managerial perquisite consumption (Cummins, Weiss, and Zi, 1999). Lastly, we find a negative and significant relation between *Standard Deviation of ROA* and ROA. The negative relation runs counter to the conventional wisdom that argues for a positive risk-turn association but is consistent with Bowman's risk-return paradox. Specifically, Bowman (1980) finds that risk and return are negatively correlated in most industries. He argues that the risk-return profiles could be affected by firms' risk attitudes and that more troubled firms tend to take more risk (Bowman, 1982; Bowman, 1984).

[Insert Table 6 Here]

Table 7 presents the results from the Heckman and 2SLS regressions of performance on board gender diversity. We find that the results after addressing the endogeneity of the board gender diversity are generally consistent with the results from the OLS regressions[8]. Table 8 reports the results from the Arellano-Bond one step regressions of performance on board gender diversity. We find that the results still hold after addressing the endogeneity arising from past performance. Taken together, our results show that the board gender diversity has a positive impact on insurers' performance after correcting for endogeneity bias, providing further support to the diversity premium hypothesis.

[8] We notice that the self-selection parameter (i.e., Inverse Mills ratio) in the second stage of the Heckman model is not significant, implying that the self-selection bias is not present in our sample.

[Insert Tables 7 & 8 Here]

Robustness

Alternative Performance Measure and Estimation Methods

As previously discussed, an alternative performance measure that we use is return on equity (ROE). To check whether our results are robust to this alternative performance measure, we reproduce all our regressions using ROE as the dependent variable. In the unreported tables, we find that the coefficient estimates on all our board gender diversity measures are positive and significant across all model specifications. In particular, the coefficient estimate on *Insurer with Female Directors* is 0.0327, 0.0436, 0.0558, and 0.0291 in OLS, Heckman, 2SLS, and Arellano-Bond regressions, respectively, implying a diversity premium of at least about 3 percent of ROE.

In our main analysis, to address the concern that better performance might be simply driven by greater risk-taking, we adjust for risk by including risk as an additional control in the regressions. The advantage of this risk adjustment method is that it allows for direct interpretation of the magnitude of the effect of the key independent variable on the dependent variable. As previously discussed, an alternative way is to calculate the risk-adjusted performance measures and use them as the dependent variables instead. In the unreported tables, we find that the coefficient estimates on all board gender diversity measures are consistently positive and significant across all regressions, suggesting that our results are robust to this alternative risk adjustment method.

Another concern is that the differences in performance might be driven by industry (line-of-business) influences and are not related to board gender diversity. To address this concern, we calculate industry-adjusted performance measures as per Liebenberg and Sommer (2008) and find that our results are robust to this industry adjustment.

Non-Linearity of Diversity-Performance Relation

Prior literature suggests that the diversity-performance relation may be non-linear. For example, the critical mass theory argues that "one is a token, two is a presence, and three is a voice" (Kristie, 2011), implying that the number of female directors matters and that a sole female director on the board may exert no impact. To investigate whether this is the case, we follow Liu, Wei, and Xie (2014) and break down *Number of Female Directors* into several dummy variables that represent different numbers of female directors on boards. Table 9 reports the results. We find that sole female directors do impact performance and that the diversity premium is nonlinear. Compared to insurers with no female directors, ROA is 1.2 percent higher for those with one female director, 2 percent higher for those with 2 female directors, and 2.6 percent higher for insurers with 3 female directors. The premium decreases to 1.6 percent for insurers with 4 female directors and is not statistically significant thereafter. The insignificant relation between the number of female directors and performance in the most gender-diverse insurers could be driven by the increasing cost of the board gender diversity. Specifically, as previously discussed, excessive monitoring and high turnover rate associated with more female directors may be detrimental to firm value. Since we do not find that the diversity-performance relation turns negative at high level of board gender diversity, our results suggest that the costs associated with female representation do not outweigh its benefits.

However, the insignificant relation may also be driven by lack of observations of insurers with at least 5 directors (13 observations, or 0.6 percent of the sample). To further check the robustness of these results, we follow Morck, Shleifer, and Vishny (1988) and run piecewise linear regressions on the continuous measures of board gender diversity (*Proportion of Female Directors* and *Blau Index*). Based on the distribution of the values of these two measures, we choose the 50th and 75th percentiles as turning points for each measure. In Table 9, we find consistent results. Specifically, the relation between board gender diversity and performance is positive and significant, but it becomes statistically insignificant when a high level of diversity is reached. Nevertheless, no negative and significant relation is detected along the distribution of the board gender diversity. Taken together, our results reveal a non-linear relation between performance and board gender diversity.

[Insert Table 9 Here]

Effects of Ownership Structure and Public Status

As previously discussed, the positive impact of board gender diversity may result from better corporate governance. Specifically, female directors can improve corporate governance by tougher monitoring, which mitigates the agency conflicts between owners and managers. To provide evidence for this channel, we investigate the diversity-performance relation in the context of different ownership structures in our sample. The prior literature suggests that mutual and stock insurers are faced with different agency problems (e.g., Mayers and Smith, 1981; Viswanathan and Cummins, 2003). Specifically, stock insurers are exposed to more severe owner-policyholder conflicts, but they are exposed to less owner-manager conflicts because of an effective market-based mechanism including executive stock options, proxy fights, and the takeover market. By contrast, while the mutual insurers reduce the owner-policyholder conflicts by merging the role of owners and policyholders, they are exposed to more severe owner-manager conflicts due to the absence of a market-based mechanism for corporate control. Therefore, the diversity-performance relation may be stronger in the mutual insurers where managerial monitoring mechanisms are weaker. We divide our sample into a subsample of mutual insurers and a subsample of stock insurers and estimate our models separately for each of these groups. Results, reported in Panel A of Table 10 indicate that the positive diversity-performance relation is limited to stock insurers – contrary to our expectation. A potential explanation for this result stems from the managerial discretion hypothesis (Mayers and Smith, 1981) which predicts that mutuals will engage in less complex activities due to the limited discretion afforded their managers. According to this view mutual managers will require less monitoring than stock insurers.

To further examine the monitoring channel as an explanation for the board gender diversity premium, we condition on stock insurers and examine the board diversity-performance relation separately for publicly traded and privately held stock insurers because these ownership structures differ substantially in terms of monitoring (and governance) provided by shareholders and other stakeholders. Publicly traded insurers are subject to far greater capital market monitoring than are privately held insurers because stock analysts, blockholders, and institutional shareholders act as monitors (e.g. Jensen and Meckling, 1976; Edmans, 2009; Hartzell and Starks, 2003). Thus, the benefits from monitoring provided by female directors should be greatest in private firms, where public mechanisms for managerial monitoring are absent. In Panel B of Table 10, we find that the positive diversity-performance relation is indeed limited to private stock insurers. The coefficient estimates on our board gender diversity measures are consistently positive and for the private stock insurer subsample but are statistically insignificant for publicly traded stock insurers. Our results for these subsamples are consistent with female directors benefiting firms via improved managerial monitoring.

[Insert Table 10 Here]

Event Study

To further examine the relation between board gender diversity and insurer performance we perform an event study to examine how insurers' performance changes following the first appointment of a female director.[9] To conduct this event study, we condition on insurers that had no female directors at the beginning of our sample period and test for the effect of appointing a female director. In this setting the treatment group is the set of insurers that had no female directors at the beginning of the sample period and later appointed a female director while the control group is the set of insurers that never appoint a female director.

We first perform a visual inspection of data around the arrival of female directors. Figure 2 exhibits the average ROA and ROE three years before and three years after the arrival of a female director. We observe a striking pattern. In terms of the ROA, the average ROA before the arrival of a female director is 2.3 percent, and after the arrival of a female director, it increases to 3.1 percent. A more significant increase is observed in the ROE. Specifically, the average ROE before the arrival of a female director is 3.7 percent, and it increases to 5.6 percent following the appointment. These results are consistent with a clear improvement in insurers' performance following the arrival of a female director.

[Insert Figure 2 Here]

[9] Jiang, Kubick, Miletkov, and Wintoki (2018) regard the first appointment of a director with connections to island tax havens as a corporate event. In a similar vein, we consider the first appointment of a female director as an event for our event study.

To control for other performance correlates, we conduct difference-in-differences regressions. Following the research design by Eckles, Hoyt, and Miller (2014), our difference-in-differences specification incudes a dummy variable that is equal to 1 if the insurer has ever had a female director during the sample period (*Female Director Insurer*) and its interaction with a dummy variable that is equal to 1 for the years starting with the first appointment of a female director (*Post*). This interaction term (*Female Director Insurer* × *Post*) is our variable of interest. We first perform OLS regressions under the difference-in-differences specification. The baseline model is shown as follows,

$$Performance_{i,t} = \beta_1 Female\ Director\ Insurer + \beta_2 Female\ Director\ Insurer \times Post_{i,t}$$
$$+\boldsymbol{\beta_3 X} + Intercept \quad (2)$$

where $Performance_{i,t}$ refers to $ROA_{i,t}$ or $ROE_{i,t}$, $\boldsymbol{X}$ represents the control variables in Equation (1), and $\boldsymbol{\beta_3}$ represents their coefficients.

However, the OLS model could be biased if the appointment of a female director coincides with changes in underlying firm characteristics. Therefore, we employ a two-step Heckman procedure to address the potential self-selection bias. The first step of the Heckman procedure is a Probit model in which the dependent variable is a dummy variable (*Insurer with Female Directors*) equal to 1 if an insurer has a female director in a year. As discussed previously, our instrument is the proportion of male directors with board connections to female directors. The second step is an OLS model specified by Equation (2) including the self-selection parameter (i.e., Inverse Mills ratio) computed from the first step as an additional control.

The regression results are reported in Table 9. We find that the coefficient estimate on *Female Director Insurer* × *Post* is positive and significant across all model specifications, suggesting that the appointment of a female director is associated with better subsequent performance. The performance improvement associated with appointing a female director ranges from 1 percent to 2.8 percent of ROA or 3 percent to 7.3 percent of ROE. These results provide further support for the diversity premium hypothesis.

[Insert Table 11 Here]

Conclusion

In this study, we examine board gender diversity in the U.S. P/L insurance industry and its impact on insurers' performance. We find that the presence of female directors on insurers' boards increased significantly over the period 2008 – 2017. Through empirical analysis, we find evidence in support of the diversity premium hypothesis. Specifically, our results suggest that, *ceteris paribus*, board gender diversify is associated with a premium of at least 1 percent of return on assets or 3 percent of return on equity. These findings are robust to corrections for potential endogeneity bias, alternative performance and gender diversity measures, and alternative estimation techniques.

Moreover, our additional analysis reveals that the diversity-performance relation is non-linear and that the positive impact of female directors tends to be concentrated in private stock insurers. To provide further evidence for the diversity-performance relation, we perform an event study, the results of which suggest that insurers' performance significantly increases following the arrival of a female director. Overall, our study suggests that female directors benefit insurers.

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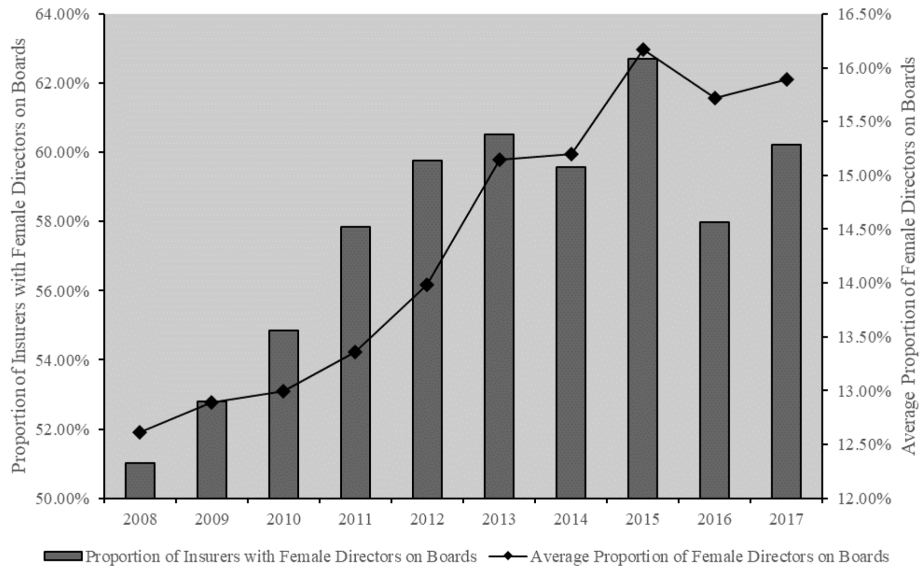
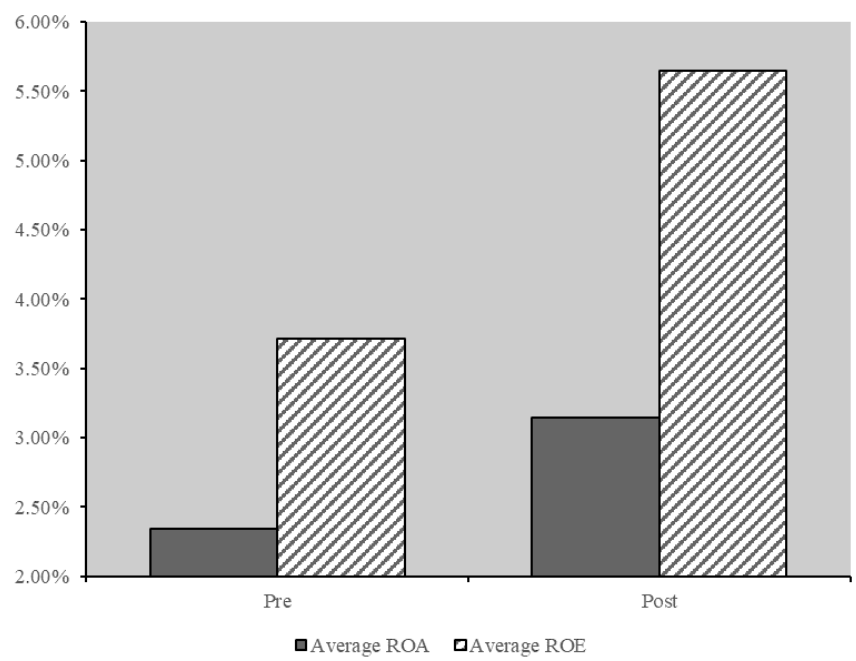
Figure 1
Time Trend of Female Representation on Boards in the U.S. Property-Liability Insurance Industry



Notes: This figure depicts the time trend of the board gender diversity observed from the NAIC InfoPro database for the years 2008 through 2017.

Figure 2
Average Level of Performance Before and After the Arrival of a Female Director



Notes: This figure depicts the average ROA and ROE three years before and three years after the arrival of a female director.

Table 1
Variables and Their Descriptions

Variable Name	Variable Description	Predicted Sign in Regression
Performance Measures:		
ROA	Return on assets, calculated as the ratio of net income over total net admitted assets.	
ROE	Return on equity, calculated as the ratio of net income to policyholder surplus.	
Board Gender Diversity Measures:		
Insurer with Female Directors	A dummy variable that is equal to 1 for an insurer with female directors on the board and 0 otherwise.	+/-
Number of Female Directors	Number of female directors on an insurer's board.	+/-
Proportion of Female Directors	Proportion of female directors on an insurer's board.	+/-
Blau Index	1 minus the Herfindahl Index of the proportions of male and female directors on an insurer's board.	+/-
Control Variables:		
Board Size	Total number of directors on an insurer's board.	+/-
CEO/Chair Duality	A dummy variable that is equal to 1 if the CEO and chair of the board are the same person and 0 otherwise.	+/-
Proportion of Insiders	Proportion of insiders on an insurer's board.	+/-
Firm Size	Natural logarithm of total net admitted assets.	+
Capitalization	The ratio of policyholder surplus to total net admitted assets.	+
Business Line Diversification	1 minus the Herfindahl index of net premiums written across all business lines.	-
Geographic Diversification	1 minus the Herfindahl index of direct premiums written across all U.S. states and territories.	+/-
Market Concentration	Herfindahl index of direct premiums written in each state-line market weighted by an insurer’s proportion of business in the corresponding market at the group level.	+/-
Mutual	A dummy variable that is equal to 1 for a mutual insurer and 0 for a stock insurer.	+/-
Public	A dummy variable that is equal to 1 for a publicly traded insurer or an insurer in a publicly traded group and 0 otherwise.	+
Group	A dummy variable that is equal to 1 for an affiliated insurer and 0 for an unaffiliated insurer.	-
Standard Deviation of ROA	Rolling standard deviation of an insurer's return on assets over the previous five years.	+
Standard Deviation of ROE	Rolling standard deviation of an insurer's return on equity over the previous five years.	+

Notes: This table presents the variables and their descriptions in our study and predicted signs on the independent variables in the regression.

Table 2
Accuracy of CMU AI Repository Name Corpus: Benchmarking Against ISS (2007-2016)

Year	Number of Misidentifications	Number of Observations	Proportion of Misidentifications	Proportion of Correct Identifications
2007	59	10,861	0.54%	99.46%
2008	46	11,212	0.41%	99.59%
2009	47	11,228	0.42%	99.58%
2010	38	11,313	0.34%	99.66%
2011	34	11,221	0.30%	99.70%
2012	35	11,427	0.31%	99.69%
2013	29	11,642	0.25%	99.75%
2014	28	11,583	0.24%	99.76%
2015	29	11,668	0.25%	99.75%
2016	33	11,683	0.28%	99.72%

Notes: This table presents the results from the out-of-sample test that benchmarks against the ISS database over the period 2007-2016.

Table 3
Summary Statistics

Variable Name	N	Mean	Median	Min	Max	Std Dev
Performance Measures:						
ROA	2,120	0.0240	0.0241	-0.6979	0.5624	0.0551
ROE	2,120	0.0492	0.0554	-0.5379	0.3246	0.1192
Board Gender Diversity Measures:						
Insurer with Female Directors	2,120	0.5925	1.0000	0.0000	1.0000	0.4915
Number of Female Directors	2,120	0.9000	1.0000	0.0000	6.0000	1.0065
Proportion of Female Directors	2,120	0.1369	0.1429	0.0000	0.8000	0.1465
Blau Index	2,120	0.1934	0.2449	0.0000	0.5000	0.1754
Control Variables:						
Board Size	2,120	6.4476	6.0000	1.0000	18.0000	2.6190
CEO/Chair Duality	2,120	0.2137	0.0000	0.0000	1.0000	0.4100
Proportion of Insiders	2,120	0.5242	0.5000	0.0000	1.0000	0.3155
Firm Size	2,120	18.5758	18.6781	13.6999	24.3973	1.9203
Capitalization	2,120	0.4542	0.4166	0.0297	1.0000	0.1839
Business Line Diversification	2,120	0.3800	0.3816	0.0000	0.8485	0.3248
Geographic Diversification	2,120	0.5039	0.6145	0.0000	0.9673	0.3733
Market Concentration	2,120	0.0834	0.0769	0.0292	0.3359	0.0363
Mutual	2,120	0.2476	0.0000	0.0000	1.0000	0.4317
Public	2,120	0.2835	0.0000	0.0000	1.0000	0.4508
Group	2,120	0.7085	1.0000	0.0000	1.0000	0.4546
Standard Deviation of ROA	2,120	0.0285	0.0189	0.0000	0.3745	0.0291
Standard Deviation of ROE	2,120	0.0693	0.0452	0.0051	0.3909	0.0704

Notes: This table presents the summary statistics of the variables in our study.

Table 4
Pearson's Correlation Matrix

Variable Name	ROA	ROE	Insurer with Female Directors	Number of Female Directors	Proportion of Female Directors	Blau Index
ROA	1					
ROE	0.8464***	1				
	(0.0000)					
Insurer with Female Directors	0.1055***	0.1595***	1			
	(0.0000)	(0.0000)				
Number of Female Directors	0.0649***	0.0868***	0.7418***	1		
	(0.0028)	(0.0001)	(0.0000)			
Proportion of Female Directors	0.0975***	0.1156***	0.7751***	0.8259***	1	
	(0.0000)	(0.0000)	(0.0000)	(0.0000)		
Blau Index	0.1077***	0.1521***	0.9148***	0.8352***	0.9333***	1
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	

Notes: This table presents the Pearson's correlation matrix of the variables of interest in our study. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

Table 5
Univariate Comparison

	Insurers with Female Directors (1,256 Insurer-Years) (1)		Insurers without Female Directors (864 Insurer-Years) (2)		Difference (1) - (2)	
Variable	Mean	Median	Mean	Median	Mean	Median
ROA	0.0288	0.0264	0.0170	0.0217	0.0118***	0.0047***
ROE	0.0650	0.0637	0.0263	0.0455	0.0387***	0.0182***
Standard Deviation of ROA	0.0258	0.0179	0.0323	0.0211	-0.0064***	-0.0032***
Standard Deviation of ROE	0.0634	0.0451	0.0778	0.0454	-0.0144***	-0.0003
Risk-Adjusted ROA	2.0595	1.6359	1.4750	1.0210	0.5845***	0.6150***
Risk-Adjusted ROE	2.0757	1.6003	1.4843	1.0406	0.5914***	0.5597***

Notes: This table compare the means and medians of performance between insurers without female directors on boards and insurers with female directors on boards in a univariate test. Risk-adjusted ROA is calculated as return on assets (ROA) divided by its standard deviation over the previous five years. Risk-adjusted ROE is calculated as return on equity (ROE) divided by its standard deviation over the previous five years. The significance of differences in means is tested by a *t*-test. The significance of differences in medians is tested by a Wilcoxon rank-sum test. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

Table 6
Effects of Board Gender Diversity on Insurers' Performance: OLS Regressions

Dependent Variable:	ROA			
Model:	OLS	OLS	OLS	OLS
Insurer with Female Directors	0.0144***			
	(0.0034)			
Number of Female Directors		0.0070***		
		(0.0016)		
Proportion of Female Directors			0.0430***	
			(0.0107)	
Blau Index				0.0422***
				(0.0090)
Board Size	-0.0006	-0.0013	-0.0002	-0.0004
	(0.0009)	(0.0010)	(0.0009)	(0.0009)
CEO/Chair Duality	0.0036	0.0045	0.0041	0.0039
	(0.0054)	(0.0055)	(0.0055)	(0.0055)
Proportion of Insiders	-0.0035	-0.0038	-0.0034	-0.0038
	(0.0091)	(0.0091)	(0.0090)	(0.0091)
Firm Size	0.0057***	0.0059***	0.0060***	0.0057***
	(0.0020)	(0.0020)	(0.0020)	(0.0020)
Capitalization	0.0974***	0.0963***	0.0955***	0.0982***
	(0.0225)	(0.0225)	(0.0223)	(0.0224)
Business Line Diversification	0.0284	0.0306*	0.0286	0.0279
	(0.0178)	(0.0180)	(0.0181)	(0.0179)
Geographic Diversification	0.0090	0.0113	0.0104	0.0092
	(0.0083)	(0.0085)	(0.0084)	(0.0082)
Market Concentration	-0.1419**	-0.1454**	-0.1439**	-0.1465**
	(0.0614)	(0.0616)	(0.0614)	(0.0614)
Mutual	-0.0123**	-0.0120**	-0.0119**	-0.0120**
	(0.0057)	(0.0058)	(0.0058)	(0.0058)
Public	-0.0030	-0.0022	-0.0025	-0.0027
	(0.0062)	(0.0063)	(0.0062)	(0.0062)
Group	-0.0100	-0.0089	-0.0092	-0.0094
	(0.0064)	(0.0065)	(0.0066)	(0.0064)
Standard Deviation of ROA	-0.2642*	-0.2612*	-0.2642*	-0.2613*
	(0.1545)	(0.1537)	(0.1537)	(0.1536)
Intercept	-0.0831***	-0.0813***	-0.0894***	-0.0865***
	(0.0311)	(0.0313)	(0.0309)	(0.0310)
Year, State, & Line Fixed Effects	Yes	Yes	Yes	Yes
Adjusted R-Squared	0.2616	0.2595	0.2599	0.2633
Observations	2,120	2,120	2,120	2,120

Notes: This table presents the multivariate regressions of performance on board gender diversity. The dependent variable is return on assets (ROA). Standard errors (in parentheses) are corrected for clustering at the insurer level. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

Table 7
Effects of Board Gender Diversity on Insurers' Performance: Heckman and 2SLS Regressions

Dependent Variable:	ROA				
Model:	Heckman	2SLS	2SLS	2SLS	2SLS
Insurer with Female Directors	0.0202***	0.0265***			
	(0.0045)	(0.0084)			
Number of Female Directors			0.0231***		
			(0.0075)		
Proportion of Female Directors				0.1257***	
				(0.0410)	
Blau Index					0.0835***
					(0.0267)
Board Size	-0.0009	-0.0012	-0.0043**	-0.0006	-0.0008
	(0.0006)	(0.0010)	(0.0019)	(0.0010)	(0.0009)
CEO/Chair Duality	0.0034	0.0032	0.0057	0.0043	0.0037
	(0.0040)	(0.0053)	(0.0058)	(0.0057)	(0.0055)
Proportion of Insiders	-0.0040	-0.0046	-0.0075	-0.0057	-0.0055
	(0.0052)	(0.0093)	(0.0105)	(0.0100)	(0.0096)
Firm Size	0.0056***	0.0056***	0.0060***	0.0063***	0.0057***
	(0.0010)	(0.0019)	(0.0020)	(0.0020)	(0.0019)
Capitalization	0.0994***	0.1017***	0.1057***	0.1018***	0.1039***
	(0.0074)	(0.0233)	(0.0250)	(0.0239)	(0.0239)
Business Line Diversification	0.0280***	0.0276	0.0334*	0.0271	0.0264
	(0.0093)	(0.0171)	(0.0183)	(0.0178)	(0.0173)
Geographic Diversification	0.0082	0.0074	0.0119	0.0093	0.0074
	(0.0063)	(0.0079)	(0.0085)	(0.0083)	(0.0079)
Market Concentration	-0.1510***	-0.1610**	-0.2063***	-0.1916**	-0.1735**
	(0.0387)	(0.0656)	(0.0770)	(0.0755)	(0.0683)
Mutual	-0.0118***	-0.0112**	-0.0084	-0.0088	-0.0105*
	(0.0037)	(0.0054)	(0.0062)	(0.0056)	(0.0055)
Public	-0.0035	-0.0040	-0.0030	-0.0038	-0.0035
	(0.0037)	(0.0062)	(0.0065)	(0.0064)	(0.0062)
Group	-0.0092***	-0.0083	-0.0019	-0.0039	-0.0069
	(0.0032)	(0.0058)	(0.0062)	(0.0058)	(0.0057)
Standard Deviation of ROA	-0.2583***	-0.2520*	-0.2208	-0.2365	-0.2442
	(0.0416)	(0.1504)	(0.1504)	(0.1507)	(0.1497)
Intercept	-0.0843***	-0.0857***	-0.0842**	-0.1072***	-0.0928***
	(0.0183)	(0.0304)	(0.0330)	(0.0348)	(0.0315)
Wald Test Statistic		156.950***	62.812***	67.438***	112.379***
Self-Selection Parameter	-0.0047				
	(0.0030)				
Year, State, & Line Fixed Effects	Yes	Yes	Yes	Yes	Yes
Adjusted R-Squared	0.2228	0.2532	0.2068	0.2220	0.2502
Observations	2,120	2,120	2,120	2,120	2,120

Notes: This table presents the Heckman and 2SLS regressions of performance on board gender diversity. The dependent variable is return on assets (ROA). The instrument variable is the proportion of male directors with board connections to female directors. Standard errors (in parentheses) are corrected for clustering at the insurer level. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

Table 8
Effects of Board Gender Diversity on Insurers' Performance: Arellano and Bond One Step Regressions

Dependent Variable:	ROA			
Model:	AB	AB	AB	AB
Lagged ROA	0.4539***	0.4540***	0.4539***	0.4520***
	(0.0209)	(0.0209)	(0.0209)	(0.0209)
Insurer with Female Directors	0.0115***			
	(0.0027)			
Number of Female Directors		0.0062***		
		(0.0015)		
Proportion of Female Directors			0.0366***	
			(0.0091)	
Blau Index				0.0348***
				(0.0074)
Board Size	0.0000	-0.0004	0.0005	0.0003
	(0.0007)	(0.0007)	(0.0007)	(0.0007)
CEO/Chair Duality	-0.0028	-0.0020	-0.0026	-0.0025
	(0.0041)	(0.0041)	(0.0041)	(0.0041)
Proportion of Insiders	0.0069	0.0074	0.0075	0.0064
	(0.0057)	(0.0056)	(0.0056)	(0.0057)
Firm Size	0.0040***	0.0043***	0.0042***	0.0040***
	(0.0011)	(0.0011)	(0.0011)	(0.0011)
Capitalization	0.0716***	0.0693***	0.0678***	0.0717***
	(0.0084)	(0.0084)	(0.0083)	(0.0084)
Business Line Diversification	0.0014	0.0047	0.0035	0.0022
	(0.0102)	(0.0102)	(0.0102)	(0.0102)
Geographic Diversification	0.0027	0.0060	0.0046	0.0035
	(0.0068)	(0.0068)	(0.0068)	(0.0068)
Market Concentration	-0.0552	-0.0639	-0.0506	-0.0625
	(0.0457)	(0.0459)	(0.0457)	(0.0457)
Mutual	-0.0030	-0.0030	-0.0028	-0.0029
	(0.0047)	(0.0047)	(0.0047)	(0.0047)
Public	0.0037	0.0045	0.0044	0.0041
	(0.0039)	(0.0039)	(0.0039)	(0.0039)
Group	-0.0061*	-0.0050	-0.0047	-0.0052
	(0.0037)	(0.0037)	(0.0037)	(0.0037)
Standard Deviation of ROA	-0.1275***	-0.1265***	-0.1304***	-0.1261***
	(0.0463)	(0.0463)	(0.0463)	(0.0462)
Year, State, & Line Fixed Effects	Yes	Yes	Yes	Yes
Observations	1,890	1,890	1,890	1,890

Notes: This table presents the Arellano-Bond one step regressions of performance on board gender diversity. The dependent variable is return on assets (ROA). AB is an Arellano-Bond one step regression. The instrument variables include two and all further period lagged performance measures and one period lags of all explanatory variables except for the year fixed effects. Standard errors (in parentheses) are corrected for clustering at the insurer level. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

Table 9
Effects of Board Gender Diversity on Insurers' Performance: Non-Linearity Analysis

Dependent Variable:	ROA				
Model:	OLS	OLS	OLS	OLS	OLS
Number of Female Directors: 1	0.0120***				
	(0.0037)				
Number of Female Directors: 2	0.0197***				
	(0.0049)				
Number of Female Directors: 3	0.0263***				
	(0.0058)				
Number of Female Directors: 4	0.0156*				
	(0.0080)				
Number of Female Directors: >=5	0.0104				
	(0.0107)				
Proportion of Female Directors: P0 to P50		0.0979***			
		(0.0303)			
Proportion of Female Directors: P50 to P100		0.0102			
		(0.0200)			
Proportion of Female Directors: P0 to P75			0.0867***		
			(0.0222)		
Proportion of Female Directors: P75 to P100			-0.0041		
			(0.0244)		
Blau Index: P0 to P50				0.0478***	
				(0.0181)	
Blau Index: P50 to P100				0.0329	
				(0.0260)	
Blau Index: P0 to P75					0.0493***
					(0.0137)
Blau Index: P75 to P100					0.0150
					(0.0402)
Controls, Year, State, & Line Fixed Effects	Yes	Yes	Yes	Yes	Yes
Adjusted R-Squared	0.2629	0.2624	0.2635	0.2631	0.2633
Observations	2,120	2,120	2,120	2,120	2,120

Notes: This table presents the multivariate regressions of performance on board gender diversity in the non-linearity analysis. The dependent variable is return on assets (ROA). *Number of Female Directors: 1* is a dummy variable that is equal to 1 if an insurer has 1 female director and 0 otherwise. The other variables associated with *Number of Female Directors* are dummy variables defined in a similar way. *Proportion of Female Directors: P0 to P50* is a continuous variable that is equal to *Proportion of Female Directors* if *Proportion of Female Directors* is less than its 50^{th} percentile and equal to the 50^{th} percentile of *Proportion of Female Directors* otherwise. *Proportion of Female Directors: P50 to P100* is a continuous variable that is equal to 0 if *Proportion of Female Directors* is less than its 50^{th} percentile and equal to *Proportion of Female Directors* minus its 50^{th} percentile otherwise. The other variables associated with *Proportion of Female Directors* and *Blau Index* are continuous variables defined in a similar way. Standard errors (in parentheses) are corrected for clustering at the insurer level. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

Table 10
Effects of Board Gender Diversity on Insurers' Performance: Subsample Analysis

Panel A: Mutual Insurers vs. Stock Insurers

Subsample:	Mutual Insurers				Stock Insurers			
Dependent Variable:	ROA				ROA			
Insurer with Female Directors	0.0053				0.0139***			
	(0.0114)				(0.0037)			
Number of Female Directors		0.0058				0.0065***		
		(0.0040)				(0.0020)		
Proportion of Female Directors			0.0508				0.0358***	
			(0.0408)				(0.0127)	
Blau Index				0.0421				0.0386***
				(0.0335)				(0.0099)
Controls, Year, State, & Line Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-Squared	0.1679	0.1718	0.1723	0.1731	0.3033	0.3008	0.3003	0.3038
Observations	525	525	525	525	1,595	1,595	1,595	1,595

Panel B: Public Stock Insurers vs. Private Stock Insurers

Subsample:	Public Stock Insurers				Private Stock Insurers			
Dependent Variable:	ROA				ROA			
Insurer with Female Directors	-0.0087				0.0199***			
	(0.0056)				(0.0054)			
Number of Female Directors		-0.0041				0.0084***		
		(0.0055)				(0.0024)		
Proportion of Female Directors			-0.0153				0.0441***	
			(0.0274)				(0.0143)	
Blau Index				-0.0157				0.0536***
				(0.0184)				(0.0132)
Controls, Year, State, & Line Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-Squared	0.4729	0.4697	0.4689	0.4698	0.4048	0.4016	0.4001	0.4064
Observations	581	581	581	581	1,014	1,014	1,014	1,014

Notes: This table presents the multivariate OLS regressions of performance on board gender diversity in the subsample analysis. Panel A reports the results for mutual insurers versus stock insurers. Panel B reports the results for public stock insurers versus private stock insurers. The dependent variable is return on assets (ROA). Standard errors (in parentheses) are corrected for clustering at the insurer level. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.

Table 11
Event Study on Insurers' Performance: Difference-in-Differences Regressions

Dependent Variable:	ROA		ROE	
Model:	OLS	Heckman	OLS	Heckman
Female Director Insurer	0.0223**	0.0228***	0.0342**	0.0357***
	(0.0087)	(0.0064)	(0.0131)	(0.0135)
Female Director Insurer × Post	0.0107*	0.0282***	0.0297**	0.0730***
	(0.0059)	(0.0105)	(0.0125)	(0.0221)
Board Size	-0.0007	-0.0009	-0.0014	-0.0020
	(0.0016)	(0.0012)	(0.0036)	(0.0025)
CEO/Chair Duality	-0.0148*	-0.0166*	-0.0209	-0.0256
	(0.0083)	(0.0094)	(0.0156)	(0.0197)
Proportion of Insiders	-0.0144	-0.0148	-0.0200	-0.0211
	(0.0133)	(0.0094)	(0.0277)	(0.0198)
Firm Size	0.0037	0.0035*	0.0049	0.0045
	(0.0022)	(0.0020)	(0.0047)	(0.0042)
Capitalization	0.1563***	0.1583***	0.2230***	0.2313***
	(0.0234)	(0.0146)	(0.0483)	(0.0329)
Business Line Diversification	0.0418	0.0480***	-0.0053	0.0103
	(0.0263)	(0.0184)	(0.0508)	(0.0388)
Geographic Diversification	0.0034	0.0028	0.0204	0.0192
	(0.0147)	(0.0124)	(0.0293)	(0.0261)
Market Concentration	-0.4620***	-0.4569***	-0.6938***	-0.6770***
	(0.1135)	(0.0793)	(0.2333)	(0.1658)
Mutual	-0.0152	-0.0159*	0.0064	0.0047
	(0.0117)	(0.0082)	(0.0263)	(0.0173)
Public	-0.0068	-0.0035	-0.0051	0.0032
	(0.0090)	(0.0070)	(0.0179)	(0.0147)
Group	-0.0140*	-0.0159***	-0.0125	-0.0170
	(0.0074)	(0.0056)	(0.0146)	(0.0119)
Standard Deviation of ROA	-0.4290***	-0.4189***		
	(0.1582)	(0.0696)		
Standard Deviation of ROE			-0.5376***	-0.5185***
			(0.1354)	(0.0570)
Intercept	-0.0193	-0.0144	-0.0300	-0.0215
	(0.0446)	(0.0362)	(0.0947)	(0.0776)
Self-Selection Parameter		-0.0134**		-0.0333**
		(0.0062)		(0.0131)
Year, State, & Line Fixed Effects	Yes	Yes	Yes	Yes
Adjusted R-Squared	0.4829	0.4678	0.4016	0.4027
Observations	876	876	876	876

Notes: This table presents the difference-in-differences regressions of performance on board gender diversity in the event study. The event study sample includes all insurers without any female director at the beginning of the sample period. The treatment group consists of insurers that later appoint a female director, and the control group consists of insurers that never have a female director throughout the sample period. The dependent variables are the return on assets (ROA) and the return on equity (ROE). *Female Director Insurer* is a dummy variable that is equal to 1 if has ever had a female director during the sample period and 0 otherwise. *Post* is a dummy variable that is equal to 1 for the years starting with the first appointment of a female director and 0 otherwise. Standard errors (in parentheses) are corrected for clustering at the insurer level. *, **, and *** denote statistical significance at 10%, 5%, and 1% levels, respectively.