The Effects of Natural Disasters on Firm Performance: Exploring the Moderating Effects of Gender Diversification

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ABSTRACT

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Natural disasters pose significant challenges to all businesses and firms, disrupting operations, profitability, and overall performance. Many researchers and business professionals link a firm's ability to recover and maintain stability in these events to its governance structures including the gender diversity of its leadership positions. While numerous studies have examined the relationship between governance structure and Corporate social responsibility (CSR) disclosures, our research extends the existing literature by investigating the moderating role of gender diversification within governance structures and CSR disclosures on firm performance. Specifically, we focus on the resilience management demonstrated by female leaders in response to external shocks caused by natural disasters. Our analysis is based on a dataset of 5,185 U.S. firms spanning the period from 2000 to 2021. We draw firm-level data from Compustat and Boardex accessed through Wharton Research Data Services (WRDS) and obtain information on natural disaster damages from the Spatial Hazard Events and Losses Database for the United States (SHELDUS). We adopt a dual-method approach, combining the fixed effects model with the period seemingly unrelated regression (SUR) method to address heteroskedasticity. Our findings reveal that while gender diversification is not a primary determinant in mitigating the economic impact of natural disasters on operational performance, firms with greater gender diversity exhibit improved performance, particularly in response to human-centric shocks. We conclude that gender-diverse firms are better equipped to manage risks, demonstrate stronger resilience, and sustain a positive reputation, all of which contribute to enhanced firm performance and value.

Keywords: Corporate Governance; Decision Making; Firm Performance; Gender Diversification; Natural Disaster; Risk Management; Resilience

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1.Intorduction

Challenges posed by natural disasters can be broadly categorized into microeconomic and macroeconomic impacts. Microeconomic challenges refer to firm-level effects, including direct consequences such as operational disruptions, asset damage, and employee dislocation, as well as indirect effects like supply chain disruptions and shifts in consumer demand. Macroeconomic challenges, on the other hand, encompass broader economic implications at the industry or national level, including direct costs such as infrastructure damage and reconstruction expenses, along with indirect consequences like economic slowdowns and rising poverty levels. Distinguishing between these two categories is crucial for understanding how firms navigate and recover from such events.

Natural disasters, such as earthquakes, floods, and wildfires, pose significant challenges to firms, affecting their operations, profitability, and overall performance. According to the World Bank (2016) extreme natural disasters lead to an estimated global loss of $520 billion USD in annual consumption and drive approximately 26 million people into poverty each year. However, the relationship between natural disasters and firm performance in the existing literature is relatively limited.

The impact of natural disasters on firm performance has become a growing concern for investors and stakeholders. In response, firms have been incentivized to strengthen their reputation, which, in turn, fosters greater customer satisfaction and stakeholder trust, particularly during crises caused by natural disasters. To address investor concerns, firms have increasingly adopted corporate social responsibility (CSR) strategies as a means of mitigating distress and external risks while enhancing financial performance and resilience, especially in the face of external shocks from natural disasters.

While some studies examine the effects of natural disasters on firm performance and financial institutions (Hsu et al., 2018; Walker et al., 2022), others extend their analysis beyond this relationship. These studies argue that, in response to the challenges posed by natural disasters, firms have increasingly focused on strengthening their governance structures and enhancing CSR disclosures as key strategies for recovery and maintaining stability (Gallego‐Álvarez & Pucheta‐Martínez, 2021; He et al, 2022). Therefore, among the various aspects of CSR, governance structures have become a focal point in determining a firm’s capacity to respond effectively to crises.

CSR disclosures play an effective factor during climate change in mitigating distress and default risk (Boubaker et al., 2020; Ozkan et al., 2022). By demonstrating a commitment to social and environmental responsibility, firms can build goodwill and trust among stakeholders, which can enhance their ability to act against negative impacts from the distress risks of natural disasters. Additionally, better CSR practices and stronger governance can lead to better risk management and preparedness, improving a firm's ability to respond effectively to external shocks.

CSR and corporate governance have long been subjects of interest for researchers, with numerous studies exploring the impact of CSR on firm performance. Many studies advocate for banks and various firms to actively engage in CSR, not only as a means of mitigating default risk and enhancing financial performance—particularly in terms of return on assets—but also as a long-term survival strategy, especially in response to climate-related risks. (Boubaker et al., 2020; Ozkan et al., 2022; Shen et al., 2016; Wu & Shen, 2013).

The decisions made within a company’s governance structure play a crucial role in shaping its overall performance. Recent studies suggest that gender diversity within corporate boards can significantly influence governance practices, particularly within risk management frameworks

(Safiullah et al., 2022). During emergencies, a diverse leadership team offers a broader range of perspectives, enabling the development of more comprehensive and adaptive strategies. Within the context of corporate governance and CSR, gender diversification emerges as a critical factor, potentially enhancing decision-making processes and strengthening risk mitigation efforts in response to external shocks caused by natural disasters.

From a behavioral finance perspective, men and women often exhibit different approaches to decision-making. However, the role of women in corporate decision-making has historically received less attention, and a gap remains in the existing literature on this topic. According to Dyvik (2024), "As of 2021, women accounted for approximately 28.2 percent of all managerial positions worldwide, compared with 1991 when 23.6 of managers were women.". While this highlights a clear increase in representation of women in leadership positions throughout the years, women remain under-represented in leadership roles. Nevertheless, research suggests that when women do attain leadership positions, their influence extends beyond representation. A study by Rahmadhani et al. (2021) shows that the greater the number of women in top and middle management, the more a company engages in social activities, which can indirectly strengthen governance structure and improve company performance through CSR activities.

Liang & Renneboog (2017) discuss the importance of "doing well by doing good" and many studies agree that CSR spans multiple dimensions of firm behavior and stirs firms' actions and efforts in the process of generating revenue and profit maximization by external factors that shareholders may not account for (Magill et al., 2017; Tirole, 2001; Liang & Renneboog, 2017). Among the multiple dimensions that CSR disclosures explore, gender diversity plays a significant role. Many studies prove that female leaders often enhance board social governance and positively impact CSR performance, especially in climate change disclosures (Boulouta, 2013; Liao et al., 2015; Qian et al., 2024). That said, gender diversity is especially important in leadership positions and accounts for a major contributing factor to not only key firm level decisions but also to firms' overall performance and value. Therefore, the emphasis on gender diversification and increase in female representation has become the subject of many studies (Bennouri et al., 2018; Conyon & He, 2017; Singh & Dwesar, 2022; Subair et al., 2020; Ullah & Mateti, 2020).

Despite various studies on this topic, the specific intersection of gender diversification within governance structures and CSR disclosures remains largely underexplored. To the best of our knowledge, no research has examined the moderating role of gender diversification in governance structures and CSR disclosures, nor its implications for decision-making and firm performance under external shocks caused by natural disasters. This gap underscores the need for focused academic inquiry into how gender diversity within CSR frameworks and governance structures interacts with external shocks, particularly in the context of distress risks posed by natural disasters, and how this interaction influences firm resilience and overall performance.

This thesis contributes to the existing literature by addressing an understudied aspect of corporate governance and CSR, providing empirical evidence that gender diversity is not merely a metric of social responsibility but a strategic asset in risk management. Moreover, most empirical studies in this field rely heavily on linear regression methods, often overlooking their potential limitations. By employing a dual-methodology framework, this research offers a more comprehensive analysis, further enriching the literature. Specifically, this study examines how gender diversification on corporate boards moderates the impact of natural disasters on firm performance. Drawing on insights from prior research on board gender diversity and firm performance, it assesses whether firms with more diverse leadership teams are better equipped to navigate the external risks and challenges posed by natural disasters.

The remainder of this thesis is organized as follows: Section 2 reviews previous studies and existing literature on the subject, along with the development of our hypotheses. It also examines the three key research questions this study seeks to address. Section 3 provides an overview of the sample data, analyzing 5,185 U.S. firms from 2000 to 2021 whose headquarters were affected by various natural disasters. Section 4 outlines the study's methodology, employing a dual approach that combines a standard fixed-effects Ordinary Least Squares (OLS) model with a more advanced Generalized Least Squares (GLS) framework to test the hypotheses. Section 5 presents the study's results, discussing key findings and their implications, and Section 6 concludes.

2.Literature Review and Hypothesis Development

2.1. Literature Review

2.1.1 Natural Disaster and Risk Mitigation Activities

Natural disasters and hazards are global concerns for governments, businesses, the general public, and academics alike. Scholars have often studied how natural disasters and hazards impact various outcomes such as economic growth or employment, looking at both the direction and size of these effects. These effects can be direct and indirect and can be shown on both macroeconomic level and microeconomic level.

The relationship between natural disaster risks and firm performance is nuanced and uncertain. Some studies show that natural disasters might exhibit negative relations with firm performance (Nguyen et al., 2023; Pankratz et al., 2021) and some show positive relations, indicating that natural disasters effects on businesses are not always negative as expected and support efforts help businesses recover well, especially in Germany and learning from past disasters may have little impact on business management (Noth & Rehbein, 2019), while others show a mixed relationship between firm performance and natural disasters (Leiter et al., 2009; Zhou & Botzen, 2021). Kousky (2014, PAGE 576) finds a mixed relationship between natural disaster risks and firm performance, claiming that "Estimating the full range of economic costs from natural disasters is difficult, both conceptually and practically." The study divides the effects of a natural disaster by the damage it creates as well as the frequency and the fatalities it has caused. The impacts are larger for more severe events, with some devastating disasters leading to long term negative economic consequences despite firms' resilience; However, Kousky (2014) proves that impact of natural disasters is distributional, emphasizing that firms with stronger institutional quality tend to experience less significant negative effects.

The negative impacts of disasters can be controlled or reduced by the adoption of risk mitigation activities. Johnson et al. (2010) highlight that CSR activities are often aimed at diminishing risk and building resilience. These findings are supported through the studies of Dobie et al. (2018) and Oware et al. (2022) which highlight the importance of CSR initiatives and corporate governance in building resilience by emphasizing their operational framework against risks. Khoo et al. (2022) further emphasizes this point by discussing the increase in firm performance when the majority of independent board members are confident in CSR activities. The integration of CSR into corporate strategies and governance structure not only addresses direct disaster-related challenges but also creates a culture of preparedness and responsiveness within the organizations.

2.1.2 Gender Diversification and Firm Performance

A firm's resilience towards external shocks is linked with the implementation of gender diversification in their CSR disclosures and governance structures. Scholars often highlight that the gender diversity of the board of directors (BOD) and leadership roles is often featured in CSR disclosures (Boulouta, 2013; Liao et al., 2015, in Qian et al., 2024). BOD gender diversification impacts decision making within a company and affects the incorporation of risk mitigation activity and/or policies. Abebe & Dadanlar (2019) show that the presence of women in corporate governance can lead to a reduction in certain negative outcomes, such as lawsuits.

In the existing literature, the impact of gender diversity on firm performance and risk mitigation has gained significant scholarly attention. The relationship between gender diversity on corporate boards and firm performance is complex and diverse, with many studies yielding mixed results.

Board characteristics are considered to have a noticeable influence on both firms' financial performance and many other firm-level decisions such as reducing the risk of managers misstating financial statements and giving a misleading picture of financial health leading to financial statement fraud and loss of investor trust (Subair et al., 2020). While some papers specifically focus on the gender aspect of board characteristics and argue the negative effects of women in management roles, particularly in firms that are experiencing financial distress, by stating that mandating gender diversification in directory roles and recruiting women as tokens or symbolically can reduce firm value (Abinzano et al., 2023; Adams & Ferreira, 2009), there exist a number of studies arguing the positive effects of gender diversification in leadership roles and their impact on improving firm's operational performance and firm value (Abbas & Frihatni, 2023; Carter et al., 2003; Conyon & He, 2017; Elmagrhi et al., 2018; Faccio et al., 2016; Khaw et al., 2016).

Adams & Ferreira (2009) demonstrate the significant impact of female directors on board input and firm outcomes. Their data set contains information on 24,820 unique directors holding a total of 125,319 directorships from 500 US companies. The study utilizes Tobin's Q and ROA as a measure of firm performance. The study concludes that women are more likely to join monitoring committees. However, their findings suggest negative relations between gender diversification and firm performance. Interestingly, they suggest that higher firm risk reduces gender diversity on boards, and any change in risk leads to changes in boardroom diversity. Contrarily, Abinzano et al. (2023) argue the inverted relationship (U-shaped) of board gender diversity on default risk. Using a sample of 917 firms in 19 merging markets for the period

2005-2016, they argue that “board diversity reforms should be tailored according to the institutional setting (i.e., where barriers exist to women’s access to leadership positions) in order to meaningfully reap the benefits of gender diversity on boards” (Abinzano et al., 2023, PAGE 14).

Many studies highlight the effectiveness of diversity in decision making, risk management and firm performance. Abbas & Frihatni (2023) investigate the effects of diversity on the performance of firms experiencing financial distress. Analyzing 467 Indonesian firms through logistic regression, their findings show that women take part in 13% of people on the commissioner board, 7% on the director board, and 5% on the audit committee. They also find that gender diversity on the board of commissioners significantly reduces financial distress. Their findings suggest that commissioners, as capital owners, are particularly impacted by financial distress, but gender diversity in these roles helps mitigate such challenges. Carter et al. (2003) examine the relationship between board diversity and firm value for Fortune 1000 firms. This study uses ethnicity and gender as a measure of diversity. Using Tobin’s Q as a measure of firm value and a Two-Stage Least Squares (2SLS) regression methodology, the study concludes a positive relationship between the number of women on a firm’s board and its subsequent value.

From the existing literature, we understand that in developed countries such as the United States, the presence of women can certainly impact the performance and risk mitigation activities of a firm due to women’s strong decision making.

2.2 Hypothesis Development

As we have detailed above, existing literature has established that the severity of natural disaster risks can affect firm performance. These effects, however, as well as the role of gender diversification on firm performance during natural disasters, remain understudied. To the best of our knowledge, no study to date has explored the moderating role of gender diversification of a firm's management, disclosed in governance structure and CSR reports, on the effects of natural disaster on firm performance.

Based on this existing gap in the literature, this study aims to answer three main questions. Firstly, our first hypothesis examines whether different levels of gender diversification in a firm's management, as disclosed in its Governance structure and CSR reports, influence the firm's ability to mitigate risks associated with severe natural disasters.

Following the studies of Abbas & Frihatni (2023), Kousky (2014), and Mohsni et al. (2021), we hypothesize that gender diversification plays a significant role in risk mitigation, ultimately leading to better firm performance and value with Mohsni et al. (2021) confirming the previous literature by reporting that women hold about 14% of board seats in 27 developing countries. Research links gender diversification, CSR, and governance quality to firm resilience amid external shocks (Amin et al., 2022; Gaio & Gonçalves, 2022; Saeed et al., 2023). Women's role in leadership positions remain underrepresented in the literature. We expand the literature by examining the influence of different levels of female representation in management positions on firm performance while faced with external shocks of natural disasters. This leads to our first hypothesis:

H1: Higher levels of gender diversification in a firm's management positively moderates the effects of natural disasters on firm performance

Secondly, we further expand our study by examining whether firms with greater gender diversity in management, as reported in their governance structure and CSR disclosures, exhibit superior performance under the economic shocks of natural disasters.

Many studies regress macroeconomic variables on some measures of disaster damage and claim this coefficient represents the economic impact of natural disasters (Kousky, 2014).

According to the previous literature firms with gender-diverse management are said to better navigate these types of challenges due to their improved decision making and resilience. Therefore, we hypothesize the following statement:

H2: Firms with higher gender diversification levels (more than 20%, female, more than 30% female) exhibit better performance when facing the economic shocks of natural disasters

Lastly, to complete our hypothesis development, we examine whether firms with greater gender diversity in management, as reported in their governance structure and CSR disclosures, exhibit superior financial performance or resilience when addressing human-centric risks, such as injuries and fatalities caused by natural disasters.

Kousky (2014) groups damages, fatalities, and occurrences of natural disasters as economic risks of these phenomena. However, because the severe impact of injuries and fatalities related to natural disasters transcends the boundaries of economic shock, natural disasters take on a human-centric risk characteristic. The psychological and sociological effects of these losses, which can in turn affect the decision-making process, cannot be captured solely through an examination of economic shocks. Moreover, the decision making of a firm is known to be adapted based on the type of risk. Therefore, we hypothesize that the human-centric risks characteristics effects can be impactful on firm performance. Thus, the third hypothesis is as follows:

H3: Firms with higher gender diversification exhibit better performances when faced with the human-centric shocks of natural disasters (i.e., fatalities and/or/injuries)

The following section discusses the sample selection, and the variables used in the study.

3.Data

3.1. Data Sources

This thesis focuses on firms located in the Unites States and uses two primary data sources. First, disaster-related data, including property damage, injuries, and fatalities, which was obtained from the Spatial Hazard Events and Losses Database for the United States (SHELDUS)[1]. This data covers the period from 2000 to 2021 and provides state-level information on the impact of natural disasters. We chose the period of 2000-2021 due to limitation of SHELDUS database regarding the reported natural disaster data. Second, firm-specific financial and board-related data, which we use Wharton Research Data Services (WRDS) databases, including Compustat IQ for financial data, and BoardEx for gender diversity metrics. We use Return on Assets (ROA) as our main measurement of firm performance.

3.2 Descriptives

3.2.1 Natural disaster data

The SHELDUS dataset includes annual property damage per capita, fatalities, injuries, and the number of recorded natural disasters. This analysis considers all types of natural disasters[2] reported by SHELDUS including but not limited to thunderstorms, hurricanes, floods, wildfires, tornados, etc., occurring annually in each U.S. state.

To measure the severity of natural disasters, we use the natural logarithm of the annual property damage per capita data of all 50U.S. states, reported and adjusted to 2021 values for comparability. We look for the natural logarithm of the number of natural disasters recorded to

[1] SHELDUS is a U.S. county-level hazard dataset that includes natural disasters like thunderstorms, hurricanes, floods, wildfires, and tornadoes, along with risks such as flash floods and heavy rainfall, and etc.
[2] Natural disaster in our research refers to all natural disasters reported in SHELDUS (including thunderstorms, hurricanes, floods, wildfires, and etc.)

use as a proxy to measure the frequency of the natural disaster in our sample period on a state-level. Additionally, the number of fatalities and injuries that occurred due to natural disasters was used as a proxy to represent high-level severities and moderate-level severity risks caused by all types of natural disasters (flood earthquake, fire, etc.).

3.2.2. Gender diversification data

To obtain a measurement for gender diversification we use the gender ratio, which is defined by the BoardEx database to be the proportion of male directors at the Annual Report Date selected for the sample period 2000-2021. Our thesis uses the proportion of female directors, which is calculated by deducting the BoardEx gender ratio from 1.

In order to examine the influence of different levels of female representation in management on governance structure and CSR disclosures, we created dummy variables to represent companies with more than 20% and more than 30% female representation in management positions. These thresholds allow us to investigate how moderate and high levels of gender diversification may drive variations in governance structure and CSR practices that will ultimately affect firm performance. By setting these benchmarks, we assess whether surpassing the 20% and 30% thresholds correlates with enhanced performance while faced with disasters, reflecting the potential impact of increasing gender diversity on corporate governance and decision-making dynamics (Mohsni et al., 2021).

Figure 1 confirms our previous statement regarding the growth of female leaders and illustrates the growth of female representation on management positions as well the growth of the number of firms throughout our sample period. Notably, despite an increase in the number of firms since 2000, most firms still have fewer than 30% female leaders, highlighting the persistent gender gap in management positions. This observation underscores the relevance of our research, which examines whether greater female leadership can enhance firm performance and resilience.

****Insert Figure 1 about here****

3.2.3 Firm performance & control variables

The main outcome variable is profitability, which represents firm performance, measured by the return on assets (ROA). Its neutrality to capital structure by remaining unaffected to how a firm is financed (debt vs. equity) makes it a pure measure of operational efficiency and it is particularly useful for comparisons across different industries, as it directly ties profits to the asset base.

We also use Tobin's Q. While ROA is based on historical accounting data, Tobin's Q introduces a forward-looking, market-based view, making it useful in situations where traditional asset-based measures like ROA may not fully capture performance. Tobin's Q is a great measurement to capture firm value.

We also calculate the Return on Equity (ROE). With its ability to show how well equity investments are being utilized to generate profit, ROE is a great complimentary measure of financial performance. ROE focuses on profitability relative to equity, giving insight into returns generated for shareholders.

To help isolate the effect of gender diversification on governance and CSR disclosures related to risk, we also control for the Size of the firm, Debt to Equity (D/E) and Price to Book (P/B) ratio. We choose these variables as standard variables because they often have a systematic influence on the dependent variable being studied. Controlling for size helps isolate the effects of other variables by accounting for the scale of the firm. Controlling P/B ensures that differences in market valuation or growth expectations are accounted for, reducing bias in the analysis. By controlling for D/E as leverage, the analysis accounts for differences in financial risk and capital structure, ensuring a clearer understanding of the relationship between the main variables in our study.

3.2.4 Final sample

To obtain the final sample, we first remove insurance firms and companies, banks, investment companies, life assurance, and health institutions from our sample. Based on Fama & French (1992), while the exclusion of these sectors does not affect firm performance, it affects the scope and applicability of the findings. By excluding these sectors, the study can produce clearer insights for firms whose performance drivers align with the assumptions of their financial models. Finally, for calculation purposes and to reduce the effects of outliers in our analysis we have winsorized the data.

Our final sample consists of 5,185 firms during the 2000 to 2021 period. In this study we analyze 47,338 observations in our panel data. *Table 1* provides details of the variable descriptions of our sample.

****Insert Table1about here****

In addition to the variable description table as represented in Table 1, Figures 2,3 & 4 provide a comprehensive visual representation of the natural disaster data collected from SHELDUS for our sample period for each U.S. state. Figure 1 illustrates the sum of reported natural disasters, highlighting their frequency and severity over time. Figure 2 shows the fatalities caused by these disasters on a state level each year, with states like Louisiana and Texas exhibiting notable spikes, likely due to major events such as hurricanes. Figure 3 represents the injuries reported in the same context. By visualizing these events, we highlight the geographic discrepancies caused by natural disasters, their severity and frequency, emphasizing both temporal and state-specific vulnerabilities.

****Insert Figure 2 about here****

****Insert Figure 3about here****

****Insert Figure 4about here****

4.Methodology

To examine the impact of natural disasters on corporate risk-taking and performance while considering for the moderating effects of gender diversity, we employ two methodologies. First, a fixed effect methodology of Panel Least Square (PLS) regression. Second, a Period Seemingly Unrelated Regressions (Period-SUR) with a Generalized Least Squares (GLS).

4.1 Main Regression – Fixed Effects Panel Least Square (PLS)

By using an OLS methodology, we control for unobserved heterogeneity when estimating the relationship between variables in panel data. The fixed effects method is particularly useful when controlling for a time-invariant and unobserved differences between entities. *Equation 1* represents our main regression, where we regress firm performance of each firm in year *t* on gender diversification variable (*Gender Ratio, Female 20, Female 30*) and natural disaster variable (*Property Damage, Fatality, Injuries, Records*). We also test the interaction between the two independent variables and their effect on ROA. Moreover, *Firm Size, D/E, P/B Ratio* are used as standard control variables[3] due to their systematic influence on the dependent variables.

$$\begin{aligned} ROA_{it} = {} & \beta_0 + \beta_1\, Gender\ diversification_{it} + \beta_2\, Natural\ disaster_{it} \\ & + \beta_3\, Gender\ diversification_{it} \times Natural\ disaster_{it} \\ & + controls_{it} + \varepsilon_{it} \end{aligned} \qquad Equation\ 1$$

[3] To avoid multicollinearity in our analysis, we exclude board size as a control variable. Because our gender ratio is defined as the proportion of female directors relative to board size, including both variables would increase the risk of multicollinearity. For the same reason and due to insufficient data, we also exclude the proportion of independent directors.

To test our first hypothesis, *Equation 1* employs *Gender Ratio* as gender diversification variable and property damage per capita adjusted for year 2021 (hereon *Damage*) is used as natural disaster variable. To further our analysis into different levels of gender diversification, we repeat this analysis with dummy variables where a firm has more than 30% and 20% females in management positions (*Female 30* and *Female 20* respectively) respectively. To test the second and third hypotheses we replace *Damage* with *Fatalities, Injuries* (to test sever risks) and *Records* (to test frequency of external risks).

4.2. Generalized Least Square (GLS) – Period SUR

Given the unbalanced nature of our panel data, we conclude that some limitations may exist within the OLS fixed effects methodology (Hill et al., 2019). In our sample, natural disaster variables were reported annually for each state and this analysis uses the same report and numbers for many firms; This could potentially cause heteroskedasticity and given the high volume of data and its multi-dimensionality (cross-sectional and time series), the likelihood of collinearity is also quite high.

Although the fixed effects model may be a reliable solution to handle heterogeneity by removing unobserved time-invariant heterogeneity. However, to account for heteroskedasticity, cross-sectional correlation and time-invariant variables, pairing with a GLS-SUR methodology addresses different aspects of the data structure that cannot be covered by the OLS methodology.

In other words, our main incentive for using a SUR model in this study is that by combining the information on different equations, we can obtain more efficiency in our estimations (Fogang & Tchitchoua, 2020; Moon & Perron, 2006; Rana & Al Amin, 2015).

This method can be particularly useful in instances where there is a high chance that the error terms of different regression equations are correlated. We employ Eviews to handle the complexity of the SUR model in our analysis.

Moon and Perron, (2006) define a classical linear SUR model as a system of linear regression equations: (*Equation 2)*

$$
\begin{gathered}
y_{1t} = \beta'_1 x_{1t} + u_{1t} \\
\vdots \\
y_{Nt} = \beta'_N x_{Nt} + u_{Nt}
\end{gathered}
\qquad \textit{Equation 2}
$$

where $i = 1, \cdots, N$, *and* $t = 1, ..., T$. Denote $L = K_1 + \cdots + K_N$. Moon and Perron (2006) simplify the notation by stacking the observations either in the t dimension or for each i. In their study, they provide an example where "if we stack for each observation t, *let* $Y_t = [y_{1t}, ..., y_{Nt}]'$, $\tilde{X}_t$= *diag* $(x_{1t}, x_{2t}, ..., x_{NT})$, a block-diagonal matrix with $x_{1t}, ..., x_{NT}$ on its diagonal, $U_t = [u_{1t}, ...u_{Nt}]'$, and $\beta = [\beta'_1, ..., \beta'_N]'$. Then,"

$$Y_t = \tilde{X}'_t \beta + U_t \qquad \textit{Equation } 3$$

In our study, we use OLS equation *(Equations 1)* to derive preliminary coefficient estimates and residuals.

The residuals from the OLS estimates are used to compute the covariance matrix of the errors, Σ, which captures the interdependence between equations. *Equations 3 and 4* show this relation in formula format where T is the number of observations, and the OLS residuals of the k^{th} equation is illustrated.

$$\hat{\sigma}_{it} = \hat{\Sigma} = \frac{1}{T} \sum_{t=1}^{T} \epsilon_t \epsilon'_t \qquad \textit{Equation } 4$$

Where:

- $\hat{\Sigma}$: Covariance matrix of the error terms.

- T: The number of time periods or observations in the data.
- ϵ_t: The error term at time t.
- ϵ_t': The transpose of the error term at time t

By using a panel regression, we can track the performance of multiple companies over time, allowing us to account for both differences across firms and variations within the same firm over different years. This approach enables a deeper understanding of how factors such as gender diversity and natural disasters influence firm performance.

In essence, we perform multiple regressions, but instead of analyzing a single point in time, we evaluate how these variables evolve and interact over time across different firms. By winsorizing the sample and using a large sample we can abide by the law of large numbers which facilitates the assumptions of our analysis.

5.Results

5.1 statistic descriptives & Correlation Matrix

5.1.1 Descriptive Statistics

Table 2 summarizes the descriptive statistics for the variables used in our regression model. The profitability metrics ROA & ROE have negative means of approximately -3% which suggests that on average, firms may be experiencing losses throughout the period. We suspect this to be the result of various international economic events such as the economic crisis, the .com bubble, Covid-19, etc. Tobin's Q, which we are using as an alternative performance metrics, has a mean of 1.55, suggesting a diverse valuations ratio across firms. The gender diversification variables show low averages, indicating the persistent underrepresentation of women in positions of leadership, regardless of notable increases.

****Insert Table 2 about here****

5.1.2 Correlation Matrix

Table 3 illustrates the correlation matrix between the variables in our analysis. The strong correlation between *Size, ROA and ROE* suggests that firms with higher ROA tend to have higher ROE and larger firms tend to have larger ROE and ROA. This relationship therefore suggests a higher operational performance among larger firms. On the other hand, the moderate and negative correlation between *Size* and *Tobin's Q* (-0.2562) implies that larger firms tend to have lower Tobin's Q values. *Gender Ratio* typically shows a weak relationship with other variables, meaning that gender does not strongly influence or is not influenced by other factors in your analysis which leads to a more accurate analysis in our research. A medium-strength positive correlation between *Gender Ratio* and *Size* (0.3313) suggests the potential implementation of gender diversity initiatives in larger companies

****Insert Table 3 about here****

5.2 Main Regression

Table 4 demonstrates the regression results of our main analysis which examines the effects of gender-related variables and natural disaster damage and their interactions on Return on Assets (ROA).

The fixed effects (FE) model includes firm and year fixed effects while the Period SUR model is weighted for cross-section heteroscedasticity and serial correlation. *Gender Ratio* is positive and significant in the PLS model (0.0668) with 10% significance, indicating that a higher proportion of women in management positions can positively affects ROA in less disaster-prone periods. However, the negative and weakly significant in the Period SUR model (-0.0705) suggests that the effect may reverse in models accounting for heteroscedasticity.

While*, Damage* does not have a direct impact in the FE model, it significantly influences ROA in the Period SUR model with a 1% positive significance (0.0018,0.0016 and 0.0017) regardless of the level of gender diversification (*Gender Ratio, Female 30, Female 20*). This indicates that disasters have impactful financial implications when accounting for period weights.

Significant in the fixed effects model at 5% (with negative slope of -0.005) but insignificant in Period Weighted, the interaction between *Gender Ratio and Damage* indicates that as damage increases, the positive effect of gender diversity on ROA diminishes (fixed effects methodology). This could indicate that the operational benefits of diversity are not as effective under severe external economic shocks. While the consistent insignificance interaction between *Damage and Female 30 and Female 20* suggests that gender diversification mass (Specific levels of female representation) do not seem to interact significantly with economic impact of natural disaster on ROA.

The consistently positive and highly significant impact of the control variables demonstrates that *Size, P/B ratio and Leverage (debt to equity ratio)* play a highly significant and impactful role in affecting firm performance. Larger firms have higher operational performance (ROA), likely due to economies of scale or greater resources. Higher valuation of book value corresponds to better profitability. Higher leverage correlates with lower ROA, consistent with risk and financial strain.

****Insert Table 4 about here****

While property damage per capita indicates the operational and economic impact of the tangible risk of natural disasters, *Table 5* shifts the focus to the human-centric risks of natural disasters. Injuries are not only a representation of human-centric risks, but they also demonstrate moderately sever risks of catastrophes caused by these natural phenomena. The *Injuries* variable consistently shows negative and significant impact with both fixed effects and the SUR methodology, proving the negative effect of injuries on firm performance. This is true not only through a firm and period fixed effects, but also while accounted for heteroskedasticity, proving that human tolls (workforce disruptions, reduced morale, stress, etc.) harm firm performance.

Gender diversification variables presented in *Table 5* have negative slopes regardless of their mass *(Gender Ratio, Female >30%, Female >20%).* These negative effects are highly significant in the SUR methodology. The interaction between *Gender Ratio and Injuries* also illustrates a positive and significant (5% and 10%) slope in both fixed effects and SUR methods.

Looking at the interaction terms between *Female 30 and Injuries* the SUR model shows both significance and positive effects (0.0000445 at 1% significance level, t=1.658836), however, the PLS model show no significance. The interaction term between *Female 20 and Injuries* is significant in the fixed effects (PLS) model (0.0000342**, t=2.309221) but weaker or insignificant in the SUR model.

The differences in significance between the two models highlight the importance of accounting for panel-specific characteristics. Employing the SUR methodology adjustments provides a more reliable relationship between *Female 30 and Injuries*, suggesting its moderating effect on the impact of injuries on ROA is stronger when heteroskedasticity and period-specific variations are accounted for in the model. However, the weaker significance of the interaction between *Female 20 and Injuries* in the SUR method suggests that this interaction may be less robust when corrected for such issues. However, the significance relation between *Female 20 and Injuries* on operational performance remains when accounted for period and firm fixed effects.

The results in *Table 5* suggest that while moderately severe human-centric risks (i.e., Injuries) negatively impact profitability (ROA), firms with greater levels of gender diversification— especially when more than 30% of the management positions are occupied by women — are better equipped to manage crises and mitigate human-centric external shocks. SUR results are more robust and reliable, suggesting that accounting for panel-specific characteristics reveals nuanced relationships. Gender diversity proves to play a moderating role in enhancing resilience against external shocks, highlighting its importance in corporate's governance structure and CSR disclosures.

****Insert Table5about here****

The results presented in Table 5 focus on less severe human risks. However, the results in *Table 6* are that of the same analysis, but in which we replaced the *Injuries* variable with a *Fatalities* variable. This additional analysis allows us to better study the effects of more gender diverse leaders and the implication of diversification on governance structure and CSR disclosure, especially it pertains to decision making results and effectiveness on improving firm resilience. *Table 6* demonstrates the results of our analysis.

As one can see from the results in Table 6, *Fatalities* have a negative and significant impact on *ROA* in both models, indicating the severe toll on workforce and morale from catastrophic losses. While the gender diversification variables seem to all have negative and significant impact on *ROA* in both FE and SUR methodologies (*Gender Ratio* with -0.018146 at 10% significant in the PLS model and -0.125672, -0.015976 and -0.014408 slope for *Gender Ratio*, *Female 30 and Female 20* all with 1% significance in the Period SUR model).

While the highly positive effects of the interaction term between *Gender and Fatalities, Female 30 X Fatalities and Female20 X Fatalities* all have positive and high significance when controlled for firm and period fixed effect, this statement loses its significance in the SUR model; however, it remains positive. These findings highlight the positive impact of gender diversification in the decision making of a company and how firms prioritize employee safety measures (e.g., evacuation plans, safety training) which could potentially gain employee trust, increase firms' reputation and ultimately its appeal to stakeholders and lastly, its firm performance.

****Insert Table 6 about here****

While Gender diversification level (*Female 20, Female 30*) shows insignificance and somewhat negative effects in our regression, the level of gender diversification in a firm's management, as disclosed in annual reports, does indeed influence a firm's ability to mitigate risks associated with severe natural disasters. While we cannot reject the null hypothesis in H1, we can certainly state that firms with greater gender diversity in management, as reported in their governance structure and CSR disclosures, exhibit superior performance under high-risk external shocks.

The results for our H2 may be mixed. We conclude that when it comes to the economic risks of natural disasters such as property damage per capita (*Damage*), firms tend to perform positively. This could be due to insurance claims and government aids which could temporarily boost financial performance. We also suspect that with regard to the firm's performance within certain industries such as construction, utilities, or retail, disasters might increase the demand for goods or services, leading to better performance. However, damage might affect the broader region but not the firm's headquarters or key operations, allowing the firm to benefit from competitors' struggles. However, the human centric risk of natural disasters significantly and negatively effects firm performance (*Injuries* and *Fatalities*) leading to mixed conclusions regarding H2.

The most interesting finds were regarding H3, where we conclude that firms with greater gender diversity in management, as reported in their governance structure and CSR disclosures, exhibit superior financial performance or resilience when addressing human-centric risks, such as injuries and fatalities caused by natural disasters. This indicates that the decision-making process of firms is highly effected and increased when gender diversification is implemented within their annual reports.

5.3 Robustness Test

Although by using two models in our main regression we have successfully accounted for both heterogeneity and heteroskedasticity and possible autocorrelation within the analysis, to ensure that the results are robust we continue with three different robustness checks. We first check to see whether the frequency of an external shock can also affect firm performance. We regress ROA on the number of natural disasters occurring annually on a state-level basis in the location of the firm's headquarters.

Secondly, to check whether the conclusions are robust, we repeat the main regression with Return on Equity (ROE) instead of ROA as another operational form of firm performance. In doing so, we ensure that our findings are not overly dependent on a single measure of performance. ROE measures profitability from the shareholder's perspective, focusing only on equity returns. If ROE leads to consistent findings, it strengthens the validity of our conclusions by showing they hold regardless of the performance metric used.

Lastly, to test whether our analysis is only limited to operational performance or if it would hold, we also check the market-based performance metrics (*Tobin's Q*). Tobin's Q broadens the performance dimension of firms by capturing external market-based evaluations which reflect competitive positioning, investor sentiment, and risk factors beyond operational efficiency.

5.3.1 Risk Frequency

Table 7 shows the results of our tests on the frequency of naturals disasters in each US state where the firms headquarter is located (*Records)*.. To our surprise, none of our main regression variables show any significance. This leads us to believe that the frequency of the risk is not an effective factor on firm performance.

While none of the primary variables from our main regression exhibit statistical significance, the control variables—*Size, Price-to-Book ratio, and Debt-to-Equity ratio*—consistently show statistical significance. This suggests that firm performance is more influenced by standard economic characteristics such as size and financial structure rather than the frequency of natural disasters, implying that other dimensions of risk, such as severity or firm-specific resilience, may be more relevant determinants.

****Insert Table 7 about here****

5.3.2 Financial Performance - ROE

Similar to our previous findings, the results from *Table 8,* which look at the effects of damages, using the *Damage* variable, seem to have highly significant and positive (0.0038, 0.0033,0.0031, with 1% significance in all regressions with *Gender Ratio*, *Female 30 and Female 20* as gender diversification variable) effects on ROE, further confirming our findings from *Table 4. Gender Ratio* has a consistently positive and significant effect on firm performance, whether considering operational or financial performance (ROA, ROE) within the PLS model. We find that *Female 30* also exhibits positive significance at the 5% level (0.078867). This confirms that a higher proportion of women in management positions can positively affects ROE in less disaster-prone periods. While the negative and weakly significant in the Period SUR model (-0.0018 for gender ratio with 1% significance and -0.0059 with 5% significance), suggesting that the effect may reverse in models accounting for heteroscedasticity. The insignificance of the interaction terms between gender diversification variables suggest that gender diversification may not effectively impact the operational performance of firms during an economic external shock such as property damage per capita.

****Insert Table8about here****

Testing the effects of injuries caused by catastrophic events, *Table 9* shows similar results to *Table 5*. We note that *Injuries* has consistently a negative and significant impact in both the PLS and SUR methodologies, proving their negative effect on firm performance regardless of using ROE. The results remain not only through firm and period fixed effects but also when we account for heteroskedasticity, showing that human tolls (workforce disruptions, reduced morale, etc.) harm firm performance.

At first glance, it seems that although gender diversification variables, regardless of their level, may have adverse impact on performance individually. However, the positive and significant interaction terms between *Gender Ratio* and *Injuries* (0.000325 at 5% significance level) in the PLS model, as well as the positive and significant effects of *Female 20* and *Injuries* (0.000118 at 1% significance level) in both the PLS model and GLS model indicate the positive effects of gender diversification implementation on firms' resilience and actions to improve shareholders' equity to produce profits and increase firm overall performance.

****Insert Table 9 about here****

Table 10 shows the results of the same methods detailed for *Table 6,* but replacing ROA with ROE. The results are surprising. Similar to ROA, ROE, and by default, firm performance, is significantly and negatively affected by gender diversification. This suggests that in some industries where gender diversification is not yet widely accepted, firms may face external resistance, especially when dealing with such high valued and human centric external shocks which could impact client relationships, investor confidence, or even employee turnover. This could potentially be linked to the empathetic attributes often associated with women in leadership, as they may respond more acutely to external events that directly impact human well-being.

The results in Table 6 show that the interaction between gender diversification variables and fatalities are significantly positive in the PLS model while the results in *Tabel 10* illustrate insignificant interactions terms on ROE. The implications of comparing the results from *Table 6* to that of *Table 10* suggest that equity dynamics are less sensitive to immediate operational or human-centric factors. This suggests that while the impact on operational performance represented by the ROA may indicate that gender diversification influences crisis response or mitigates operational risks during external shocks, ROE captures distinct dimensions of firm performance that are not as significantly impacted by gender diversity. The insignificance of ROE could imply that equity returns are shaped by additional factors, such as capital structure, corporate reputation, market perception, or investor expectations.

The findings suggest that firms with greater gender diversity may be more affected by operational impacts (as seen in ROA) while dealing with disasters. However, these impacts might not translate into shareholder-level outcomes (ROE). We believe that potential external adjustments including insurance claims could offset these effects.

****Insert Table 10 about here****

Lastly, the analysis of equity-based performance metrics shows similar findings to asset-based performance. In both performance metrices (ROA and ROE), *Damage* (economic shock) and *Gender Ratio* have a positive and significant impact individually while the interaction term between *Damage and Gender* variables seem to have low and somewhat negative insignificant effect. However, when dealing with human centric shocks of natural disasters (Injuries and Fatalities), gender diversification has moderating effects on firm performance. Although the severity of the shock seems to have an impactful role in the performance of firms which implement gender diversification in their governance structure.

5.3.3 Market-Based Performance – Tobin's Q

Table 11 suggests that *Damage* shows signs of high significance at the 1% level and positive effects on market-based performance in the PLS model accounting for period and firm fixed effects.

Gender Ratio has a consistent positive and significant effect on firm performance in both the PLS and GLS model (0.4674 with 5% significance in the PLS model and 0.61914 coefficient with 1% significance in the GLS model).

Similar to the results from ROA and ROE as performance metrices, the interaction between *Gender Ratio* and *Damage* is negative at 5% significance level (-0.032212) in the PLS model. *Female 20* and *Female 30* seems to consistently not to be the threshold of gender diversification significance.

Insert Table11about here

To our surprise, the significance of injuries drops on market-based performance in both PLS and GLS models, implying that mid-level human-centric risks have an insignificant effect on the market valuation of a firm (Tobin's Q) and its performance. While injuries may not significantly affect performance, the previous negative performance of gender diversity on operational performance has converted to a positive and significance effect, especially in the GLS model with significance at 1% level (*Gender Ratio* = 0.4145, *Female 30* = 0.0448, *Female 20* = 0.0624). Market performance of firms tend to increase significantly when firms focus on increasing the gender diversification factor in their governance structure. From the analysis we find that firms especially perform best in the market when more than 20% of the firm consist of female leaders. On the other hand, the positive and significant relationship between *Injuries* and *Female 30* suggests that when firms include more than 30% females in leadership positions their market value will increase during a human centric crisis.

****Insert Table 12 about here****

Similar to *Table 10,* we find that *Fatalities* does not have a significant impact on market performance of a firm (*Table 13).* However, the results in *Table 13* show that the previously negative performance of firms with gender diverse leaders is converted to positive. gender diversification variables (*Gender Ratio, Female 30, Female 20*) show positive and highly significant at 1% level in relations to market based firm performance (Tobin's Q) in the GLS model. With consistency of the 1% significance with *Female 20* in the PLS model. The consistency of the positive and significant coefficient of *Female 20* implies that when firms implement more than 20% female leaders, they can increase their market performance not only in firm and period fixed effects but also when we account for heteroskedasticity and correlation between the error terms.

****Insert Table13about here****

Our overall findings from using Tobin's Q as a market-based firm performance indicate that gender diverse firms tend to generally increase performance in the market. From the results in Tables 12 and 13, we conclude that firms which have moderately implemented gender diversification into their annual reports by having more than 30% female in their leadership positions tend to perform favorably in the market during human-centric shocks of natural disaster. However, this reaction tends to be weak.

6.Conclusion

This thesis explores a unique and compelling subject by employing a dual-methodology approach that combines OLS-fixed effects and GLS-Period SUR, enhancing both the study's originality and its contribution to the finance literature. The OLS method uncovers the intricate dynamics between key variables, while the GLS framework ensures the robustness and validity of the results, allowing for credible conclusions regarding the role of gender diversity in influencing firm performance under various shocks caused by natural disasters. By analyzing the integration of gender diversity within firms' governance structures, this study examines its nuanced impact on firm performance in the presence of both economic and human-centric shocks. Our findings indicate that gender diversity in leadership plays a significant role in determining firm performance during natural disasters; however, its effects vary depending on the severity and type of disaster, as well as the specific performance measures used.

We addressed several key research questions. The first hypothesis examined the role of gender diversity in helping firms effectively manage risks associated with severe natural disasters. Our findings suggest that gender diversity is particularly beneficial in crises that directly impact people, such as those involving injuries or fatalities. Firms with diverse leadership teams demonstrate stronger resilience and more effective response strategies, ultimately enhancing their ability to navigate these challenges.

We also hypothesized that gender diversity improves firm performance under economic shocks; however, our findings do not provide clear evidence to support this claim. While firms may maintain stability during such events, gender diversity does not appear to significantly influence performance outcomes in these scenarios. This may be due to structural factors within firms, such as governance frameworks or resource allocation strategies, which could result in delayed effects. Future research could explore these lagged effects to deepen our understanding of gender diversity’s role in economic crisis management.

Lastly, our final hypothesis tested whether gender-diverse firms perform better when facing human-centric risks, such as disasters that cause injuries or fatalities. Our results indicate that firms with greater gender diversity exhibit stronger resilience and superior performance in these situations. This effect is particularly pronounced in organizations where women constitute at least 20% of leadership positions, suggesting that a critical mass of female representation enhances crisis management capabilities and fosters a more adaptive corporate culture.

In summary, our results show that gender diversity alone does not consistently enhance operational performance (ROA) or financial performance (ROE) and, in some cases, yields weaker results. However, it consistently improves market-based performance (Tobin's Q), indicating that investors perceive gender-diverse leadership as a positive signal of innovation and adaptability. While gender diversification may not fully capture the operational performance of firms, it does contribute to increasing firm value. When examining the impact of external economic shocks caused by natural disasters, our findings suggest that gender diversity does not significantly enhance firm performance in these scenarios. Although firms may demonstrate resilience to economic damage, having more women in leadership does not consistently lead to improved outcomes during economic shocks.

However, gender diversity plays a crucial moderating role in building resilience and enhancing firm performance when firms face human-centric shocks from natural disasters. Its greatest value emerges in crises that directly affect people, where firms with higher female leadership—particularly those with at least 20% female representation—are more effective in managing disruptions. These firms sustain operations more efficiently and maintain or even improve market confidence during such events.

Like all studies, this research has limitations. Expanding the analysis to industry-specific contexts could provide more granular insights and further contribute to the literature. Additionally, investigating potential lagged effects in firm performance would offer a more comprehensive understanding of gender diversity's long-term impact. Moreover, our study is constrained to the period between 2000 and 2021 due to data limitations in the SHELDUS database. Future research could extend the time frame to capture broader trends and assess how gender-diverse firms manage risks over longer periods.

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*****Note: In the preparation of this work, I consulted ChatGPT, an AI conversational agent developed by OpenAI, on Dec 24 for editorial purposes (OpenAI,2024)***

Reference Entry: OpenAI. (2023). ChatGPT [AI conversational agent]. OpenAI. https://www.openai.com/chatgpt

Figures

Figure 1 – Trend line of gender diversification in CSR from period 2000-2021

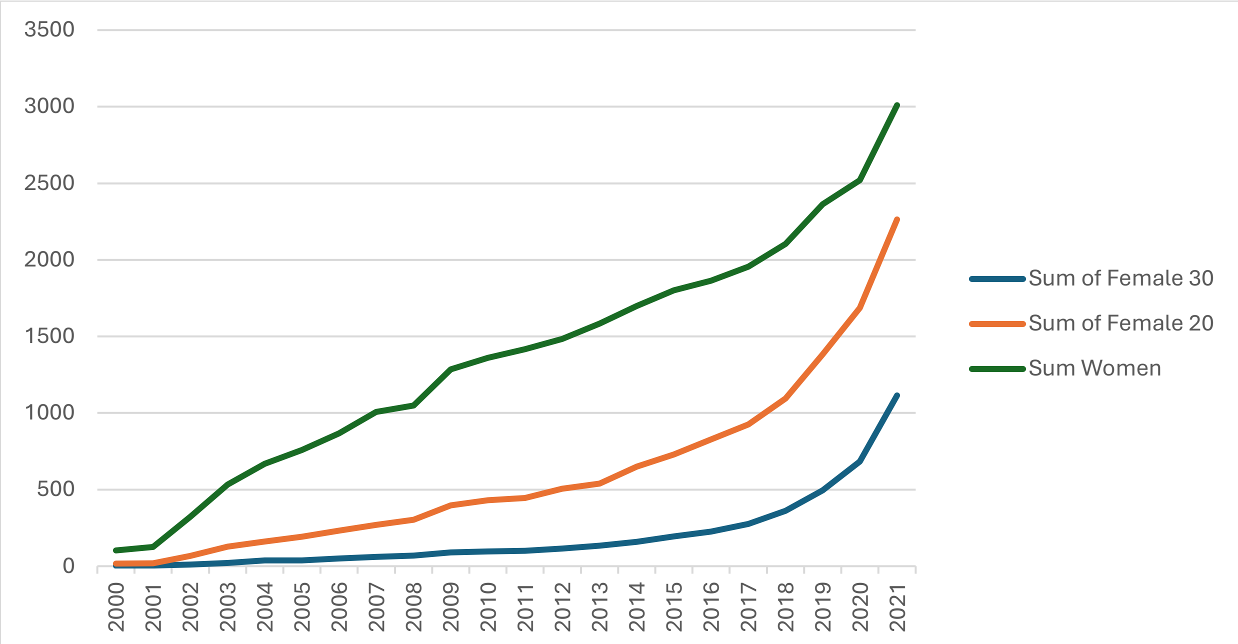


Figure 1 – Trend line of gender diversification implementation in CSR from period 2000-2021

Figure 2 – Total Natural Disasters Reported in U.S. States (2000-2021)

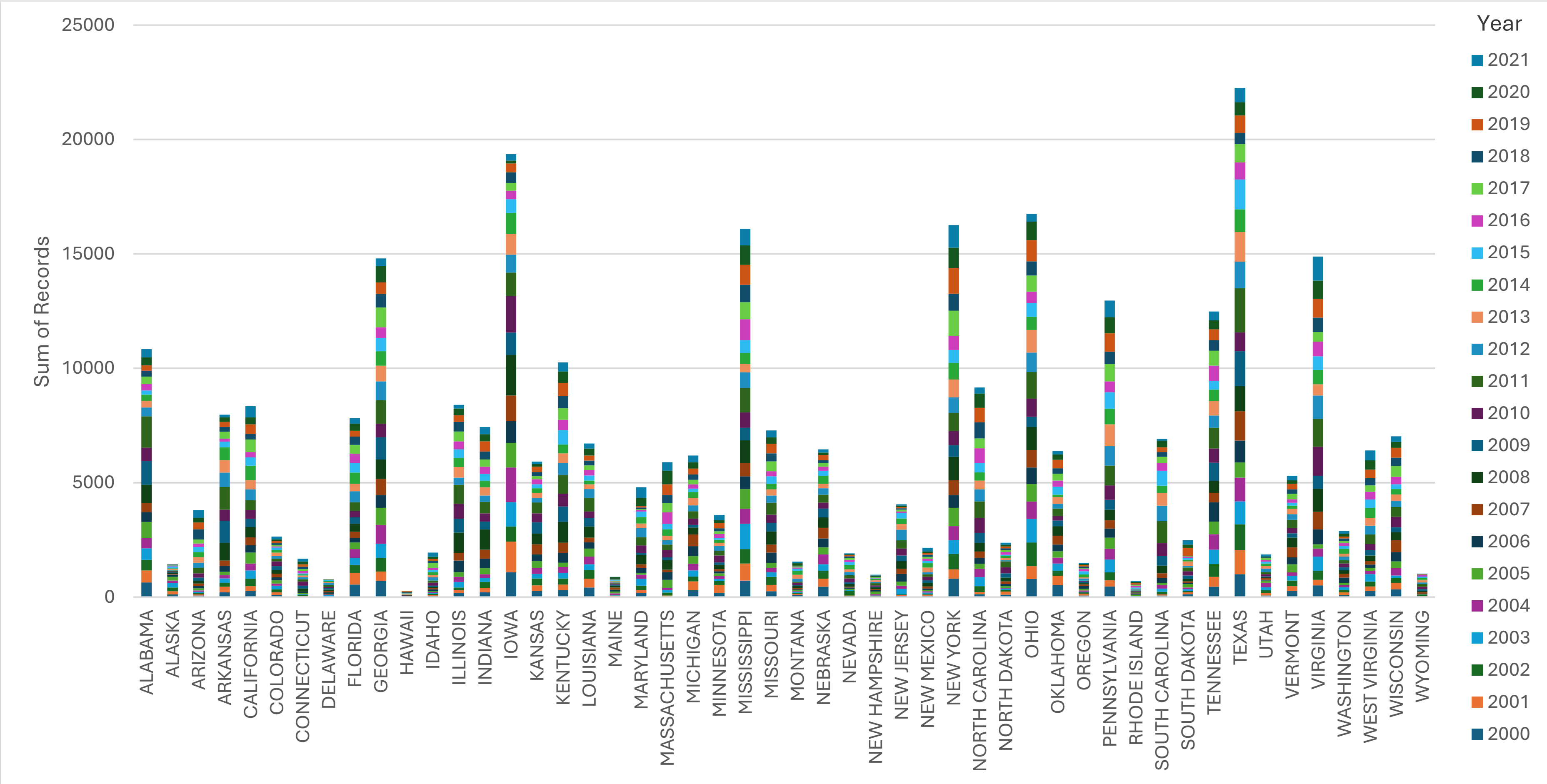


Figure 3 – State-level Fatalities from Natural Disasters (2000-2021)

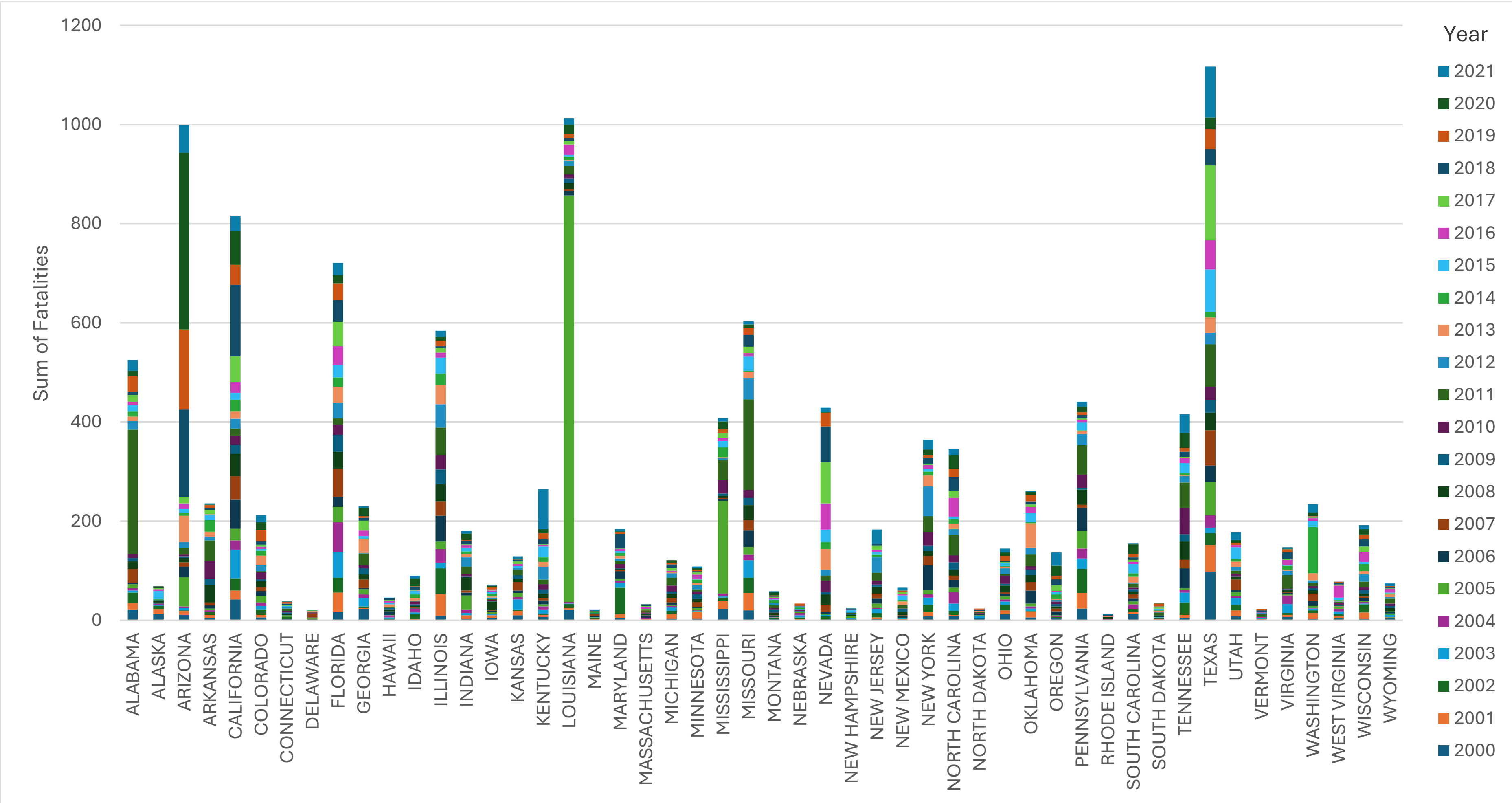
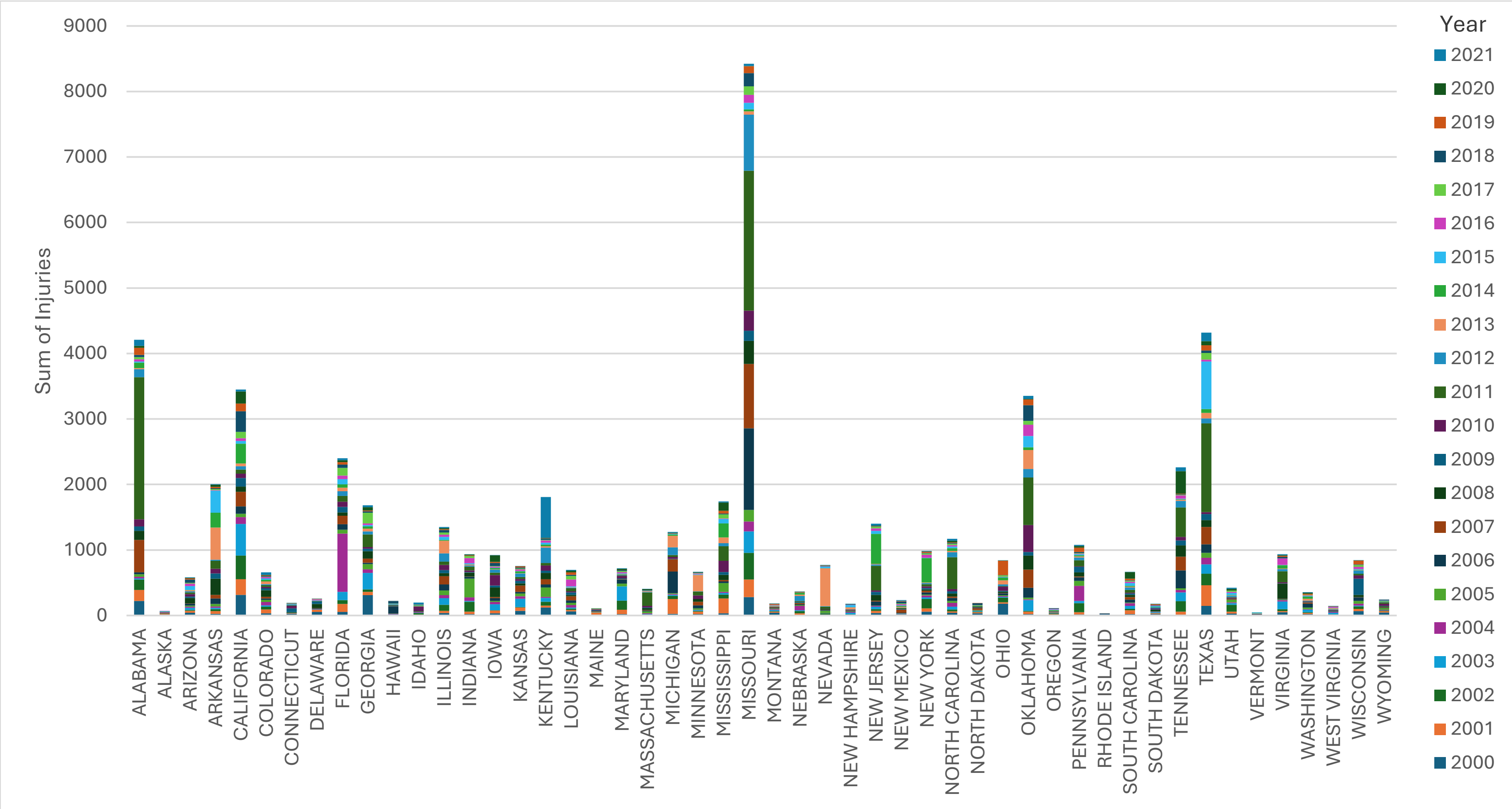


Figure 4 – State-level Injuries from Natural Disasters (2000-2021)



Tables

Table 1 Variable Description

Table 1 – Variable Description

Dependent variable(s)	
Name	**Description and Definition**
Return on Assets (ROA)	Measures a company's profitability relative to its total assets. It shows how efficiently management is using its assets to generate earnings. (Calculated as the percentage of Net income/Total assets).
Return on Equity (ROE)	Measures the profitability of a company relative to the equity invested by shareholders. It indicates how effectively a company is using the equity financing to generate profits. (Calculated as percentage of Net income/Shareholders' equity)
Tobin's Q	Tobin's Q represents the ratio of a firm's market value of assets to its book value of assets. It is calculated as (mkvalt/at), where **mkvalt** denotes the market value of the firm's assets, and **at** refers to the book value of its total assets. This measure is used to assess whether a firm is valued above or below the replacement cost of its assets, providing insight into market perceptions of the firm's growth prospects and performance.
Independent variable(s)	
Gender Ratio	The proportion of female directors at the Annual Report Date selected (2000- 2021) calculated as 1- Gender Ratio gathered through WRDS- BoardEx
Female >30%	Dummy variable created for when Gender ratio is smaller that 70% (more than 30% of directors are Female) is 1, if not 0.
Female >20%	Dummy variable created for when Gender ratio is smaller that 80% (more than 20% of directors are Female) is 1, if not 0.
Damage	Natural og of the adjusted property damage per capita in the state, calculated by dividing the inflation-adjusted property damage by the population of the state (e.g., 1,258.37829 dollars per person in 2021).
Injuries	The total number of injuries caused by the disaster in that year (e.g., 222 injuries).
Fatalities	Number of fatalities caused by natural disasters in that specific year and state
Records	Number of disaster event records included in the data.
Size	Represents the size of the firm by indicating the Natural log of the total value of a company's assets.
Debt to Equity Ratio	Measures the company's financial leverage, calculated by dividing total debt by total equity. (calculated as Total Debt/Total Equity)
Price to Book Ratio	Ratio of a company's market price to its book value, used to evaluate valuation. (calculated as Market Price per Share/Book Value per Shar)

Table 2 - Descriptive Statistics

Table 2 - Descriptive Statistics

Variables	N	Maximum	Minimum	Mean	median	Std. Deviation
ROA	47338	0.1667	-0.5837	-0.0304	0.0281	0.1852
ROE	47338	0.4886	-1.1270	-0.0323	0.0697	0.3727
Tobin's Q	47338	5.4282	0.0873	1.5554	1.0740	1.4152
Gender Ratio	47338	0.3330	0.0000	0.1200	0.1250	0.1106
Female_30	47338	1.0000	0.0000	0.0917	0.0000	0.2886
Female_20	47338	1.0000	0.0000	0.2803	0.0000	0.4491
Damage (Ln)	47338	17.6190	9.8220	13.9497	13.9351	2.1177
Injuries	47338	312.4100	2.0000	64.4673	32.0000	81.3720
Records (Ln)	47338	7.0121	4.2195	5.8978	6.0039	0.7761
Fatalities	47338	71.0000	1.0000	19.6755	13.0000	19.7062
Price To Book Ratio	47338	11.8572	0.0000	3.1139	2.1266	3.0043
Size (Ln)	47338	23.8928	16.8825	20.3795	20.4129	1.951435
Debt To Equity Ratio	47338	3.4414	0.0000	0.6761	0.3173	0.9197

The table displays the summary statistics for all dependent and independent variables used in our study. All variables with the exception of the dummy variables (Female 20, Female 30) are winsorized.

Table 3- Correlation Matrix

Table 3- Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) ROA	1.000										
(2) ROE	0.750	1.000									
(3) Tobin's Q	-0.160	-0.104	1.000								
(4) Gender Ratio	0.073	0.059	0.044	1.000							
(5) Damage Ln	0.082	0.056	-0.051	-0.063	1.000						
(6) Records Ln	0.048	0.031	-0.076	-0.029	0.465	1.000					
(7) Injuries Ln	0.004	-0.008	0.024	-0.086	0.438	0.261	1.000				
(8) Fatalities	-0.019	-0.021	0.024	-0.009	0.563	0.315	0.550	1.000			
(9) Size Ln	0.450	0.363	-0.256	0.331	0.055	0.086	-0.001	0.019	1.000		
(10) Debt to Equity Ratio	0.073	0.010	-0.271	0.115	0.017	0.041	-0.025	-0.002	0.347	1.000	
(11) Price to Book Ratio	-0.072	-0.088	0.716	0.113	-0.036	-0.053	0.019	0.021	-0.045	0.208	1.000

Table 4- Main Regression Results (ROA, Damage)

Table 4- Main Regression Results (ROA-Damage)

	Panel Least Squares			Period Weighted		
Variables	1	2	3	1	2	3
Gender Variables						
Gender Ratio	0.0668*			-0.0705*		
	(1.8743)			(-1.7132)		
Female 30		0.0166			0.0029	
		(1.3276)			(0.2025)	
Female 20			0.0105			-0.0053
			(1.2818)			(-0.5577)
Natural Disaster Variables						
Damage	0.0005	-0.0001	0.00002	0.0019***	0.0017***	0.0017***
	(1.0493)	(0.0004)	(0.0416)	(3.9342)	(0.0003)	(4.4025)
Interactions						
Gender Ratio X Damage	-0.0051**			-0.0035		
	(-2.0492)			(-1.216)		
Female 30 X Damage		-0.0011			-0.0012	
		(-1.2393)			(-1.1378)	
Female 20 X Damage			-0.0005			-0.0006
			(-0.8372)			(-0.8788)
Controls						
Size	0.0476***	0.0475***	0.0474***	0.0562***	0.0543***	0.0546***
	(45.0372)	(45.1956)	(45.0833)	(71.0499)	(70.0583)	(70.2352)
Price to Book Ratio	0.0074***	0.0074***	0.0074***	0.0026***	0.0024***	0.0025***
	(29.5477)	(29.5563)	(29.4750)	(8.95075)	(8.2611)	(8.4447)
Debt to Equity Ratio	-0.0293***	-0.0293***	-0.0293***	-0.0219***	-0.0216***	-0.0216***
	(-33.0912)	(-33.1067)	(-33.0912)	(-20.5889)	(-20.2542)	(-20.3167)
Constant	-1.0097***	-1.002602***	-1.0023***	-1.1918***	-1.1611***	-1.1670***
	(-45.318)	(-45.6581)	(-45.5261)	(-69.8979)	(-71.2617)	(-70.8549)
Observations	47338	47338	47338	47338	47338	47338
Periods included	22	22	22	22	22	22
Cross-sections included	5185	5185	5185	5185	5185	5185
Firm fixed effects	Yes	Yes	Yes			
Year fixed effects	Yes	Yes	Yes			
F-statistic	0	0	0	1111.468	1078.895	1084.883
Prob(F-statistic)	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
R Squared	0.712812	0.712795	0.712825	0.123497	0.120313	0.1209

Table 4 reports the results of two regressions, Panel Least Squares (PLS)- fixed effects regression and Panel EGLS- Period SUR regression, with Return on Assets (***ROA***) as the dependent variable. The table checks the effects of the natural log of the cost of damage per capita adjusted for the year 2021 (***Damage***) The PLS model includes cross-sectional & period fixed effects. Both models span the **years 2000–2021**, with 5185 cross-sections and 47,338 unbalanced panel observations. *Column (1)* checks the moderating effects of ***Gender ratio*** in the regression, *columns (2) and (3)* checks the moderating effects of the dummy variables ***Female 30*** and ***Female 20*** respectively. ***Size, P/B ratio and D/E ratio*** act as standard econometric control variables. (Refer to table 1 for the variable definition). Table 4 reports the coefficients and t values are reported in parentheses. Significance levels are denoted by ***, **, and *, indicating 1%, 5%, and 10% significance, respectively.

Table 5- Regression Results (ROA, Injuries)

Table 5- Regression Results (ROA-Injuries)

	Panel Least Squares			Period Weighted		
Variables	1	2	3	1	2	3
Gender Variables						
Gender Ratio	-0.0124 (-1.3854)			-0.1269*** (-12.3565)		
Female 30		-0.0002 (-0.0504)			-0.0157*** (-5.0055)	
Female 20			0.0020 (0.9584)			-0.0149*** (-6.8657)
Natural Disaster Variables						
Injuries	-0.0000229** (-2.374019)	-0.0000109 (0.00000742)	-0.000017** (-2.117514)	-0.000016* (-1.759579)	-0.00000461 (0.00000672)	-0.00000686 (-0.9323)
Interactions						
Gender Ratio X Injuries	0.000129** (2.158937)			0.000114* (1.851895)		
Female 30 X Injuries		0.000028 (1.122873)			0.0000445* (1.658836)	
Female 20 X Injuries			0.0000342** (2.309221)			0.0000207 (1.344332)
Controls						
Size	0.0476*** (45.0963)	0.0475*** (45.2264)	0.0475*** (45.1451)	0.056416*** (71.1865)	0.0544*** (70.1721)	0.0548*** (70.3628)
Price to Book Ratio	0.0075*** (29.5679)	0.0074*** (29.5731)	0.0074*** (29.4735)	0.002592*** (8.8973)	0.0024*** (8.1991)	0.0024*** (8.3949)
Debt to Equity Ratio	-0.0293*** (-33.1042)	-0.0292*** (-33.1118)	-0.0293*** (-33.0935)	-0.0218*** (-20.5588)	-0.0216*** (-20.2236)	-0.0216*** (-20.2926)
Constant	-1.0019*** (-46.6519)	-1.0026*** (-46.7331)	-1.001666*** (-46.6945)	-1.1676*** (-73.6681)	-1.1405*** (-72.6246)	-1.1461*** (-72.8326)
Observations	47338	47338	47338	47338	47338	47338

Periods included	22	22	22	22	22	22
Cross-sections included	5185	5185	5185	5185	5185	5185
Firm fixed effects	Yes	Yes	Yes			
Year fixed effects	Yes	Yes	Yes			
F-statistic	0	0	0	1105.827	1072.602	1078.616
Prob(F-statistic)	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
R Squared	0.712826	0.712803	0.712866	0.122947	0.119695	0.120286

Table 5 reports the results of two regressions, Panel Least Squares- Fixed Effects regression and Panel EGLS - Period SUR regression, with Return on Assets (***ROA***) as the dependent variable. The table checks the effects of the number of ***Injuries*** happened in the certain stater due to natural disaster each year (***Injuries***) The PLS model includes cross-sectional & period fixed effects. Both models span the years ***2000–2021***, with 5185 cross-sections and 47,338 unbalanced panel observations. *Column (1)* checks the moderating effects of ***Gender ratio*** in the regression, *columns (2) and (3)* checks the moderating effects of the dummy variables ***Female 30 and Female 20*** respectively. (Refer to T*able 1* for the variable definition). ***Size, P/B ratio and D/E ratio*** act as standard econometric control variables. Coefficients are reported and t values are reported in parentheses. Significance levels are denoted by ***, **, and *, indicating 1%, 5%, and 10% significance, respectively

Table 6- Regression Results (ROA, Fatalities)

Table 6- Regression Results (ROA-Fatalities)

	Panel Least Squares			Period Weighted		
Variables	1	2	3	1	2	3
Gender Variables						
Gender Ratio	-0.018146*			-0.125672***		
	(-1.87385)			(-11.00087)		
Female 30		-0.002387			-0.015976***	
		(-0.829221)			(-4.370522)	
Female 20			0.00072			-0.014408***
			(0.363189)			(-5.897589)
Natural Disaster Variables						
Fatalities	-0.000125***	-0.0000571	-0.0000869**	-0.000096**	-0.0000778**	-0.0000759*
	(-2.639848)	(0.0000361)	(-2.207579)	(-1.973334)	(0.0000364)	(-1.912339)
Interactions						
Gender Ratio X Fatalities	0.000689***			0.000283		
	(2.675106)			(0.927068)		
Female 30 X Fatalities		0.000186**			0.000128	
		(1.996546)			(1.10774)	
Female 20 X Fatalities			0.000156***			0.0000386
			(2.58753)			(0.533235)
Controls						
Size	0.0476***	0.0476***	0.0475***	0.0564***	0.0544***	0.0548***
	(45.0876)	(45.222)	(45.1338)	(71.2641)	(70.2338)	(70.4328)
Price to Book Ratio	0.0074***	0.0075***	0.0074***	0.0026***	0.0024***	0.0025***
	(29.558)	(29.5739)	(29.4669)	(8.8918)	(8.1960)	(8.3937)
Debt to Equity Ratio	-0.0293***	-0.0293***	-0.0293***	-0.0218***	-0.0216***	-0.0216***
	(-33.1074)	(-33.1198)	(-33.0911)	(-20.5555)	(-20.2202)	(-20.2847)
Constant	-1.0011***	-1.0023***	-1.0011***	-1.1671***	-1.1395***	-1.1453***
	(-46.5935)	(-46.7235)	(-46.6646)	(-73.6828)	(-72.6214)	(-72.841)
Observations	47338	47338	47338	47338	47338	47338

Periods included	22	22	22	22	22	22
Cross-sections included	5185	5185	5185	5185	5185	5185
Firm fixed effects	Yes	Yes	Yes			
Year fixed effects	Yes	Yes	Yes			
F-statistic	0	0	0	1107.982	1074.947	1081.007
Prob(F-statistic)	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
R Squared	0.71284	0.712819	0.712874	0.123157	0.119926	0.12052

Table 6 reports the results of two regressions, OLS-FE regression and SUR regression, with ***ROA*** as the dependent variable. The table checks the effects of the natural logarithm of the number of recorded deaths occurred annually due to natural disaster in each state (***Fatalities***) The FE model includes cross-sectional & period fixed effects. Both models span the ***years 2000–2021***, with 5185 cross-sections and 47,338 unbalanced panel observations. *Column (1)* checks the moderating effects of ***Gender Ratio*** in the regression, *Columns (2) and (3)* checks the moderating effects of the dummy variables ***Female 30 and Female 20*** respectively. (Refer to *Table 1* for the variable definition). ***Size, P/B ratio and D/E ratio*** act as standard econometric control variables. Coefficients are reported and t values are reported in parentheses. Significance levels are denoted by ***, **, and *, indicating 1%, 5%, and 10% significance, respectively.

Table 7- Regression Results (ROA, Records) - Robustness

Table 7- Regression Results (ROA-Records) - Robustness

	Panel Least Squares			Period Weighted		
Variables	1	2	3	1	2	3
Gender Variables						
Gender Ratio	-0.0241			-0.0711		
	(-0.5260)			(-1.1819)		
Female 30		-0.0209			-0.0106	
		(-1.3796)			(-0.5353)	
Female 20			0.0002			-0.0080
			(0.0202)			(-0.5964)
Natural Disaster Variables						
Records	0.000776	0.000762	0.000923	0.00135	0.0007	0.000811
	(0.437158)	(0.001513)	(0.584694)	(0.758022)	(0.001386)	(0.549358)
Interactions						
Gender Ratio X Records	0.0033			-0.0082		
	(0.4361)			(-0.8167)		
Female 30 X Records		0.0038			-0.0005	
		(1.4818)			(-0.1363)	
Female 20 X Records			0.0006			-0.0009
			(0.3473)			(-0.4218)
Controls						
Size	0.0475***	0.0476***	0.0474***	0.0564***	0.0544***	0.0548***
	(45.0471)	(45.1944)	(45.0709)	(71.1061)	(70.0710)	(70.2781)
Price to Book Ratio	0.0074***	0.0075***	0.0074***	0.0026***	0.0024***	0.0025***
	(29.5559)	(29.5649)	(29.4672)	(8.9020)	(8.2121)	(8.3982)
Debt to Equity Ratio	-0.0292***	-0.0293***	-0.0293***	-0.0218***	-0.0216***	-0.0216***
	(-33.0991)	(-33.1156)	(-33.0872)	(-20.5642)	(-20.2315)	(-20.2892)
Constant	-1.0077***	-1.0077***	-1.0075***	-1.1759***	-1.14432***	-1.1509***

	(-42.8521)	(-43.9301)	(-43.6841)	(-63.1797)	(-65.9135)	(-65.3253)
Observations	47338	47338	47338	47338	47338	47338
Periods included	22	22	22	22	22	22
Cross-sections included	5185	5185	5185	5185	5185	5185
Firm fixed effects	Yes	Yes	Yes			
Year fixed effects	Yes	Yes	Yes			
F-statistic	23.5444	23.54595	23.54828	1106.513	1072.442	1079.656
Prob(F-statistic)	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
R Squared	0.712789	0.712803	0.712824	0.123014	0.11968	0.120388

Table 7 reports the results of two regressions, OLS regression and Panel SUR regression, with Return on Assets (***ROA***) as the dependent variable. The table checks the effects of the frequency of the risks which is calculated as the natural logarithm of the number of natural disaster occurrences in each sates each year (***Records***) The OLS model includes cross-section and period fixed effects. Both models span the ***years 2000–2021***, with 5185 cross-sections and 47,338 unbalanced panel observations. *Column (1)* checks the moderating effects of Gender ratio in the regression, *Columns (2) and (3)* checks the moderating effects of the dummy variables ***Female 30*** and ***Female 20*** respectively. (Refer to *Table 1* for the variable definition). ***Size, P/B ratio and D/E ratio*** act as standard econometric control variables. Coefficients are reported and t values are reported in parentheses. Significance levels are denoted by ***, **, and *, indicating 1%, 5%, and 10% significance, respectively.

Table 8- Regression Results (ROE, Damage) - Robustness

Table 8- Robustness Test: Regression Results (ROE- Damage) - Robustness

	Panel Least Squares			Period Weighted		
Variables	1	2	3	1	2	3
Gender Variables						
Gender Ratio	0.2134**			-0.0633		
	(2.1781)			(-0.6368)		
Female 30		0.0788**			0.0076	
		(2.2961)			(0.2083)	
Female 20			0.0234			-0.0228
			(1.0396)			(-0.9704)
Natural Disaster Variables						
Damage	0.001901	0.000291	0.000135	0.003863***	0.003329***	0.003034***
	(1.454948)	(0.001034)	(0.121526)	(3.350824)	(0.000844)	(3.261569)
Interactions						
Gender Ratio X Damage	-0.017671***			-0.008903		
	(-2.584412)			(-1.275363)		
Female 30 X Damage		-0.005946**			-0.002751	
		(-2.425271)			(-1.056044)	
Female 20 X Damage			-0.001341			-0.000202
			(-0.841605)			(-0.121295)
Controls						
Size	0.0718***	0.0715***	0.0715***	0.0871***	0.0841***	0.0848***
	(24.7708)	(24.7641)	(24.7194)	(58.5065)	(58.2578)	(58.2887)
Price to Book Ratio	0.0051***	0.0051***	0.0051***	-0.0075***	-0.0079***	-0.0077***
	(7.3547)	(7.3520)	(7.31140)	(-11.2710)	(-11.9375)	(-11.7418)
Debt to Equity Ratio	-0.0825***	-0.0825***	-0.0825***	-0.0718***	-0.0712***	-0.0713***
	(-33.9495)	(-33.9461)	(-33.9461)	(-30.1876)	(-29.9411)	(-29.9740)
Constant	-1.4797***	-1.4545***	-1.4525***	-1.7759***	-1.7247***	-1.7308***
	(-24.1786)	(-24.1155)	(-24.0163)	(-53.3671)	(-55.4638)	(-54.7357)
Observations	47338	47338	47338	47338	47338	47338

Periods included	22	22	22	22	22	22
Cross-sections included	5185	5185	5185	5185	5185	5185
Firm fixed effects	Yes	Yes	Yes			
Year fixed effects	Yes	Yes	Yes			
F-statistic	0	0	0	807.2797	794.0224	796.4393
Prob(F-statistic)	***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
R Squared	0.523516	0.523485	0.523437	0.092836	0.091451	0.091704

Table 8 reports the results of two regressions, OLS- Fixed effects regression and Panel EGLS - Period SUR regression, with Return on Equity (***ROE***) as the dependent variable. The table checks the effects of the natural log of the cost of damage per capita adjusted for the year 2021 (***Damage***) The PLS model includes period & cross-section fixed effects. Both models spans the ***years 2000–2021***, with 5185 cross-sections and 47,338 unbalanced panel observations. *Column (1)* checks the moderating effects of ***Gender Ratio*** in the regression, *Columns (2) and (3)* checks the moderating effects of the dummy variables ***Female 30 and Female 20*** respectively. (Refer to *Table 1* for the variable definition). ***Size, P/B ratio and D/E ratio*** act as standard econometric control variables. Coefficients are reported and t values are reported in parentheses. Significance levels are denoted by ***, **, and *, indicating 1%, 5%, and 10% significance, respectively.

Table 9 - Regression Results (ROE, Injuries) - Robustness

Table 9 - Regression Results (ROE- Injuries)- Robustness

	Panel Least Squares			Period Weighted		
Variables	1	2	3	1	2	3
Gender Variables						
Gender Ratio	-0.053551**			-0.205534***		
	(-2.171416)			(-9.091398)		
Female 30		-0.005426			-0.034508***	
		(-0.776042)			(-4.646336)	
Female 20			-0.002198			-0.030933***
			(-0.440632)			(-6.15536)
Natural Disaster Variables						
Injuries	-0.0000688***	-0.0000371*	-0.0000613***	-0.0000713***	-0.0000496***	-0.000063***
	(-2.597683)	(0.0000204)	(-2.787218)	(-3.116195)	(0.000017)	(-3.390361)
Interactions						
Gender Ratio X Injuries	0.000325**			0.000199		
	(1.971324)			(1.276723)		
Female 30 X Injuries		0.0000416			0.0000657	
		(0.607499)			(0.959945)	
Female 20 X Injuries			0.000118***			0.0000744*
			(2.902402)			(1.894859)
Controls						
Size	0.0721***	0.0716***	0.0716***	0.0875***	0.0844***	0.0852***
	(24.8397)	(24.8145)	(24.7784)	(58.8019)	(58.4805)	(58.5478)
Price to Book Ratio	0.0052***	0.0051***	0.0051***	-0.0075***	-0.0079***	-0.0077***
	(7.3972)	(7.3902)	(7.3179)	(-11.2768)	(-11.9677)	(-11.7675)
Debt to Equity Ratio	-0.0825***	-0.0825***	-0.0825***	-0.0718***	-0.0714***	-0.0714***
	(-33.9741)	(-33.9619)	(-33.9529)	(-30.2185)	(-29.9732)	(-30.0086)
Constant	-1.4518***	-1.4506***	-1.4489***	-1.7247***	-1.6816***	-1.6914***
	(-24.6089)	(-24.6177)	(-24.5905)	(-58.1312)	(-57.5485)	(-57.6602)
Observations	47338	47338	47338	47338	47338	47338

Periods included	22	22	22	22	22	22
Cross-sections included	5185	5185	5185	5185	5185	5185
Firm fixed effects	Yes	Yes	Yes			
Year fixed effects	Yes	Yes	Yes			
F-statistic	8.882047	8.879864	8.883472	807.2403	793.0941	796.4978
Prob(F-statistic)	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
R Squared	0.523517	0.523456	0.523557	0.092832	0.091354	0.09171

Table 9 reports the results of two regressions, OLS-fixed effects regression and Panel EGLS -Period SUR regression, with Return on Equity (***ROE***) as the dependent variable. The table checks the effects of the number of injuries happened in the certain stater due to natural disaster each year (***Injuries***) The PLS model includes firm & period fixed effects. Both models span the years ***2000–2021***, with 5185 cross-sections and 47,338 unbalanced panel observations. *Column (1)* checks the moderating effects of ***Gender Ratio*** in the regression, *Columns (2) and (3)* checks the moderating effects of the dummy variables ***Female 30 and Female 20*** respectively. (Refer to *Table 1* for the variable definition).). ***Size, P/B ratio and D/E ratio*** act as standard econometric control variables. Coefficients are reported and t values are reported in parentheses. Significance levels are denoted by ***, **, and *, indicating 1%, 5%, and 10% significance, respectively.

Table 10 - Regression Results (ROE, Fatalities) – Robustness

Table 10 - Regression Results (ROE- Fatalities) - Robustness

	Panel Least Squares			Period Weighted		
Variables	1	2	3	1	2	3
Gender Variables						
Gender Ratio	-0.050761*			-0.179746***		
	(-1.908182)			(-7.078675)		
Female 30		-0.001126			-0.027547***	
		(-0.14244)			(-3.164946)	
Female 20			-0.000354			-0.025061***
			(-0.065074)			(-4.412709)
Natural Disaster Variables						
Fatalities	-0.0000172	0.0000951	0.00000871	-0.0000778	-0.000125	-0.000122
	(-0.131956)	(0.0000993)	(0.080503)	(-0.663067)	(0.0000875)	(-1.273421)
Interactions						
Gender Ratio X Fatalities	0.000858			-0.000517		
	(1.213849)			(-0.700819)		
Female 30 X Fatalities		-0.0000979			-0.000146	
		(-0.38334)			(-0.517028)	
Female 20 X Fatalities			0.000262			-0.0000476
			(1.581738)			(-0.268157)
Controls						
Size	0.0719***	0.0716***	0.0714***	0.0875***	0.0845***	0.0852***
	(24.7913)	(24.7725)	(24.7134)	(58.8542)	(58.5645)	(58.6109)
Price to Book Ratio	0.0051***	0.0051***	0.0051***	-0.0075***	-0.0079***	-0.0078***
	(7.3405)	(7.3320)	(7.2696)	(-11.2763)	(-11.9653)	(-11.7538)
Debt to Equity Ratio	-0.0825***	-0.0824***	-0.0824***	-0.0718***	-0.0713***	-0.0713***
	(-33.9450)	(-33.9315)	(-33.9221)	(-30.1894)	(-29.9426)	(-29.9851)

Constant	-1.4536***	-1.4529***	-1.4499***	-1.7273***	-1.6829***	-1.6930***
	(-24.6278)	(-24.6548)	(-24.6015)	(-58.2779)	(-57.6652)	(-57.7814)
Observations	47338	47338	47338	47338	47338	47338
Periods included	22	22	22	22	22	22
Cross-sections included	5185	5185	5185	5185	5185	5185
Firm fixed effects	Yes	Yes	Yes			
Year fixed effects	Yes	Yes	Yes			
F-statistic	8.880215	8.878892	8.88022	807.3204	793.4242	796.2724
Prob(F-statistic)	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
R Squared	0.523466	0.523429	0.523466	0.09284	0.091388	0.091686

Table 10 reports the results of two regressions, OLS-fixed effects regression and Panel EGLS -Period SUR regression, with Return on Equity (***ROE***) as the dependent variable. The table checks the effects of the natural logarithm of the number of recorded deaths occurred annually due to natural disaster in each state (***Fatalities***). The PLS model includes firm & period fixed effects. Both models span the ***years 2000–2021***, with 5185 cross-sections and 47,338 unbalanced panel observations. *Column (1)* checks the moderating effects of ***Gender Ratio*** in the regression, *Columns (2) and (3)* checks the moderating effects of the dummy variables ***Female 30 and Female 20*** respectively. (Refer to *Table 1* for the variable definition). ***Size, P/B ratio and D/E ratio*** act as standard econometric control variables. Coefficients are reported and t values are reported in parentheses. Significance levels are denoted by ***, **, and *, indicating 1%, 5%, and 10% significance, respectively.

Table 11 - Regression Results (Tobin's Q, Damage)- Robustness

Table 11 - Regression Results (Tobin's Q - Damage)- Robustness

	Panel Least Squares			Period Weighted		
Variables	1	2	3	1	2	3
Gender Variables						
Gender Ratio	0.467407**			0.619149***		
	(2.309468)			(2.945826)		
Female 30		0.096841			0.041776	
		(1.364839)			(0.546568)	
Female 20			0.064283			0.07846
			(1.383388)			(1.596529)
Natural Disaster Variables						
Damage	0.0095***	0.006072***	0.006447***	0.002617	0.000401	0.001011
	(3.51999)	(0.002137)	(2.815898)	(1.073621)	(0.001787)	(0.51438)
Interactions						
Gender Ratio X Damage	-0.032212**			-0.012094		
	(-2.280571)			(-0.822767)		
Female 30 X Damage		-0.005501			0.002267	
		(-1.08638)			(0.418077)	
Female 20 X Damage			-0.003005			-0.000308
			(-0.913471)			(-0.088637)
Controls						
Size	-0.0401***	-0.0398***	-0.0402***	-0.0746***	-0.0675***	-0.0698***
	(-6.6925)	(-6.6555)	(-6.7352)	(-20.5974)	(-19.1513)	(-19.6798)
Price to Book Ratio	0.3017***	0.3018***	0.3017***	0.31491***	0.3158***	0.3154***
	(210.7266)	(210.785)	(210.632)	(216.3827)	(217.2627)	(216.8938)
Debt to Equity Ratio	-0.5866***	-0.5868***	-0.5866***	-0.6162***	-0.6174***	-0.6169***
	(-116.8693)	(-116.9079)	(-116.8855)	(-117.3631)	(-117.5131)	(-117.499)

Constant	1.6945***	1.7354***	1.7362***	2.4326***	2.3616***	2.3878***
	(13.4039)	(13.9288)	(13.8982)	(30.8578)	(31.6656)	(31.5957)
Observations	47338	47338	47338	47338	47338	47338
Periods included	22	22	22	22	22	22
Cross-sections included	5185	5185	5185	5185	5185	5185
Firm fixed effects	Yes	Yes	Yes			
Year fixed effects	Yes	Yes	Yes			
F-statistic	49.25595	49.2541	49.25837	10762.22	10737.19	10749.54
Prob(F-statistic)	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
R Squared	0.859015	0.859011	0.859021	0.57704	0.576472	0.576753

Table 11 reports the results of two regressions, OLS-fixed effects regression and Panel EGLS -Period SUR regression, with ***Tobin's Q*** as the dependent variable. The table checks the effects of the natural log of the cost of damage per capita adjusted for the year 2021 (***Damage***) The PLS model includes cross-sectional & period fixed effects. Both models span ***the years 2000–2021***, with 5185 cross-sections and 47,338 unbalanced panel observations. *Column (1)* checks the moderating effects of ***Gender Ratio*** in the regression, *Columns (2) and (3)* checks the moderating effects of the dummy variables ***Female 30 and Female 20*** respectively. (Refer to *Table 1* for the variable definition). ***Size, P/B ratio and D/E ratio*** act as standard econometric control variables. Coefficients are reported and t values are reported in parentheses. Significance levels are denoted by ***, **, and *, indicating 1%, 5%, and 10% significance, respectively.

Table 12 - Regression Results (Tobin's Q, Injuries) - Robustness

Table 12 - Regression Results (Tobin's Q - Injuries)- Robustness

	Panel Least Squares			Period Weighted		
Variables	1	2	3	1	2	3
Gender Variables						
Gender Ratio	0.042043			0.460633***		
	(0.825169)			(9.159429)		
Female 30		0.008338			0.064723***	
		(0.577316)			(4.108477)	
Female 20			0.025266**			0.074208***
			(2.451731)			(6.849276)
Natural Disaster Variables						
Injuries	0.0000485	-0.00000613	0.000019	0.0000359	-0.000000841	0.0000125
	(0.887278)	(0.0000421)	(0.417664)	(0.767233)	(0.0000347)	(0.328393)
Interactions						
Gender Ratio X Injuries	-0.000374			-0.000176		
	(-1.099653)			(-0.551639)		
Female 30 X Injuries		0.000253*			0.000167	
		(1.787546)			(1.186305)	
Female 20 X Injuries			-0.0000431			-0.00000216
			(-0.512025)			(-0.026974)
Controls						
Size	-0.0394***	-0.0394***	-0.0397***	-0.0746***	-0.0674***	-0.0697***
	(-6.5764)	(-6.5918)	(-6.6562)	(-20.5947)	(-19.1497)	(-19.6797)
Price to Book Ratio	0.3018***	0.3018***	0.3017***	0.3148***	0.3157***	0.3153***
	(210.7187)	(210.7461)	(210.5984)	(216.3133)	(217.1951)	(216.8264)
Debt to Equity Ratio	-0.5869***	-0.5869***	-0.5868***	-0.6161***	-0.6173***	-0.6169***
	(-116.9209)	(-116.9284)	(-116.9224)	(-117.345)	(-117.4876)	(-117.4794)

Constant	1.8096***	1.8126***	1.81488***	2.4661***	2.3674***	2.4010***
	(14.8477)	(14.8903)	(14.9086)	(34.1677)	(33.2639)	(33.6257)
Observations	47338	47338	47338	47338	47338	47338
Periods included	22	22	22	22	22	22
Cross-sections included	5185	5185	5185	5185	5185	5185
Firm fixed effects	Yes	Yes	Yes			
Year fixed effects	Yes	Yes	Yes			
F-statistic	49.24079	49.2472	49.24791	10759.25	10733.47	10746.31
Prob(F-statistic)	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
R Squared	0.858978	0.858994	0.858996	0.576973	0.576388	0.576679

Table 12 reports the results of two regressions; OLS-fixed effects regression and Panel EGLS -Period SUR regression, with ***Tobin's Q*** as the dependent variable. The table checks the effects of the number of injuries happened in the certain stater due to natural disaster each year (***Injuries***) The PLS model includes cross-sectional & period fixed effects. Both models span the ***years 2000–2021***, with 5185 cross-sections and 47,338 unbalanced panel observations. *Column (1)* checks the moderating effects of ***Gender Ratio*** in the regression, *Columns (2) and (3)* checks the moderating effects of the dummy variables ***Female 30 and Female 20*** respectively. (Refer to *Table 1* for the variable definition) ***Size, P/B ratio and D/E ratio*** act as standard econometric control variables. Coefficients are reported and t values are reported in parentheses. Significance levels are denoted by ***, **, and *, indicating 1%, 5%, and 10% significance, respectively.

Table 13 - Regression Results (Tobin's Q, Fatalities) - Robustness

Table 13 - Regression Results (Tobin's Q - Fatalities)- Robustness

	Panel Least Squares			Period Weighted		
Variables	1	2	3	1	2	3
Gender Variables						
Gender Ratio	0.047112			0.414498***		
	(0.857276)			(7.355062)		
Female 30		0.010088			0.044795**	
		(0.617517)			(2.421258)	
Female 20			0.029013***			0.062404***
			(2.579152)			(5.093516)
Natural Disaster Variables						
Fatalities	0.000224	0.00000345	0.000142	0.00016	0.000245	0.0002
	(0.832739)	(0.000205)	(0.63756)	(0.646929)	(0.000185)	(0.994389)
Interactions						
Gender Ratio X Fatalities	-0.001413			0.00169		
	(-0.967457)			(1.086168)		
Female 30 X Fatalities		0.00056			0.001391**	
		(1.061575)			(2.358878)	
Female 20 X Fatalities			-0.000321			0.000572
			(-0.940145)			(1.548041)
Controls						
Size	-0.0394***	-0.0393***	-0.0397***	-0.0747***	-0.0676***	-0.0699***
	(-6.5760)	(-6.5919)	(-6.6533)	(-20.6204)	(-19.2134)	(-19.7161)
Price to Book Ratio	0.3018***	0.3018***	0.3017***	0.3148***	0.3157***	0.3153***
	(210.6967)	(210.7293)	(210.5852)	(216.2936)	(217.2076)	(216.802)
Debt to Equity Ratio	-0.5868***	-0.5869***	-0.5868***	-0.6159***	-0.6172***	-0.6167***
	(-116.9131)	(-116.9326)	(-116.9201)	(-117.326)	(-117.4849)	(-117.4571)
Constant	1.8087***	1.8124***	1.8132***	2.4674***	2.3667***	2.4006***
	(14.8337)	(14.8883)	(14.8934)	(34.1723)	(33.2618)	(33.6161)
Observations	47338	47338	47338	47338	47338	47338

Periods included	22	22	22	22	22	22
Cross-sections included	5185	5185	5185	5185	5185	5185
Firm fixed effects	Yes	Yes	Yes			
Year fixed effects	Yes	Yes	Yes			
F-statistic	49.24044	49.24441	49.24876	10762.78	10739.95	10750.37
Prob(F-statistic)	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
R Squared	0.858977	0.858987	0.858998	0.577053	0.576535	0.576772

Table 13 reports the results of two regressions; OLS-fixed effects regression and Panel EGLS -Period SUR regression, with ***Tobin's Q*** as the dependent variable. The table checks the effects of the natural logarithm of the number of recorded deaths occurred annually due to natural disaster in each state (***Fatalities***) The PLS model includes cross-sectional & period fixed effects. Both models span the ***years 2000–2021***, with 5185 cross-sections and 47,338 unbalanced panel observations. *Column (1)* checks the moderating effects of ***Gender Ratio*** in the regression, *Columns (2) and (3)* checks the moderating effects of the dummy ***variables Female 30 and Female 20*** respectively. (Refer to *Table 1* for the variable definition). ***Size, P/B ratio and D/E ratio*** act as standard econometric control variables. Coefficients are reported and t values are reported in parentheses. Significance levels are denoted by ***, **, and *, indicating 1%, 5%, and 10% significance, respectively.