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Board Gender Diversity and Financial Performance of US Banks: Evidence from Quantile Regression

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Abstract

In recent years, the influence of board gender diversity on bank outcomes has attracted the interest of regulators, policymakers, and academics worldwide. This paper aims to investigate the impact of board gender diversity on bank performance using mean-based and quantile-based regression methods. Based on a sample of 305 listed US banks, we find that board gender heterogeneity positively impacts the performance of banks, and this impact varies across the performance distribution. More precisely, we find that female board members exert a significantly larger positive influence in high-performing US banks relative to low-performing counterparts. Contrary to previous studies predicting a uniform effect of gender diversity on the performance of banks, our results support the heterogeneous impact of board gender diversity on bank performance.

Keywords

Corporate Governance, Board Gender Diversity, US, Banks, Quantile Regression

1. Introduction

In recent years, the issue of board gender diversity has attracted the interest of regulators, policymakers, and academics since gender equality has become one of the universally recognized social norms. Many regulatory bodies worldwide are encouraging or even requiring publicly traded companies to increase the number of women on their boards. For example, Italy, France, Germany, and Belgium have enacted legislation requiring female representation on boards to be between 30% and 40% of total board members. Opposite to Europe, there are no federal diversity requirements for corporate boards in the US. Most of the governance matters are usually handled by the states in which firms are located or by exchanges in which firms are listed. For instance, the Securities and Exchange Commission (SEC) accepted the NASDAQ's proposal, which requires all NASDAQ-listed corporations (with limited exclusions) to have, or explain why they do not, at least one woman and one minority director on their boards[1]. These legislative actions in Europe and the US have been important driving forces for the improvement of gender diversity on corporate boards. More specifically, in 2022, the proportion of female directors among S&P 500 firms as a whole rose to 32%, marking an 86% increase over the last decade (Catalyst, 2023), while the proportion of women directors in EU's largest listed corporations reached an all-time high of 32% in April 2022 (EIGE, 2022).

Based on the agency (Berle & Means, 1932; Fama & Jensen, 1983) and resource dependence (Pfeffer & Salancik, 1978) theoretical predictions, there are a lot of advantages associated with greater gender diversity on corporate boards. More precisely, female directors supervise more rigorously than their male counterparts (Adams & Ferreira, 2009), improve the quality of board decisions (Milliken & Martins, 1996), and enable corporations to secure vital external resources (Liu et al., 2014), leading to superior performance outcomes (Nguyen et al., 2015; Ntim, 2015). In contrast, according to social identity theory (Tajfel, 1978), greater board diversity may increase the relationship conflicts between gender-diverse subgroups, which in turn can harm the board's unity, cohesion, cooperation, and decision-making, thus leading to lower performance.

Many empirical studies have investigated the impact of board gender diversity on firm performance with contradicted findings, and a few have examined it in the banking industry specifically (e.g. García-Meca et al., 2015; Fernandes et al., 2017; Owen & Temesvary, 2018; Tampakoudis et al., 2022; Issa et al., 2021; Marie et al., 2021). In addition, the majority of empirical studies on this topic have assumed that the effect of boardroom gender heterogeneity on corporate performance is constant across the performance distribution. Drawing on threat-rigidity theory (Gladstein & Reilly, 1985; Staw et al., 1981) and job sorting and matching theories (Kremer & Maskin, 1996), we propose that the influence of female directors varies across the different points of the conditional distribution of corporate performance due to the fact that the unique perspectives, talents, and skills of women directors are more likely to be utilized in high-performing firms than low-performing counterparts. Considering the above, our research aims to explore the impact of board gender diversity on both the conditional mean and the dispersion of bank performance. For this purpose, we implement mean-based and quantile regression-based methods on a sample of 305 listed US banks dur-

[1]https://www.sec.gov/news/public-statement/statement-nasdaq-diversity-080621.

ing 2016-2021. In general, we find that board gender diversity has a positive impact on bank performance, providing support for agency and resource dependence theories. However, the quantile regression results show that this impact varies at different parts of the performance distribution. More specifically, we conclude that the positive influence of female board members is more pronounced in high-performing banks relative to low-performing counterparts, providing support for threat-rigidity theory and job sorting and matching theories. Our empirical findings are notable because they call into question the underlying assumption employed in previous studies that the influence of gender diversity is constant across the performance distribution.

Our study contributes to the existing literature in several ways. First, our research helps to reconcile the inconclusive empirical findings of prior studies regarding the influence of board gender diversity on bank performance by using the quantile regression approach. Indeed, we provide evidence that board gender diversity impacts both the conditional mean and the quantiles of the performance distribution. Thus, our findings enrich and extend the gender diversity literature. Second, unlike previous studies that prefer to use multi-industry datasets to generalize their findings, our study, by focusing solely on banking institutions, provides industry-specific results. Therefore, our empirical results enrich the governance literature of banks. Third, given that our study is centered on the US and considering that there are no federal diversity requirements for corporate boards in this country, as most of the governance matters are typically handled by the states or exchanges, our results serve as a valuable reservoir of insights for regulators and policymakers in that country. Moreover, from a methodological standpoint, our study differs from others on this topic, as it uses the two-step system GMM estimator (Blundell & Bond, 1998) and the generalized quantile regression estimator (Powell, 2016) to address the endogeneity issues that have plagued earlier studies.

The rest of the paper is organized as follows. Section 2 presents the literature review and develops our hypotheses. Section 3 describes our sample, variables, and econometric models. Section 4 presents our empirical findings. Section 5 concludes the paper.

2. Literature Review

There has been a growing concern in recent years regarding the representation of women on corporate boards compared to their presence in the population, which has been attributed to discrimination and moral injustice that has prompted regulatory actions worldwide to increase boardroom gender equality (Bertrand & Hallock, 2001). Based on academic research, board gender diversity can lead to beneficial corporate results, stemming from differences in social and human capital between women and men (e.g. Carter et al., 2010; Terjesen et al., 2015; Burgess & Tharenou, 2002). Various theoretical frameworks in the field of governance have sought to gain insight into the link between board gender diversity and corporate outcomes. According to agency theory (Berle & Means, 1932; Fama & Jensen, 1983), managers are motivated to act in their own self-interest rather than in the best interest of their shareholders. Based on this theory gender-diverse boards can mitigate agency conflicts between managers and shareholders, as female directors have superior monitoring capacity relative to their male counterparts (Carter et al., 2003; Adams & Ferreira, 2009). In addition, female directors through their unique viewpoints and experiences can improve the decision-making process and reduce groupthink simultaneously (Janis, 1972; Ujunwa et al., 2012). From the perspective of resource dependence theory (Pfeffer & Salancik, 1978), the main role of the corporate board is to link the firm with the external environment by securing access to critical resources. According to this theoretical framework, female directors, through their experiences, skills, and social backgrounds, may enable organizations to obtain, maintain and expand these vital resources (Liu et al., 2014). Furthermore, women directors can provide fruitful insights into strategic issues (Daily et al., 1999) and help their companies gain legitimacy (Hillman et al., 2002). Both agency and resource dependence theories support the beneficial impact of diversity on corporate success. However, contrary to the aforementioned theories, social identity theory (Tajfel, 1978) reports that diversity harms board cohesion and unity, which in turn may lead to increased conflicts and disagreements between board members (Pelled et al., 1999). More precisely, diversity may foster self-categorization within the boards and may cause undesirable in-group versus out-group stereotyping, harming the overall board function. In line with this argument, Adusei and Obeng (2019) state that board gender diversity diminishes the technical efficiency of microfinance institutions as heterogeneous groups experience more communication conflicts and barriers than homogeneous ones.

Given the theoretical benefits and costs of gender heterogeneity on boards, a plethora of empirical research sheds light on the influence of board gender diversity on bank performance. However, the empirical findings remain inconclusive. For a sample of 159 banks in nine different countries (Spain, Italy, France, Germany, Sweden, Canada, the Netherlands, the UK, and the US), García-Meca et al. (2015) contend that board gender heterogeneity enhances bank's governance, which in turn leads to superior bank performance. In the same vein, Fernandes et al. (2017), by using a sample of 72 European publicly traded banking institutions, conclude that there is a positive relationship between women supervisory directors and the performance of banks during the economic crisis period. Further, Marie et al. (2021) find that board gender diversity is positively related to the financial stability of Egyptian banks, attributing this finding to the tendency of female board members to make more cautious and less risky financial decisions (Abbott et al., 2012; Mateos de Cabo et al., 2012). On the contrary, Adams and Ferreira (2009) assert that the overall effect of gender diversity on shareholders' value is negative, attributing this finding to the over-monitoring of female board members, which hinders strategic decision-making. In the US context, Tampakoudis et al. (2022) document that gender heterogeneity among directors diminishes the financial value of banking institutions. Nevertheless, based on the results of Owen and Temesvary (2018), the contradicting findings in the empirical research are because there is a non-linear U-shaped relationship between board gender diversity and bank performance. The non-linear relationship between the proportion of female directors and corporate performance is also supported by Arvanitis et al. (2022), however, based on their results it follows an inverted U-shaped scheme. Despite the above, some studies conclude that there is no significant impact of gender diversity on bank outcomes. Specifically, Issa et al. (2021) find that board gender heterogeneity has no influence on the performance of banks in the Middle East and North Africa (MENA) region. Likewise, in the Spanish context, Fernández-Temprano and Tejerina-Gaite (2020) do not find a possible link between board gender diversity and corporate performance. Considering the above we expect that:

H1: The relationship between board gender diversity and bank performance is positive.

The above-mentioned empirical studies assume that the effect of board gender diversity on performance is the same for all banks. More specifically, they investigate the impact of boardroom gender heterogeneity on the conditional mean of bank performance. However, another stream of literature supports that the effect of boardroom gender heterogeneity differs at several locations of the conditional distribution of corporate performance (Maji & Saha, 2021).

Based on the framework of threat-rigidity theory (Gladstein & Reilly, 1985; Staw et al., 1981) in social psychology the unique and diverse viewpoints of female board members may not be fully considered in corporations with low performance due to changes in group dynamics in reply to the threat imposed by declining performance (Staw et al., 1981). In addition, groups tend to respond to external threats (e.g. low performance) by restricting information flow and promoting uniformity of ideas (Janis, 1972). On the contrary, in well-performing corporations, there is less pressure to stifle the ideas of female board members, which enables female directors to effectively express their diverse opinions and knowledge during the decision-making process. Therefore, the contribution of female directors to corporate value may be less pronounced in poorly performing corporations compared to those that achieve higher performance. Moreover, from the perspective of job sorting and matching theories in labor economics (Kremer & Maskin, 1996; Wheeler, 2001), high-performing firms tend to attract highly qualified women directors and are also more capable of utilizing the human and social capital of these directors than low-performing firms. Consequently, female directors in companies that exhibit higher performance are better able to exert a beneficial influence on their companies than their counterparts in companies with lower performance.

Drawing on these theories, Conyon and He (2017), by employing a quantile regression methodology in a multi-industry (manufacturing, financial, and utility companies) dataset of US firms, find that female board members exert a significantly larger positive influence in high-performing US publicly traded corporations relative to low-performing counterparts. In a similar vein, for a sample of non-financial firms, Maji and Saha (2021) conclude that the positive influence of female directors on corporate performance appears to be stronger at the upper quantiles of the conditional distribution of corporate performance, providing further support for the threat-rigidity theory and job sorting and matching theories. Charles et al. (2018), based on a sample of non-financial and non-utility companies belonging to the S&P 100 Index, find that the impact of board gender diversity on corporate performance varies at the different locations of the performance distribution. Moreover, Solakoglu (2013) reports that for average or above-average-performing firms, the presence of female board members can improve their accounting performance. He also argues that manufacturing companies tend to respond positively to gender diversity, while companies in nonmanufacturing sectors, especially financial companies, either show negative or no response at all. However, none of these studies do not examine exclusively banks. Thus, this research aims to fill this literature gap. Based on the above, we hypothesize that:

H2: Board gender diversity does not have the same influence across the different points of the performance distribution.

3. Data, Variables and Methodology

3.1. Sample

Our sample consists of 305 publicly listed US banks between 2016 and 2021, yielding a total of 1609 bank-year observations. Considering that there is no available data for some banks during the whole period of our analysis, our panel dataset has an unbalanced form. We collected governance and financial information from the Refinitiv database. It is worth noting that we obtained data only for those US banks with available data on our key independent variable of interest (the proportion of female directors). Furthermore, the time frame of our research begins in 2016, given that before this year, only a small number of sampled banks had relevant board-related information.

3.2. Variables

Following previous studies (Conyon & He, 2017; Solakoglu, 2013; Duppati et al., 2020), we use accounting and market-based performance measures. However, unlike Conyon and He (2017) and Duppati et al. (2020) who have used Tobin's q and ROA as performance measures, our study utilizes Return on Equity (ROE) and Net Interest Margin (NIM). Our main independent variable of interest is board gender diversity. We use the percentage of female directors as a proxy for gender diversity (Bruna et al., 2021; Conyon & He, 2017; Charles et al., 2018). Moreover, we use a set of control variables related to board and bank structure that may impact bank performance. More precisely, we use the following control variables: board size, board meetings, board independence, CEO duality, loans ratio, leverage, Tobin's q, bank size and bank age. **Table 1** shows the detailed definitions and acronyms of our variables.

Table 1. Definition of variables.

Variables	Acronyms	Definitions
Dependent variables		
Return on Equity	ROE	The ratio of earnings before interest and taxes (EBIT) to the book value of total equity.
Net Interest Margin	NIM	Net interest income divided by the average of the interest earning assets.
Independent variables		
Proportion of female board members	FEMALE	The ratio of female board members to total number of board members.
Control variables		
Board size	LNBSIZE	Board size is the total number of board members. The natural logarithm of board size (LNBSIZE) is used in our regression models.
Percentage of independent directors	IND	The ratio of independent directors to board size.
Board meetings	LNBMEET	Board meetings represent the annual number of board meetings. The natural logarithm of board meetings (LNBMEET) is used in our regression models.
CEO duality	DUAL	Dummy variable that takes the value of one if the chairman of the board is also the CEO, and zero otherwise.
Leverage	LEV	The ratio of total debt to total assets at book value.
Loans ratio	LOANS	The ratio of loans to total assets at book value.
Tobin's q	TQ	Tobin's q is calculated as the value of equity plus the book value of assets minus the book value of equity minus deferred taxes, all divided by the book value of total assets.
Bank size	LNSIZE	Natural logarithm of total assets at book value.
Bank age	LNAGE	Bank age is calculated as the current fiscal year minus the founding year. The natural logarithm of bank age (LNAGE) is used in our regression models.

3.3. Descriptive Statistics and Correlation Analysis

Table 2 contains the descriptive statistics of our variables. The mean (median) value of ROE in our sample is 0.150 (0.143), which is higher than the average value of 0.083 documented by Mohsni et al. (2021). The average (median) value of NIM is 0.022 (0.034), which is lower than that of 0.04 reported by Pathan and Faff (2013). The average proportion of female directors (FEMALE) is 18.1% ranging from 0% to 58.3%. Our mean value of FEMALE is comparable to that of 16% in Bruna et al. (2021). However, women's presence on US bank boards is still low and could be enhanced. The mean value of the Natural Logarithm of Board Size (LNBSIZE) is 2.407 corresponding to approximately 12 members, while the average value of the Natural Logarithm of Board Meetings (LNBMEET) is 2.317 corresponding to 11 meetings per year. On average, Independent Directors (IND) account for 81.2% of total board members, while 51.3% of sampled banks have combined the roles of CEO and board chairperson. We also find that during the examined period the mean leverage (LEV) is 0.135, which is lower than the 0.222 reported by Charles et al. (2018). Moreover, we notice that the average proportion of loans over total assets (loans) is 0.678, lower than the mean value of 0.740 documented by Bouteska (2020) for EU banks. Finally, the mean values of bank size (LNSIZE), bank age (LNAGE) and Tobin's q (TQ) are 22.577, 3.242 and 1.195, respectively. Following Bruna et al. (2021), we implemented the Shapiro-Wilk test for univariate normality and Doornik-Hansen test for multivariate normality. As shown in the last column of **Table 2**, none of our variables (except DUAL) are normally distributed. In addition, the Doornik-Hansen test (p-value = 0.000) rejects the null of multivariate normality. As a result, our variables do not precisely satisfy the normality and no-outlier assumptions.

Table 2. Descriptive statistics.

Variables	Obs	Mean	SD	Q (0.25)	Median	Q (0.75)	Min	Max	S-W (p-value)
ROE	1609	0.150	0.066	0.118	0.143	0.171	−0.207	1.102	0.000
NIM	1586	0.022	0.210	0.030	0.034	0.038	−4.305	0.101	0.000
FEMALE	1609	0.181	0.104	0.100	0.167	0.250	0	0.583	0.000
LNBSIZE	1609	2.407	0.269	2.197	2.397	2.564	1.098	3.496	0.000
IND	1609	0.812	0.109	0.750	0.833	0.900	0	1	0.000
LNBMEET	1607	2.317	0.397	2.079	2.397	2.564	0	4.204	0.000
DUAL	1609	0.513	0.500	0	1	1	0	1	1
LEV	1609	0.135	1.567	0.010	0.022	0.041	0	29.058	0.000
LOANS	1583	0.678	0.120	0.623	0.700	0.763	0.055	0.932	0.000
TQ	1609	1.195	2.565	1.004	1.029	1.063	0.083	48.808	0.000
LNSIZE	1609	22.577	1.496	21.482	22.350	23.345	18.842	28.951	0.000
LNAGE	1609	3.242	0.702	2.890	3.332	3.610	0	5.267	0.000

Note: Authors' estimations.

Table 3 presents Pearson's correlation analysis. We observe that female directors (FEMALE) are positively correlated with ROE and negatively correlated with NIM. The highest correlation coefficient among explanatory variables is 0.368 suggesting that multicollinearity is not an issue in this study.

3.4. Model and Methodology

To examine the influence of board gender diversity on bank performance we use the following model:

$$\begin{aligned}\text{PERF}_{it} = {} & \beta_0 + \beta_1\text{FEMALE}_{it} + \beta_2\text{LNBSIZE}_{it} + \beta_3\text{IND}_{it} + \beta_4\text{LNBMEET}_{it} \\ & + \beta_5\text{DUAL}_{it} + \beta_6\text{LOANS}_{it} + \beta_7\text{LEV}_{it} + \beta_8\text{TQ}_{it} + \beta_9\text{LNSIZE}_{it} \\ & + \beta_{10}\text{LNAGE}_{it} + \text{year dummie} + \varepsilon_{it}\end{aligned} \tag{1}$$

where the subscript i indexes observational banks and the subscript t denotes time; β_0 is the constant; β_1, …, β_{10} are the coefficients of the explanatory variables; PERF_{it} is the bank performance measured by ROE or NIM. FEMALE_{it} is the proportion of female board members; LNBSIZE_{it} is the natural logarithm of board size; IND_{it} is the proportion of independent board members; LNBMEET_{it} is the natural logarithm of board meetings; DUAL_{it} is a dummy variable that takes the value of one if the CEO is also the chairman of the board, and zero otherwise; LOANS_{it} is the ratio of loans to total assets; LEV_{it} represents the ratio of the bank's total debt to its total assets; TQ_{it} denotes the Tobin's q; LNSIZE_{it} is the natural logarithm of the book value of total assets; LNAGE_{it} is the natural logarithm of the number of years since the bank was incorporated; year dummies are year dummy variables; ε_{it} is a random error term.

Table 3. Correlation among variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) ROE	1.000											
(2) NIM	0.223***	1.000										
(3) FEMALE	0.136***	−0.152***	1.000									
(4) LNBSIZE	−0.040	−0.062*	0.038	1.000								
(5) IND	0.048	0.007	0.223***	0.006	1.000							
(6) LNBMEET	−0.010	−0.053*	0.040	−0.045	0.111***	1.000						
(7) DUAL	0.030	−0.021	0.055*	0.044	−0.143***	−0.138***	1.000					
(8) LOANS	0.050	0.304***	−0.167***	−0.164***	0.025	0.063*	−0.087**	1.000				
(9) LEV	−0.005	−0.111***	0.040	0.187***	−0.206***	0.003	0.050	−0.323***	1.000			
(10) TQ	0.160***	0.068*	−0.072**	−0.004	−0.169***	−0.130***	0.045	−0.093***	0.232***	1.000		
(11) LNSIZE	0.134***	−0.255***	0.296***	0.368***	0.150***	−0.087**	0.239***	−0.316***	0.271***	−0.057*	1.000	
(12) LNAGE	0.053*	−0.143***	0.093***	0.246***	0.003	−0.097***	0.119***	−0.197***	0.223***	0.060*	0.286***	1.000

Note: Asterisks indicate significance at 10% (*), 5% (**), and 1% (***).

As a first step, the model is estimated using the pooled OLS estimator. Next, we employ traditional panel estimation techniques such as Fixed Effects (FEs) and Random Effects (REs). To choose between fixed effects and random effects we perform the Hausman test. However, the aforementioned techniques suffer from endogeneity bias (simultaneity, unobserved heterogeneity, and dynamic endogeneity). Moreover, conventional panel estimators provide biased results in the case of not strictly exogenous explanatory variables and small panel time dimensions (Wintoki et al., 2012), leading to misleading conclusions (Ullah et al., 2018). To address endogeneity problems, we employ the two-step system GMM estimator proposed by Blundell and Bond (1998). Based on the simulation analysis conducted by Flannery and Hankin (2013), the system GMM constitutes the appropriate estimator in the case of short or/and unbalanced panels with endogenous variables.

Unlike mean-based approaches, to investigate the impact of board gender diversity at different parts of the performance distribution we implement the quantile regression-based approach. Quantile regression is a statistical method used to estimate the conditional quantiles of an outcome variable. Unlike the Ordinary Least Squares (OLS) technique, which estimates the conditional mean of the response variable, quantile regression can estimate any part of the conditional distribution of the response variable that the researcher is interested in. So, contrary to the standard conditional mean regression models applied in earlier studies, the quantile regression technique provides a more comprehensive picture of the possible relationship between a response variable and the predictor variables at different locations of the response variable (Koenker & Bassett Jr., 1978; Koenker & Hallock, 2001). Moreover, in contrast with classic linear regression models (e.g. ordinary least squares), quantile regression does not require strict assumptions regarding normality, homoskedasticity, and the absence of outliers (Johnston & DiNardo, 1997).

Relevant to our context, as previously mentioned, most of the earlier studies have mainly used the conditional mean regression method to examine the relationship between board gender diversity and corporate performance. However, our study is methodologically different, as it uses the quantile regression approach to investigate the impact of board gender diversity at different points of the performance distribution, providing a clearer picture. Moreover, we also account for the endogenous selection of female directors by employing the generalized quantile regression estimator with nonadditive fixed effects (Powell, 2016). Generalized quantile regression nests quantile regression and instrumental variable quantile regression. Following previous studies (Conyon & He, 2017; Charles et al., 2018), we treat the proportion of female directors as an endogenous variable. Furthermore, drawing inspiration from Conyon and He (2017), we use as an instrument the percentage of employed women in the US state where the given bank is headquartered.

Although a large body of empirical studies has implemented panel quantile regression estimators with fixed effects (α_i), these techniques suffer from the incidental parameter problem when the time dimension (T) of panel data is small and face difficulties in estimating a large number of fixed effects in a quantile framework. To address this limitation, Powell (2016) suggests a quantile regression estimator of panel data with nonadditive fixed effects. The main advantage of this approach is that it provides estimates of the distribution of Y_{it} given D_{it} instead of $Y_{it} - \alpha_i$ given D_{it}. According to Powell (2016), the latter is undesirable in many empirical applications, as observations at the top of the ($Y_{it} - \alpha_i$) distribution may be near the bottom of the (Y_{it}) distribution. Powell's (2016) approach furnishes point estimates that can be comprehended in a manner analogous to those arising from cross-sectional regressions and provides consistent estimates for small T. Furthermore, Powell's (2016) estimator addresses the fundamental problem raised by conventional quantile estimators. More precisely, the inclusion of additional covariates alters the interpretation of the estimated coefficient on the treatment variable. The generalized quantile estimator addresses this issue and produces unconditional quantile treatment effects even in the presence of additional control variables. Our panel quantile regression model has the following form:

$$Y_{it} = \sum_{j=1}^{10} D'_{it}\beta_j\left(U^*_{it}\right) \tag{2}$$

where Y_{it} is the performance variable (ROE or NIM), D'_{it} is the set of our explanatory variables, β_j represents the parameters to be estimated and U^*_{it} is the error term that may be a function of several (fixed or time-varying) disturbance terms. The model is linear in parameters and $D'_{it}\beta(\tau)$ is strictly increasing in τ.

Generally speaking, for the τ^{th} quantile of Y_{it}, the quantile regression relies on the conditional restriction expressed in Equation (3):

$$P\left(Y_{it} \le D'_{it}\beta(\tau) \mid D_i\right) = \tau \tag{3}$$

Equation (3) means that the probability of the response variable being smaller than the quantile function is the same for all D_{it} and is identical to τ. The estimator developed by Powell (2016), assumes that this probability varies across individuals and even within individuals as long as such variation is orthogonal to the instruments. Therefore, quantile regression relies on two restrictions: the conditional restriction (Equation (4)) and the unconditional restriction (Equation (5)), letting $D_i = \left(D_{i1}, \cdots, D_{iT}\right)$.

$$P\left(Y_{it} \le D'_{it}\beta(\tau) \mid D_i\right) = P\left(Y_{is} \le D'_{is}\beta(\tau) \mid D_i\right) \tag{4}$$

$$P\left(Y_{it} \le D'_{it}\beta(\tau)\right) = \tau \tag{5}$$

Powell's (2016) approach develops the estimator in an instrumental variable framework, with instruments $Z_i = \left(Z_{i1}, \cdots, Z_{iT}\right)$, using the Generalized Method of Moments (GMM). The sample moments are defined as follows:

$$\hat{g}(b) = \frac{1}{N}\sum_{i=1}^{N} g_i(b) \text{ with } g_i(b) = \frac{1}{T}\sum_{t=1}^{T}\left(Z_{it} - \bar{Z}_i\right)\left[1\left(Y_{it} \le D'_{it}b\right)\right] \tag{6}$$

where $\bar{Z}_i = \frac{1}{T}\sum_{t=1}^{T} Z_{it}$.

The parameter set is defined as:

$$B \equiv \left\{ b \mid \tau - \frac{1}{N} < \frac{1}{N}\sum_{i=1}^{N} 1\left(Y_{it} \le D'_{it} b\right) \le \tau \text{ for all } t \right\} \quad (7)$$

Then, the parameter of interest is estimated as follows:

$$\hat{\beta}(\tau) = \arg\min_{b \in B} \hat{g}(b)' \hat{A} \hat{g}(b) \quad (8)$$

With weighting matrix $\hat{A}$.

4. Results and Discussion

This study uses both accounting-based and market-based performance measures. Our first performance measure is ROE. **Table 4** contains our empirical results. We observe that in the OLS model (Column 1), the impact of the proportion of female directors on ROE is positive and significant. In the fixed effects model (Column 2) and the random effects model (Column 3), the effect of gender diversity on ROE is not statistically significant. However, when performance is measured by ROE, based on the Hausman test (p-value = 0.0003), the appropriate model is the fixed effects model. Unlike the previous three estimators, the two-step system GMM estimator deals efficiently with endogeneity problems. Based on the results in Column 4, there is a positive and significant relationship between the proportion of female board members and bank performance measured by ROE. This result is consistent with our Hypothesis 1. In addition, this finding is consistent with García-Meca et al. (2015), Fernandes et al. (2017), and Marie et al. (2021). This finding also corroborates agency theory and resource dependence theory. According to these theoretical frameworks, female directors are more active monitors than their male counterparts, bring a variety of unique viewpoints to board discussions, and enable corporations to gain easier access to vital external resources, enabling banks to achieve better financial performance.

The methodologies mentioned above assume that the effect of board gender diversity is constant across the performance distribution. To test if the impact of board gender diversity differs across the performance distribution, we apply the generalized quantile regression estimator proposed by Powell (2016). Columns 5 - 9 in **Table 4** present our empirical results. We observe an insignificant effect of gender diversity (FEMALE) on ROE at the 0.1 and 0.75 quantiles. On the contrary, the impact of board gender diversity (FEMALE) on ROE is positive and significant at the 0.25, 0.5, and 0.9 quantiles. Notably, the estimated effect of FEMALE on ROE is greater (in magnitude) at quantile 0.9 compared to the quantile 0.5 (median). Moreover, the impact at the median is also larger than the impact at quantile 0.25. This result indicates that board gender heterogeneity exerts a significantly larger positive influence on bank performance in high-performing banks relative to low-performing counterparts, providing support for threat-rigidity theory and job sorting and matching theories. Based on job sorting and matching

Table 4. The influence of gender diversity on return on equity.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
D. V. = ROE	OLS	FE	RE	GMM	Q(0.1)	Q(0.25)	Q(0.5)	Q(0.75)	Q(0.9)
LAGROE				0.5201***					
				(6.6863)					
FEMALE	0.0408***	−0.0226	0.0004	0.0956*	0.3125	0.0408***	0.0716***	−0.1127	0.7747***
	(3.2069)	(−1.2881)	(0.0288)	(1.9443)	(0.3073)	(6.0173)	(10.3331)	(−0.2010)	(6.4213)
LNBSIZE	−0.0199***	−0.0307***	−0.0294***	0.0269	1.7388	−0.0039	−0.0168***	6.4352	−0.0754
	(−3.4736)	(−3.9351)	(−4.6567)	(0.9637)	(0.6403)	(−0.6588)	(−3.0804)	(1.5723)	(−0.8951)
IND	0.0024	0.0355**	0.0254*	−0.0043	0.2787	0.0027	−0.0077	0.5528	−0.2140
	(0.1631)	(2.2206)	(1.8344)	(−0.0561)	(0.0998)	(0.1881)	(−0.5320)	(0.4203)	(−1.3059)
LNBMEET	0.0017	−0.0038	−0.0012	−0.0294	0.1549	0.0049*	0.0024	−0.1073	0.0631
	(0.5564)	(−0.9908)	(−0.3614)	(−1.3136)	(0.1462)	(1.6939)	(0.7354)	(−0.3910)	(1.3055)
DUAL	−0.0026	−0.0018	−0.0020	0.0042	0.8490	−0.0060**	−0.0039	1.7938	−0.0346
	(−1.0217)	(−0.4289)	(−0.6193)	(0.3448)	(0.5969)	(−2.2817)	(−1.4522)	(1.5762)	(−1.0074)
LOANS	0.0731***	0.0426**	0.0697***	0.0563	0.2508	0.0357***	0.0341***	0.0665	−0.0585
	(4.4241)	(2.0701)	(4.4794)	(0.5366)	(0.1179)	(2.7020)	(2.5862)	(0.0744)	(−0.2614)
LEV	−0.0451	0.0070	−0.0019	−0.2603	−0.3972	−0.0987	−0.1208**	−0.0541	−0.1270
	(−0.8737)	(0.1502)	(−0.0540)	(−0.9228)	(−0.0626)	(−1.4223)	(−2.1795)	(−0.0119)	(−0.1671)
TQ	0.2273***	0.2394***	0.2284***	−0.1894	−0.0161	0.0580	0.0720***	0.0305	0.1168
	(6.6889)	(7.9059)	(8.8343)	(−1.0618)	(−0.0030)	(1.5965)	(2.8810)	(0.0124)	(0.2756)
LNSIZE	0.0069***	−0.0024	0.0061***	−0.0020	0.1976	0.0039***	0.0052***	1.3996	0.4381
	(6.1212)	(−0.4125)	(3.3980)	(−0.4843)	(0.8084)	(3.2779)	(4.4980)	(1.5252)	(1.5673)
LNAGE	0.0034	0.0782***	0.0098***	0.0024	6.5036	0.0091***	0.0054**	−0.3018	−0.0653*
	(1.5159)	(5.8919)	(2.8159)	(0.4629)	(0.8673)	(4.1794)	(2.2755)	(−1.0494)	(−1.6852)
CONSTANT	−0.2806***	−0.2813**	−0.2652***	0.2556	−36.0679	−0.0891*	−0.0572	−44.8420	−8.8493
	(−4.9274)	(−2.0597)	(−5.1182)	(0.7955)	(−1.1012)	(−1.6827)	(−1.2234)	(−1.4997)	(−1.4943)
Observations	1581	1581	1581	1284	1581	1581	1581	1581	1581
R-squared	0.1170	0.1536	0.1334						
Number of banks		299	299	297					
Number of instruments				41					
Year dummies	Yes	Yes	Yes	Yes					
Hausman test (p-value)		0.0003	0.0003						
AR(1) test (p-value)				0.000					

Continued

AR(2) test (p-value)	0.330
Hansen test (p-value)	0.397

Note: Column 1 reports the OLS results. Column 2 presents the fixed-effects results. Column 3 reports the random effects results. Estimations obtained from the two-step system GMM estimator are reported in Column 4. Columns 5 - 9 report the results gained from the quantile regression. The dependent variable is Return on Equity (ROE). LAGROE is the one-year lagged performance variable. We use the proportion of female directors (FEMALE) as a proxy for gender diversity. The rest of the variables are defined as in Table 1. t-Statistics of pooled OLS (Column 1), FE (Column 2), and two-step system GMM (Column 4) estimators are reported in parentheses. z-Statistics of RE (Column 3) and generalized quantile regression estimators (Columns 5 - 9) are reported in parentheses. Asterisks denote significance at 10% (*), 5% (**), and 1% (***). Hausman test is under the null that the preferred model is random effects. AR(1) and AR(2) are tests for first-order and second-order serial correlation in the first-differenced residuals and are under the null of no serial correlation. The Hansen test of over-identification is under the null that our instruments are valid.

theories (Kremer & Maskin, 1996; Wheeler, 2001), high-performing corporations tend to attract and hire highly qualified female directors, as high-performing organizations are better able to utilize the talents and skills of these directors compared to their low-performing counterparts. From the perspective of threat-rigidity theory, low-performing corporations tend to restrict the exchange of information and foster uniformity of ideas as a response to external threats, which hampers the contribution of female directors to board operations. In contrast, as high-performing corporations face fewer external pressures, they can benefit from the unique perspectives and talents of female directors. Thus, the positive influence of female directors is more pronounced in high-performing banks (upper quantiles). In addition, our findings are in line with Conyon and He (2017) and Maji and Saha (2021). Our results also provide support for our Hypothesis 2, which states that there is heterogeneity in the influence of board gender diversity on bank performance. The influence of control variables on ROE varies across different econometric models.

Our second proxy for bank performance is NIM. Table 5 contains our empirical results. We notice that the impact of female directors on NIM is negative and significant in the OLS model (Column 1). Furthermore, the effect of FEMALE on NIM is insignificant both in the fixed effects model (Column 2) and in the random effects model (Column 3). However, when our performance measure is NIM, based on the Hausman test (p-value = 0.0708), the appropriate model is the random effects model. Moreover, when we use the two-step system GMM estimator (Column 4), we observe that the proportion of female directors enhances bank performance measured by NIM, which corroborates our Hypothesis 1.

Consistent with our Hypothesis 2, the quantile regression results indicate that there is heterogeneity in the effect of board gender diversity on bank performance measured by NIM. Again, we observe that the estimated quantitative impact of the proportion of female directors is larger in higher quantiles compared to lower quantiles. More precisely, the influence of board gender diversity

Table 5. The influence of gender diversity on net interest margin.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. Var. = NIM	OLS	FE	RE	GMM	Q(0.1)	Q(0.25)	Q(0.5)	Q(0.75)	Q(0.9)
LAGNIM				0.7019***					
				(8.5027)					
FEMALE	−0.0029*	−0.0009	−0.0011	0.0124**	−0.1315	−0.0051**	3.4371***	1.6310**	6.1741***
	(−1.8512)	(−0.5826)	(−0.8039)	(2.5016)	(−0.0176)	(−1.9770)	(50.4664)	(2.4327)	(33.6798)
LNBSIZE	0.0015**	0.0006	0.0007	−0.0016	5.6358	0.0034*	0.2751***	5.1528	−0.0029
	(2.1063)	(0.8598)	(1.1273)	(−1.0388)	(0.5764)	(1.8040)	(3.7342)	(1.6439)	(−0.0273)
IND	0.0051***	0.0013	0.0014	−0.0146***	20.9562	0.0021	0.0230	−0.8673	−0.0025
	(2.8934)	(0.9471)	(1.1029)	(−2.7965)	(1.1932)	(0.4295)	(0.1734)	(−0.6585)	(−0.0122)
LNBMEET	−0.0013***	−0.0009***	−0.0009***	−0.0054***	−8.2625*	−0.0005	−0.0006	0.2563	0.0451
	(−3.0552)	(−2.6317)	(−2.9921)	(−2.8721)	(−1.7966)	(−0.4309)	(−0.0189)	(0.7782)	(0.8284)
DUAL	0.0006*	0.0002	0.0002	−0.0003	11.8697**	0.0012	0.0016	2.0933*	−0.0001
	(1.7635)	(0.5892)	(0.6878)	(−0.2683)	(2.0709)	(1.2619)	(0.0617)	(1.7096)	(−0.0035)
LOANS	0.0126***	0.0253***	0.0227***	0.0161**	−8.2150	0.0082*	0.0139	−0.2204	0.0058
	(6.4275)	(14.3725)	(14.6117)	(2.5467)	(−0.6247)	(1.8962)	(0.1082)	(−0.1923)	(0.0336)
LEV	−0.0001	−0.0109***	−0.0068*	0.0216	−20.5847	−0.0793***	−0.0627	−0.0381	−0.0589
	(−0.0214)	(−2.7535)	(−1.9473)	(1.3797)	(−0.3523)	(−4.0615)	(−0.1207)	(−0.0070)	(−0.0614)
TQ	0.0103**	0.0085***	0.0104***	−0.0033	−5.1112	−0.0459***	−0.0330	−0.0039	−0.0171
	(2.1882)	(3.2713)	(4.3116)	(−0.3338)	(−0.2312)	(−4.2447)	(−0.1641)	(−0.0015)	(−0.0613)
LNSIZE	−0.0008***	−0.0012**	−0.0008***	−0.0005	10.9955**	−0.0002	−0.0024	1.6286	−0.0002
	(−5.4140)	(−2.4308)	(−3.2434)	(−1.6389)	(2.4918)	(−0.5062)	(−0.1815)	(1.6263)	(−0.0066)
LNAGE	−0.0007***	0.0014	0.0002	−0.0003	23.6644**	0.0004	0.0008	0.1632	−0.0019
	(−2.6901)	(1.2681)	(0.3667)	(−0.6410)	(2.4032)	(0.6054)	(0.0351)	(0.8421)	(−0.0609)
CONSTANT	0.0316***	0.0307***	0.0241***	0.0389**	−368.3779**	0.0697***	−1.1717**	−48.3728*	−0.4805
	(3.9375)	(2.6286)	(4.0483)	(2.4079)	(−2.3116)	(4.4022)	(−2.4687)	(−1.6461)	(−0.5710)
Observations	1581	1581	1581	1284	1581	1581	1581	1581	1581
R-squared	0.1752	0.4324	0.4299						
Number of banks		299	299	297					
Number of instruments				56					
Year dummies				Yes					
Hausman test (*p*-value)		0.0708	0.0708						
AR(1) test (*p*-value)				0.000					

Continued

AR(2) test (*p*-value)	0.940
Hansen test (*p*-value)	0.194

Note: Column 1 reports the OLS results. Column 2 presents the fixed-effects results. Column 3 reports the random effects results. Estimations obtained from the two-step system GMM estimator are reported in Column 4. Columns 5 - 9 report the results gained from the quantile regression approach. The dependent variable is the Net Interest Margin (NIM). LAGNIM is the one-year lagged performance variable. We use the proportion of female directors (FEMALE) as a proxy for gender diversity. The rest of the variables are defined as in Table 1. t-Statistics of pooled OLS (Column 1), FE (Column 2), and two-step system GMM (Column 4) estimators are reported in parentheses. z-Statistics of RE (Column 3) and generalized quantile regression estimators (Columns 5 - 9) are reported in parentheses. Asterisks denote significance at 10% (*), 5% (**), and 1% (***). Hausman test is under the null that the preferred model is random effects. AR(1) and AR(2) are tests for first-order and second-order serial correlation in the first-differenced residuals and are under the null of no serial correlation. The Hansen test of over-identification is under the null that our instruments are valid.

(FEMALE) on the market-based performance (NIM) is insignificant at quantile 0.1, negative and significant at quantile 0.25, and positive and significant at 0.5 (median), 0.75, and 0.9 quantiles. This result also provides support for the threat-rigidity theory and job sorting and matching theories. The influence of control variables on NIM varies across different econometric models. Lastly, in non-tabulated results, we re-estimated the quantile regression models in Table 4 and Table 5 using an alternative instrumental variable: the proportion of women in management, business, and financial occupations in the US state where the given bank is headquartered, to check the credibility of our results. Our findings remain qualitatively unchanged.

5. Conclusion

Using a sample of 305 US banks during 2016-2021, we investigate the influence of board gender diversity on bank performance using both mean-based and quantile regression approaches. In general, our results demonstrate that board gender diversity positively impacts bank performance, and this impact varies at different locations of the performance distribution. More precisely, we find that the positive influence of female directors is more pronounced in high-performing banks relative to low-performing banks, providing support for threat-rigidity theory and job sorting and matching theories. Our findings are notable since they challenge the underlying assumption used in previous studies predicting a uniform impact of female directors on bank performance.

Our research is noteworthy for several reasons. First, our research helps to reconcile the mixed empirical findings of prior studies regarding the influence of gender diversity on bank performance by using the quantile regression technique. More specifically, we provide evidence that board gender diversity impacts the conditional mean as well as the different quantiles of the performance distribution. Therefore, our findings enrich and extend the gender diversity literature. Second, unlike previous studies that prefer to use multi-industry datasets to generalize their findings, our study, by focusing specifically on banking firms, provides industry-specific results. Thus, our findings enrich the governance literature of banks. Third, from a methodological point of view, to address endogeneity issues that have plagued many earlier studies, our research employs the two-step system GMM estimator (Blundell & Bond, 1998) and the generalized quantile regression estimator (Powell, 2016). Finally, given that our research is focused on the US and considering that there are no federal diversity requirements for corporate boards in this country, as most of the governance matters are usually handled by the states or exchanges, our findings constitute a valuable source of knowledge for regulators and policymakers in that country.

However, this study has some limitations that may be promising areas for future research. First, although our study relies on data from a large country such as the USA, they are based on a single country, making our findings less generalizable. As a result, future research attempts can broaden this empirical research by integrating an international sample. Second, we limit our analysis of board diversity to gender. Therefore, future studies can examine how the influence of other diversity attributes of directors (such as expertise, ethnicity, tenure, and age) varies across the different locations of the performance distribution. Third, our study focuses on the impact of gender diversity on the financial performance of corporations. Future studies can take it one step further by investigating the impact of gender diversity on the conditional distribution of ESG performance.

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Conflicts of Interest

The authors declare no conflicts of interest.

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