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Research article

CEO power and bank risk-taking: A revisit in an emerging market context

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Abstract: This study examines the impact of chief executive officers' (CEOs)' power on banks' risk-taking for publicly listed commercial banks in Vietnam from 2011 to 2021. Using generalized least square (GLS) random effect (RE) estimation, this study finds that the presence of powerful CEOs, with a large share of ownership and a role as the chairperson of the bank boards, reduce banks' risk-taking. Regarding other bank governance factors, a larger bank board results in lower bank risk-taking, while board independence, in contrast, is positively associated with bank risk. These results are robust to different proxies for banks' risk-taking and different estimation techniques.

Keywords: CEO power; bank risk-taking; bank governance; commercial banks

JEL Codes: G21, G28

1. Introduction

The banking industry plays a vital role in economic development, especially for bank-based Asian economies such as Vietnam. Understanding what factors drive banks' performance and risks has long attracted significant attention in the literature, as commercial banks often take excessive risks to generate larger cash flows, which subsequently might increase the probability of bank failures. For example, the 1997 Asian financial crisis exposed weaknesses in the corporate governance practices of

commercial banks in Asian countries. Previous studies (e.g., Demsetz and Strahan, 1997; Anderson and Fraser, 2000; Boyd et al., 1993; Lu and Boateng, 2018) show that weak bank boards, large gaps between the board's and chief executive officer's (CEO's) responsibilities, and cross-ownership are among the main factors that increase banks' risk.

Our study focuses on CEOs' power as the main focus of interest because the CEO is the highest title on the executive team to take responsibility of the vision, strategy, coordination, and oversight of the bank's operations. The literature has two different views about the power of CEOs. The first view indicates that if the CEO is more powerful, especially in the context of weak bank boards, the likelihood of fraud in financial statements tends to be higher (Pathan, 2009; Victoravich et al., 2011). The second view states that if the CEOs is also the board's chairperson, they are likely to work hard and add more value to the company (Anderson and Galinsky, 2006).

While the previous studies have focused on developed countries and arrived at contradicting conclusions, no study has empirically examined the extent to which multiple dimensions of CEOs' power and banks' risk-taking are related in the context of the Vietnamese banking system, a typical example among developing countries. The Vietnamese government has only initiated consolidation and reform activities in the banking system since 2005. Among the newly developed laws and regulations, policymakers consider a legal framework for corporate governance as one of the top priorities to maintain the stability of the Vietnamese banking industry. Our study, therefore, provides timely and imperative implications and helps inform policymakers and regulators who are concerned with the stability and resilience of the banking system in Vietnam.

Using a sample of 19 publicly traded commercial banks in Vietnam from 2011 to 2021, we provide comprehensive evidence on the impact of CEOs' power on banks' risk-taking. Recognizing the potential for endogeneity and reverse causality—common challenges in corporate governance research—we adopt a multi-method approach to strengthen the robustness and causal interpretation of our findings. In addition to the baseline generalized least squares (GLS) random effects model, which accounts for unobserved heterogeneity and autocorrelation in unbalanced panel data, we apply three-stage least squares (3SLS) to address simultaneity between governance mechanisms and risk-taking. Furthermore, we use the system generalized method of moments (GMM) estimator to control for dynamic endogeneity and firm-specific effects. These complementary methods reinforce the credibility of our results and allow for a more accurate assessment of the relationship between CEOs' power and banks' risk-taking in the Vietnamese institutional setting.

Consistent with prior research in the international context (e.g., Anderson and Fraser, 2000; Chen et al., 2006; Altunbas et al., 2020; Sghaier and Hamza, 2024), we document that CEOs' power, including CEO duality and CEO ownership, is generally associated with decreased bank risk-taking. Our results are robust to different market and hybrid measures to determine a bank's risks. Furthermore, we find that a larger bank board, as well as other characteristics such as bank size and bank capital, result in lower bank risk-taking. In contrast, board independence is positively associated with bank risk. The findings are also consistent with previous research (Baysinger and Hoskisson, 1990; Boyd, 1994; Andres and Vallelado, 2008) for developed countries.

Understanding banks' risks is increasingly important, especially for an emerging economy, because of rising competition, globalization, technological innovation, and deregulation (Haan and Kooi, 2000; Mirzaei et al., 2013; Palvia, 2011; Saadaoui, 2011). However, as far as it is ascertained, there is hardly

any research investigating the relationship between CEOs' power and banks's level of risk-taking in an emerging economy. Most research is conducted in major developed economies such as the US banking system (Chen et al., 2006; Houston and James, 1995; Pathan, 2009; Victoravich et al., 2011) or European banking systems (Farag and Mallin, 2017; Fernandes et al., 2021; Vallascas and Hagendorff, 2013). Our paper, to the best of our knowledge, is one of the few studies examining this relationship in the context of an emerging economy. Unlike developed economies, the banking sector in emerging economies is dominated by state-owned banks with large levels of market capitalization (Dinç, 2005; Klomp and De Haan, 2014; Mirzaei et al., 2013). Their banks often experience intervention by the government at the national or local level (Fang et al., 2020). Specifically, these authors also pointed out that since the managers of commercial banks often hire the senior managers of state-owned banks, the governance of these individual banks tends to follow a similar path to that of state-owned banks. In addition, the banking sector in emerging economies generally typically lacks institutional development compared with those in developed countries (Klomp and De Haan, 2014) and lags behind them with regard to bank regulations, disclosure requirements, and contract enforcement (Lane and Milesi-Ferretti, 2011). All of the abovementioned differences motivate us to question the relationship between CEOs' power and banks' risk-taking levels in emerging economies such as Vietnam.

The study adds to the literature by being the first to provide evidence on how CEOs' power influences banks' risk-taking behavior in Vietnam, where most consolidation and reform activities in the banking system have only taken place since 2005. Vietnamese banks are still undercapitalized despite their banking system's relatively long transition process (Stewart et al., 2016). Along with the slow reform that is still in progress, Vietnamese banks have to face a challenging business environment that is characterized by tight credit margins and a large volume of nonperforming loans (Dinh and Kleimeier, 2007). Furthermore, the Vietnamese stock market has only flourished since 2007; thus, commercial banks may still not follow international standards of information disclosure. Although the disclosure requirements increase after the banks go public, outside supervision of Vietnamese banks is relatively weak. This provides an ideal context to examine how corporate governance affects bank risk-taking behaviors where the legal framework is still pretty much at its dawn. Our study, therefore, joins the debate on corporate governance in banking (Srivastav and Hagendorff, 2016) and contributes to our understanding of the CEO's role in the risk-taking incentives of Vietnamese banks.

In addition, unlike Pathan (2009), who used the study period before the 2007–2009 financial crisis, our paper uses recent data from 2011 to 2021. Furthermore, our study is the first paper to investigate the relationship between CEOs' power and banks' risk-taking in an emerging economy by employing a wide range of risk indices. Most previous literature has adopted only one of the following risk categories, namely (1) the three types of bank risks including total risk, systematic risk, and idiosyncratic risk (Altunbaş et al., 2020; Anderson and Fraser, 2000; Farag and Mallin, 2017; Fernandes et al., 2021; Victoravich et al., 2011); (2) the standard deviation of return on assets (ROA), the standard deviation of return on equity (ROE) and Z-scores (Altunbaş et al., 2020); and (3) nonperforming loan (NPL) or loan loss provision (LLP) (Tadele and Kalyebara, 2020), to measure the risk-taking levels of commercial banks. Employing a wide range of risk measures, our study provides a more comprehensive view of the relationship between CEOs' power and bank risk-taking in Vietnam during a recent period after the 2007–2009 financial crisis. Our study provides important and timely implications for regulators and bank supervisors alike. While the CEO position requires a certain level

of power in order to execute leadership effectively (Finkelstein et al., 1996), executives and boards of directors should be aware that a CEO having too much power can lead to an over-emphasis on upside opportunities while ignoring potential pitfalls. Commercial banks, for example, with CEOs who own fewer bank shares, are more likely to pursue unnecessarily risky strategies due to the disparity between the CEOs' interests and shareholders' benefits. Commercial banks, therefore, can effectively monitor bank risks by developing the CEO's capacity and dedication and adjusting the bank board's features to align CEOs' benefits with the wealth-maximizing objectives of shareholders. In addition, our study also informs regulators and policymakers who are concerned with banks' risk-taking behaviors and the overall stability of the banking system.

The remainder of the paper is structured as follows. Section 2 presents a critical literature review and development of the hypotheses. Section 3 describes the data and econometric methods. Section 4 provides the empirical results. Section 5 shows the robustness of the results. Section 6 concludes the paper.

2. Related literature and development of hypotheses

This section describes previous literature in accordance with theoretical framework related to CEOs' power and banks' risk-taking before developing the hypotheses. CEOs are key in making corporate decisions such as capital structure (Brickley et al., 1988; Jokipii and Milne, 2011; De Jonghe and Öztekin, 2015), business strategy (Caroll, 1984, Eisenhardt and Schoonhoven, 1990), and staff recruitments. Their power and characteristics have the potential to influence corporate risk-taking behaviors.

According to Daily and Dalton (1994), the CEO's power is a complicated factor because some sources of power can be perceived as both positive and negative. CEOs hold a position of unparalleled power within commercial banks. The most widely used proxy for CEOs' power is structural power, specifically the dual leadership system, known as CEO duality. When an individual serves as both the CEO and the chairperson of the board of directors, the term "CEO duality" is used (Hermalin and Weisbach, 1998). Due to totality and dominance, the CEO's duality can be detrimental to an organization's performance (Daily and Johnson, 1997). As a result, if the CEO enjoys taking risks, the bank may suffer losses or face significant default risks. Lewellyn and Muller-Kahle (2012) found that powerful CEOs are also associated with excessively risky credit policies. Adams et al. (2005) showed that firms with more powerful CEOs pursue riskier policies by overriding board decisions.

Others, on the other hand, argue that such duality provides the firm with a unified vision and direction. If the CEO is also the chairperson of the board, they can be more willing to work for the banks. Given the consistency of commercial banks' hierarchical systems, the CEO is encouraged to prioritize the bank's stability over short-term benefits (Victoravich et al., 2011). As a result, CEO duality tends to reduce risk-taking behaviors. Pathan (2009), for example, showed how powerful CEOs in bank holding companies can influence the board's decisions, reducing risk-taking. Victoravich et al. (2011) contended that high CEO equity compensation has a negative impact on banks' risk-taking.

These contrasting findings illustrate the theoretical tension in the literature surrounding CEOs' power. Specifically, agency theory suggests that concentrated power in the hands of CEOs can weaken the board's oversight and lead to excessive risk-taking, as CEOs may pursue personal objectives at the expense of shareholders (Jensen and Meckling, 1976). In contrast, stewardship theory posits that powerful CEOs can act as dedicated stewards of the firm, using their authority to promote long-term

stability and performance (Davis et al., 1997; Anderson and Galinsky, 2006). Given the Vietnamese institutional context, where external governance mechanisms remain relatively underdeveloped and the enforcement of disclosure regulations is inconsistent, the interpretation should be considered carefully. In such an environment, CEO duality and ownership may actually function as internal governance tools, promoting stable leadership and long-term vision. Therefore, Vietnamese CEOs, often operating under public and regulatory scrutiny despite formal governance limitations, may adopt more risk-averse strategies to maintain organizational resilience and avoid reputational damage (Klomp and De Haan, 2014; Stewart et al., 2016). Therefore, the first hypothesis is proposed as follows:

Hypothesis 1 (H_1): CEO duality is negatively related to bank risk-taking.

The CEO's ownership power is determined by the amount of equity held by CEOs (Tosi et al., 2000). Shareholder power can help to balance managerial influence with the board (Useem et al., 1993; Hartzell and Starks, 2003). As a result, Jensen and Meckling (1976) proposed linking the interests of shareholders and managers through share ownership in order for managers to act in the best interests of the shareholders.

Stock ownership is a type of incentive that encourages managers to operate more efficiently (Brickley et al., 1988). Previous empirical studies (e.g., Adams et al., 2005; Elsilä et al., 2013) show that the management's capital ownership ratio is positively related to banks' performance. A concentration in ownership would alleviate the separation between ownership and management decisions (Pham and Hoang, 2022). In other words, once executives, particularly CEOs, are motivated by stock ownership, they will be motivated to increase the bank's value (Lilienfeld-Toal and Ruenzi, 2014).

Increased stock ownership, however, does not always result in mutual interests between shareholders and executives. CEOs tend to seize company assets (Fama and Jensen, 1983) or to make decisions that benefit them in the short term but harm the bank in the long run (Victoravich et al., 2011). According to Bhagat and Bolton (2013), CEOs with substantial ownership stakes may exhibit lower risk tolerance, which can, in turn, reduce the bank's performance. This suggests that as CEO ownership increases, so does their control, but rather than encouraging risk-taking, it may lead to more conservative decision-making and a reduced appetite for risk. Similar to the case of CEO duality, CEO ownership may play a stabilizing role. Drawing from stewardship theory, CEOs with equity stakes in Vietnamese banks may view themselves as long-term custodians of the institution, particularly given their heightened exposure to reputational and regulatory scrutiny. Rather than pursuing aggressive strategies, these CEOs may be inclined to adopt risk-averse behavior to protect both personal wealth and institutional credibility. As a result of these findings, we formulate the second hypothesis:

Hypothesis 2 (H_2): CEO ownership is negatively related to bank risk-taking.

3. Data selection, variable measurement, and methodology

This section outlines the data selection process, defines the key variables, and explains the econometric methodology used to examine the relationship between CEOs' power and bank risk-taking.

3.1. Sample and data

The sample includes 17 commercial banks listed on the Ho Chi Minh Stock Exchange and 2 commercial banks listed on the Hanoi Stock Exchange from 2011 to 2021. The CEO power index and strong board index corporate governance data were manually collected from audited annual reports, corporate governance disclosures, and the management reports available on each bank's official website. To ensure consistency, we cross-verified key variables across multiple years and sources. Missing values were handled conservatively: Observations with incomplete CEO identity or equity data were excluded, and imputed only when validated through official company disclosures. Detailed documentation of the data collection and cleaning procedure is available upon request to enhance transparency and replicability.

Daily commercial bank stock prices can be downloaded from the websites of Vietstock[1] and CafeF[2], two popular data sources for research on Vietnamese markets. Accounting data such as total assets, total liabilities, and market equity were obtained from the FiinPro3 platform to calculate bank capital, bank charter value, and bank ratios such as ROA and ROE. We also obtained market indices (the VN index and the HNX index) data from the Trading Economics website (tradingeconomics.com).

3.2. Variable measurement

3.2.1. CEOs' power

We measure CEOs' power by using structural power and ownership power. Following the literature (e.g., Hermalin and Weisbach, 1998; Adams et al., 2005), a CEO's structural power is measured by CEO duality (CEODUAL), with a value of 1 if the CEO is the chair of the board and zero otherwise. Hermalin and Weisbach (1998) explained that when the CEO holds the chair position, the CEO's power increases because the board of directors' influence over the CEO's decisions is limited. In terms of ownership power, CEO shareholding can also increase the CEO's power. However, because of this convergence of interests, linking the CEO's personal interests with those of shareholders can align both the CEO's and shareholders' incentives, making the CEO more motivated to improve the bank's performance (Fama and Jensen, 1983). The CEO ownership variable in this study is determined by the amount of CEO stockholding as a percentage of the total number of the bank's outstanding shares. These data were manually collected from the banks' annual reports.

3.2.2. Bank risk

Following previous studies (e.g., Anderson and Fraser, 2000; Chen et al., 2006), bank risk is proxied by total risk, systematic risk, and idiosyncratic risk. In addition, we also employ two additional

[1] The data are available here: https://finance.vietstock.vn.

[2] The data are available here: https://s.cafef.vn/du-lieu.chn.

[3] The data platform is provided by StoxPlus.

risk-taking measures (Z-scores and asset return risk) to examine the impact of CEOs' power on banks' risk-taking. Total risk (TLR) is determined as the standard deviation of the daily stock return (R_{it}) for each fiscal year from 2011 to 2021. The daily stock return of commercial banks is defined as follows:

$$R_{ix} = \ln\left(\frac{P_{i,x}}{P_{i,x-1}}\right) \quad . \tag{1}$$

where $P_{i,x}$ is the daily stock price of bank i on day x. Total risk reflects the overall fluctuation of the banks' stock return and the market views of commercial banks' assets, liabilities, and off-balance-sheet activities. This type of risk is closely monitored by both regulators and bank managers.

Idiosyncratic risk (unsystematic risk) enables bank managers to assess the stock price volatility that is unique to the commercial bank, as well as the quality of its loans, bank investment, amount of bank deposits, and bank capital. Following Anderson and Fraser (2000), idiosyncratic risk (IDIOR) is calculated by taking the standard deviation of the residuals of a single index market model[4] as follows:

$$R_{ix} = \alpha_i + \beta_i \times R_{mx} + \varepsilon_{ix} \tag{2}$$

where R_{ix} is the stock return of bank i on day x and R_{mx} is the return of market index (either the VN index or the HNX index). Finally, systematic risk (SYSR) is determined as the difference between total risk and idiosyncratic risk.

In addition to three risk-taking proxies, the insolvency risk of a bank is employed by using Z-scores to check the robustness of the results (e.g. Pathan, 2009). Z-scores[5] calculate the distance to bankruptcy, which occurs when equity is insufficient to offset losses (Boyd et al., 1993)

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[4]For robustness check, we use Pathan's (2009) two-index model with the interest rate of the Vietnamese stock market (sources: https://tradingeconomics.com/vietnam/interest-rate and https://www.sbv.gov.vn).

To address a concern regarding the illiquidity in Vietnam stock market, we have added lead and lag market returns when calculating stock returns to control for the lead–lag trading effects. Our model is as follows:

$$R_{i,x} = \alpha_i + \beta_{1i} \times R_{m,x} + \beta_{2i} \times INTEREST_x + \beta_{3i} \times R_{m,x-1} + \beta_{4i} \times R_{m,x+1} + \varepsilon_{i,x}.$$

New measures of idiosyncratic risk and systematic risk were obtained from the model above. Our new systematic risk is now proxied by the estimated beta on the market return. Our robust result is reported in Table A3 in the Appendices.

[5] As a robustness check, we construct an alternative Z-score following the approach of Yeyati and Micco (2007). Specifically, we calculate the moving average and standard deviation of annual ROA over a 4-year rolling window and combine these with the current equity-to-assets ratio.

$$Z_{1,it} = \frac{\mu_{ROA,i,t-3:t} + \frac{E_{i,t}}{TA_{i,t}}}{\sigma_{ROA,i,t-3:t}}$$

This method captures the time-varying nature of banks' performance and accounts for potential instability in shorter time-series risk estimates. The resulting Z-score provides an alternative proxy for insolvency risk. As shown in Table A3 in the Appendices, the results are consistent with our main findings.

$$Z = \frac{\overline{R_{it}} + \frac{E_{it}}{TA_{it}}}{TLR_{it}} \quad (3)$$

where $\overline{R_{it}}$ is the average stock return of bank i in year t, calculated as the average daily stock price for each fiscal year; E_{it} is the average equity of bank i in year t; TA_{it} is the average total asset of bank i in year t; and TLR_{it} is the total risk of bank i in year t. Because the Z-score measures the distance from default, the interpretation of the sign for the Z-score will be the inverse of that of other risk-taking measures. Thus, a high Z-score indicates a low risk-taking level, whereas higher *TLR, SYSR,* or *IDIOR* would signal higher risk-taking behavior.

This study also uses the asset return risk (ARR) to determine banks' risk-taking, as this proxy can provide insights into commercial banks' risky assets. An increase in risky assets indicates that banks are in a riskier situation. As a bank's equity finance acts as a minor claim on bank cash flows and protects fixed claimants from default losses in the event of moderate declines in commercial banks' total market value, we follow Flannery and Rangan (2008) to estimate banks' total risk exposure using equity volatility as follows:

$$\sigma_A = \frac{E}{A} \times \sigma_E \quad (4)$$

where σ_E is the standard deviation of the daily equity return in each fiscal year, E is the market value of the bank's equity at the end of the fiscal year, and A is the market value of total assets (which equals the sum of equity (E) plus the book value of total debt) at the end of the fiscal year. The market value of equity is calculated as the stock price at the end of the fiscal year multiplied by the total number of outstanding shares, and σ_A is annualized by multiplying with the square root of 250 (the approximate number of trading days in a year).

3.2.3. Strong board and bank-specific characteristics

In our study, we control for several board and bank-specific characteristics. Board size (BS) is defined as the total number of members on the board of directors (Golden and Zajac, 2001). Within the Vietnamese stock market, Pham and Hoang (2022) provided evidence that a large board size is crucial to business management due to the support and counsel from widely experienced board members. Even though there is no optimal board size for all businesses, the size of the board appears to impact the risk-taking of commercial banks (Pathan, 2009).

Independent directors on the board are believed to have a critical monitoring role in resolving, or at least lessening, agency conflicts between management and shareholders (Eisenhardt, 1989). In this context, board independence might be viewed as a safeguard against excessive risk-taking. Board independence (BINDEP) is measured by the percentage of independent members on the board.

Table 1. Definitions of the variables.

Variables	Definition
Panel A: Bank risk variables	
Total risk	Standard deviation of the daily bank stock returns in each year
Systematic risk	The difference between total risk and idiosyncratic risk
Idiosyncratic risk	Standard deviation of the residual in Equation (2)
Insolvency risk	Z-scores as demonstrated in Equation (3)
Assets' return risk	Asset volatility as demonstrated in Equation (4)
Panel B: CEO power variables	
CEO duality	A dummy variable equals 1 if CEO chairs the board and ze0ro otherwise
CEO ownership	The percentage of CEO ownership
Panel C: Strong board and bank characteristics	
Board size	The number of directors on the board
Board independence	The total number of independent directors, as a percentage
Outside directors	The total number of nonexecutive directors, as a percentage
Bank size	The natural logarithm of total bank assets at the end of each fiscal year
Bank capital structure	The ratio of total equity to total assets, as a percentage
Charter value	Keeley's Q (Keeley, 1990) which is determined by dividing the book value of total assets by the market value of equity and the book value of liabilities.

Previous research has identified the effects of bank size (LNTA) on bank risk-taking. Large banks are internally diversified, which provides one method of mitigating banks' idiosyncratic risk (Konishi and Yasuda, 2004; Stiroh, 2006). In contrast, the positive relationship between systematic risk and bank size is documented as large banks lending to different sectors and holding less equity capital than smaller banks (Demsetz and Strahan, 1997).

Commercial banks with a low leverage ratio and a conservative capital structure finance their assets with more equity than debts. We also use banks' capital structure (CAP), defined as the ratio of equity to total assets, as equity capital acts as a cushion against losses and reduces a bank's probability of default (Saunders et al., 1990; Demsetz and Strahan, 1997; Anderson and Fraser, 2000).

Finally, following the banking literature, we control for banks' charter value (CV) as the sum of market value of common equity (price per share times the number of shares) plus the book value of liabilities divided by the book value of assets. Anderson and Fraser (2000) showed that a bank's charter value encourages the CEO to take on additional risk. We report the detailed definitions of all variables used in the study in Table 1.

3.3. Methodology

We follow Pathan (2009) to run the model as follows:

$$\ln(RISK)_{i,t} = \propto + \beta_1\,(\mathrm{CEODUAL})_{i,t} + \beta_2\,(\mathrm{CEOOWN})_{i,t} + \delta_1 \ln(BS)_{i,t} + \delta_2\,(\mathrm{BINDEP})_{i,t} + \gamma_1\,(LNTA)_{i,t} + \gamma_2\,(CAP)_{i,t} + \gamma_3\,(CV)_{i,t} + \psi_t\,(YEAR)_t + \varepsilon_{i,t} \quad (5)$$

where *RISK* represents the measure of banks' risk-taking, and *YEAR* is the time dummy. The estimation method used for the regression model above is the GLS RE technique, following the procedure of Baltagi and Wu (1999). Compared with ordinary least squares (OLS), GLS RE is more appropriate for unbalanced panel data with heteroskedasticity, autocorrelation, and potential cross-sectional correlation, which are commonly observed in banking panel datasets (Pathan, 2009). As our dataset spans 19 commercial banks over 11 years (2011–2021), it is essential to use an estimator that can handle serial correlation and unobserved heterogeneity efficiently. The GLS RE model achieves this by relaxing the OLS assumption of spherical errors and producing more efficient estimates in the presence of heteroskedasticity and first-order autoregressive AR(1) disturbances (Baltagi and Wu, 1999).

To determine the appropriate panel estimator, we conducted Hausman's specification test, which supports the use of the random effects model over fixed effects. This choice is further justified by the nature of our key explanatory variables, such as CEO duality and board independence, which exhibit minimal within-firm variation or are time-invariant. In such cases, the fixed effects (FE) model may lead to imprecise or biased estimates, as it eliminates the variation of time-invariant regressors by design (Wooldridge, 2002). Moreover, the GLS RE model allows us to exploit both within-entity and between-entity variation, offering a broader view of the role of CEOs' power in shaping banks' risk-taking across Vietnamese banks.

However, we acknowledge that endogeneity concerns may persist, particularly regarding reverse causality and omitted variable bias. Therefore, to enhance the robustness of our causal claims, we supplement the GLS RE model with more advanced techniques, namely 3SLS and the two-step system GMM, which are designed to address potential endogeneity and dynamic relationships (Arellano and Bover, 1995; Blundell and Bond, 1998).

3.4. Descriptive statistics

We report the descriptive statistics of the variables used in the study in Table 2. In terms of CEOs' power, the average index value of CEO duality in the leadership structure (CEODUAL) is 0.11, indicating that CEO duality is relatively low across the sample of Vietnamese commercial banks, compared with 0.46 in Victoravich et al. (2011) for US commercial banks. The mean of CEO shareholdings (CEOOWN) is 0.65%, lower than Pathan's (2009) average of 4.41% and the value of 2.27% reported by Adams and Mehran (2008). Even though the maximum value of shareholdings is nearly 7%, most CEOs do not have large ownership values. This reflects the institutional context of Vietnam's banking sector. Unlike in developed markets, Vietnamese banks are heavily state-owned or institutionally dominated, where executive shareholding is limited by regulation and ownership caps. As such, low CEO ownership[6] is not an outlier but a systemic feature of the governance environment, aligning with findings in emerging market studies (e.g., Fang et al., 2020; Klomp and De Haan, 2014).

[6] To account for the skewed distribution and low variance of CEO ownership, we re-estimate the models using a categorical variable that groups CEO shareholding into three levels: no ownership (0%), low ownership (0–0.5%), and high ownership (>0.5%). This approach helps assess whether threshold effects exist. As shown in Table A4 in the Appendices, the results

Table 2. Descriptive statistics.

Variables	Mean	SD	Min	First quartile	Median	Third quartile	Max	Skew	Kurt	*N*
CEO variables										
CEODUAL	0.11	0.32	0.00	0.00	0.00	0.00	1.00	2.42	6.84	209
CEOOWN (%)	0.65	1.54	0.00	0.00	0.02	0.23	7.00	2.87	10.68	209
Bank risk-taking measures										
TLR (%)	4.94	27.61	1.01	1.72	2.33	2.85	318.19	11.27	128.45	209
SYSR (%)	0.56	0.91	0.00	0.10	0.23	0.61	5.68	3.27	14.53	209
IDIOR (%)	1.99	0.91	0.84	1.44	1.86	2.29	8.60	3.25	22.84	209
Z	3.70	1.96	0.10	2.45	3.23	4.57	12.41	1.30	5.60	209
ARR (%)	0.48	0.94	0.01	0.09	0.22	0.39	7.22	4.93	30.74	209
Strong board and bank characteristic variables										
BS (No.)	7.63	1.80	5.00	6.00	8.00	9.00	15.00	0.35	3.21	209
BINDEP (%)	12.12	7.72	0.00	9.09	12.50	16.67	40.00	-0.06	2.92	209
OUTDIR (%)	23.40	6.16	14.95	18.20	21.45	27.93	47.33	0.54	3.41	209
LNTA	32.72	2.25	3.52	32.24	32.77	33.53	35.11	-10.51	137.47	209
CAP (%)	10.80	5.48	2.15	7.03	10.36	13.16	26.95	0.88	3.53	209
CV	1.04	0.05	0.95	1.00	1.02	1.06	1.23	1.19	4.57	209

This table presents the distribution of variables by showing the mean, standard deviation (SD), minimum (Min.), first quartile, median, third quartile, maximum (Max), skewness (Skew), kurtosis (Kurt.), and the number of observations. See Table 1 for the variables' definitions.

The average total risk (TLR) is 4.94, followed by a Z-score of 3.70 (Z) and 1.99 for idiosyncratic risk (IDIOR). The idiosyncratic risk index is higher than the systematic risk index, implying that Vietnamese commercial banks acquire more nonsystematic risks than market risks. This trend is also reported in the studies of Anderson and Fraser (2000), Chen et al. (2006), and Pathan (2009). ARR is recorded as having the lowest mean value among the five risk-taking measures.

The board structure variables show that the mean board size (BS) is 7.63, with a minimum of 5 and a maximum of 15. Board independence has a mean value of 12.12%, varying from 0% of independent directors on the board to a maximum of 40%. We present the Pearson pairwise correlation matrix among regression variables in the Appendix.

4. Regression results and discussion

This section presents empirical findings based on three estimation techniques: GLS RE, 3SLS, and system GMM.

remain consistent with the main findings, confirming the negative association between CEO ownership and banks' risk-taking even at low ownership levels.

4.1. Generalized Least Squares Random Effects

We report the regression results of the GLS RE estimation in Table 3. CEODUAL significantly negatively correlates to all bank risk-taking measures. In terms of economic significance, if the CEO also serves as the chairperson, the total bank risk (TLR) decreases by approximately 17.34 percentage points [1*(–0.277)/ln (4.94) = −0.1734]. These results support the stewardship theory perspective, which argues that a unified leadership structure promotes consistency in decision-making and a stronger sense of responsibility. In the Vietnamese context, where boards are often weaker, and external governance enforcement remains limited, this leadership concentration may enhance internal accountability rather than exacerbate agency problems. Our findings are consistent with Victoravich et al. (2011), Fernandes et al. (2021), and Lin et al., (2023), who also documented negative associations between CEO duality and risk-taking in banking, particularly in contexts with limited external control. Comparable evidence from China (Fang et al., 2020) also indicates that in emerging economies where governance infrastructure is still maturing, CEO duality can promote stability and align leadership with long-term strategic goals. In contrast, studies in the US and UK—which have stronger regulatory institutions—often find the opposite, as CEOs' power is more likely to be abused under lax monitoring (Adams et al., 2005; Bhagat and Bolton, 2013). This positions Vietnam alongside other Southeast Asian Nations ASEAN peers such as Indonesia, where concentrated leadership is shown to reduce risk due to stronger reputational pressures and local ownership ties (Karyani and Utama, 2015).

Turning to CEO ownership (CEOOWN), we also find a negative relationship with all risk-taking proxies, except for idiosyncratic risk. This finding supports the risk aversion and stewardship perspectives, which suggest that CEOs with substantial equity stakes may become more conservative to protect their personal wealth and long-term reputations. This means that the greater the percentage of shareholdings owned by CEOs, the less that risky projects will be pursued. For example, increasing CEO ownership by 1% reduces total bank total risk (TLR) by nearly 5.7 percentage points [1*(−0.0907)/ ln(4.94) = −0.0567]. The findings are consistent with previous research demonstrating that banks' risk preferences coincide with CEO ownership (Chen et al., 2006; Lewellyn and Muller-Kahle, 2012; Altunbaş et al., 2020; Sghaier and Hamza, 2024).

As expected, the coefficient on board size (BS) is negatively correlated with most risk-taking proxies and is statistically significant. Notably, while the number of directors on the BOD greatly influences idiosyncratic risk, the coefficient of the Z-scores shows no impact of this risk on board size. Unlike board size, board independence (BINDEP) positively impacts most risk-taking proxies. Regarding other characteristics, while bank size (LNTA) and bank capital structure (CAP) significantly reduce banks' risks, banks' charter value (CV) encourages the banks' risk-taking behavior. Specifically, consistent with Furlong and Kwan (2005) and Pathan (2009), bank size is negatively associated with idiosyncratic risk (IDIOR), total risk (TLR), and ARR but positively correlated with Z-score (Z). We also document similar findings for banks' capital structure (CAP). On the contrary, banks'' charter value (CV) is positively associated with most risk measures.

Table 3. GLS RE regression results of banks' risk-taking using board independence.

Variables	TLR	SYSR	IDIOR	Z	ARR
CEODUAL	−0.277***	−0.875***	−0.171**	0.335***	−0.824***
	(−3.80)	(−3.58)	(−2.78)	(4.86)	(−4.19)
CEOOWN	−0.0907*	−0.205*	−0.0582	0.117***	−0.202**
	(−2.03)	(−2.01)	(−1.66)	(3.91)	(−2.64)
BS	−0.252*	−0.872*	−0.382***	0.181	−0.776*
	(−2.12)	(−2.17)	(−3.29)	(1.55)	(−2.55)
BINDEP	0.354*	−1.923	0.776**	0.588	1.689*
	(0.72)	(−1.19)	(1.73)	(1.25)	(1.46)
LNTA	−0.0590**	0.0353	−0.0240**	0.236***	−0.132***
	(−1.70)	(0.89)	(−2.85)	(33.63)	(−6.12)
CAP	−0.338*	2.505	1.343	12.51***	−8.859**
	(−0.3)	(0.59)	(1.23)	(9.92)	(−2.86)
CV	−0.15	1.488*	2.030*	−10.79***	5.491*
	(−0.14)	(0.38)	(1.98)	(−8.61)	(1.97)
Constant	−0.633**	−6.586*	−0.411	2.273*	−3.657*
	(−0.61)	(−2.03)	(−0.46)	(1.91)	(−1.55)
Time	Yes	Yes	Yes	Yes	Yes
N	209	209	209	209	209
Within R^2	0.6903	0.4728	0.4985	0.9119	0.6826
Between R^2	0.7218	0.5177	0.5983	0.8275	0.677
Overall R_2	0.6718	0.4045	0.5003	0.8784	0.6742
χ^2 – statistics	140.97	58.67	72.07	583.81	144.91

This table presents the GLS RE estimates following Baltagi and Wu (1999) (see Equation (5)) using board independence (BINDEP).

$$\ln(RISK)_{i,t} = \propto + \beta_1\,(\text{CEODUAL})_{i,t} + \beta_2\,(\text{CEOOWN})_{i,t} + \delta_1 \ln(BS)_{i,t} + \delta_2\,(\text{BINDEP})_{i,t} + \gamma_1\,(LNTA)_{i,t} + \gamma_2\,(CAP)_{i,t} + \gamma_3\,(CV)_{i,t} + \psi_t\,(YEAR)_t + \varepsilon_{i,t}$$

The subscripts i represent individual commercial banks (i = 1, 2,… 19); t denotes the time (t = 2011, 2012… 2021); and ln is the natural logarithm; $\beta, \delta, \gamma,$ and ψ are the parameters to be estimated; and ε is the idiosyncratic error term. $RISK$, represented in Columns 1 to 5, indicates total risk (TLR), systematic risk ($SYSR$), idiosyncratic risk ($IDIOR$), insolvency risk (Z), and asset return risk (ARR). TLR is the standard deviation of daily stock return ($R_{i.t}$) for each fiscal year from 2011 to 2021 (see Equation (1)). $IDIOR$ is the standard deviation of the residuals of a single index market model following Anderson and Fraser (2000) (see Equation (2)). $SYSR$ is the difference between TLR and $IDIOR$. Z is the distance to bankruptcy, which occurs when equity is insufficient to offset losses (Boyd et al., 1993) (see Equation (3)). ARR is the standard deviation of daily equity return in each fiscal year following Flannery and Rangan (2008) (see Equation (4)). $CEODUAL$ takes a value of 1 if the CEO is also the chair of the board and 0 otherwise. $CEOOWN$ is the amount of CEO stockholding as a percentage of the total outstanding shares. BS is the number of directors on the board. $BINDEP$ is the percentage of independent members on the board. $LNTA$ is the natural logarithm of total bank assets at the end of each fiscal year. CAP is the ratio of total equity to total assets as a percentage. CV is the bank's charter value calculated by dividing the book value of total assets by the market value of equity and the book value of liabilities following Keeley (1990). $YEAR$ is a time dummy variable. The *t*-statistics reported in parentheses are robust to heteroskedasticity. Statistical significance at the 10%, 5%, and 1% levels is indicated by the superscripts *, **, and ***, respectively.

4.2. Three-stage least squares

Endogeneity is a major concern in the relationships between board characteristics and banks' risk-taking (Hermalin and Weisbach, 1998; Adams et al., 2005; Fernandes et al., 2021). According to Fernandes et al. (2021), there is a potential bidirectional causality between board factors and banks' risk proxies. In our context, a bank's risk may influence the board's size and independence, while those same governance factors may, in turn, affect risk-taking. By using 3SLS, we mitigate simultaneity bias and obtain more efficient and consistent estimates (Zellner and Theil, 1992; Greene, 2012). We follow the literature (Linck et al., 2008; Fernandes et al., 2021) to specify the following equations:

$$\ln(BS)_{i,t} = \propto + \beta_1\,(\mathrm{BINDEP})_{i,t} + \beta_2\,\ln(RISK)_{i,t} + \beta_3\,(\mathrm{CEOOWN})_{i,t} + \beta_4\,(LNTA)_{i.t} + \beta_5\,(CAP)_{i.t} + \beta_6\,(BOARDOWN)_{i.t} + \varepsilon_{i,t} \quad (6)$$

$$\mathrm{BINDEP}_{i,t} = \propto + \beta_1\,(\mathrm{BS})_{i,t} + \beta_2\,\ln(RISK)_{i,t} + \beta_3\,(\mathrm{CEODUAL})_{i,t} + \beta_4\,(LNTA)_{i.t} + \beta_5\,(CV)_{i.t} + \beta_6\,(BOARDOWN)_{i.t} + \varepsilon_{i,t} \quad (7)$$

where BOARDOWN is measured by the total percentage of ownership value of the whole board (except the CEO in the case of CEO duality). Equations (5), (6), and (7) form a system that captures the interdependence among the CEO's power, board structure, and risk-taking. This 3SLS estimation corrects for the endogenous feedback loops that would otherwise bias the results in a single-equation model. The findings are reported in Table 5 and remain consistent. For instance, the coefficient on CEODUAL is negative and statistically significant for total bank risk, reinforcing the argument that unified leadership is associated with lower risk-taking.

Table 4. Three-stage least squares regression results of total risk.

Explanatory variables	TLR	BS	BINDEP
TLR		−8.726**	1.975**
		(−3.16)	(3.27)
CEODUAL	−0.294***		0.0171
	(−3.30)		(1.15)
CEOOWN		−7.330*	
		(−1.34)	
BS	−0.615***		0.0149***
	(−3.86)		(4.88)
BINDEP	4.390*	2.708**	
	(2.46)	(2.64)	
BOARDOWN		−0.00420*	0.0282***
		(−2.32)	(3.86)
LNTA	−0.195*	0.143***	0.381***
	(−2.41)	(3.34)	(4.34)

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Explanatory variables	TLR	BS	BINDEP
CAP	1.322	0.359	
	(0.98)	(0.64)	
CV	−0.944		−1.168
	(−0.62)		(−1.23)
Constant	−7.083**	−2.904	1.130***
	(−2.97)	(−1.49)	(4.43)
Time	Yes	Yes	Yes
N	209	209	209
Adjusted R^2	0.5099	0.0786	0.446
χ^2-statistics	154.74	44.14	120.23

Table 4 presents 3SLS estimates calculated by the following simultaneous equations:

$$\ln(RISK)_{i,t} = \propto + \beta_1\,(\text{CEODUAL})_{i,t} + \beta_2\,(\text{CEOOWN})_{i,t} + \delta_1 \ln(BS)_{i,t} + \delta_2\,(\text{BINDEP})_{i,t} + \gamma_1\,(LNTA)_{i,t} + \gamma_2\,(CAP)_{i,t} + \gamma_3\,(CV)_{i,t} + \psi_t\,(YEAR)_t + \varepsilon_{i,t}$$

$$\ln(BS)_{i,t} = \propto + \beta_1\,(\text{BINDEP})_{i,t} + \beta_2\,\ln(RISK)_{i,t} + \beta_3\,(\text{CEOOWN})_{i,t} + \beta_4\,(LNTA)_{i.t} + \beta_5\,(CAP)_{i.t} + \beta_6\,(BOARDOWN)_{i.t} + \varepsilon_{i,t}$$

$$\text{BINDEP}_{i,t} = \propto + \beta_1\,(\text{BS})_{i,t} + \beta_2\,\ln(RISK)_{i,t} + \beta_3\,(\text{CEODUAL})_{i,t} + \beta_4\,(LNTA)_{i.t} + \beta_5\,(CV)_{i.t} + \beta_6\,(BOARDOWN)_{i.t} + \varepsilon_{i,t}$$

The subscripts i represent individual commercial banks (i = 1, 2,… 19); t denotes the time period (t = 2011, 2012… 2021); ln is the natural logarithm; $\beta, \delta, \gamma,$ and ψ are the parameters to be estimated; ε is the idiosyncratic error term; and TLR is the standard deviation of daily stock returns ($R_{i.t}$) for each fiscal year from 2011 to 2021 (see Equation (1)). $CEODUAL$ takes the value of 1 if the CEO is also the chair of the board and 0 otherwise. $CEOOWN$ is the proportion of CEO stockholding as a percentage of the total outstanding shares. BS is the number of directors on the board. $BINDEP$ is the percentage of independent members on the board. $BOARDOWN$ is measured by the total percentage of the ownership value of the bank's whole board (except the CEO in the case of CEO duality). $LNTA$ is the natural logarithm of total bank assets at the end of each fiscal year. CAP is the ratio of total equity to total assets as a percentage. CV is the bank's charter value calculated by dividing the book value of total assets by the market value of equity and the book value of liabilities, following Keeley (1990). $YEAR$ is a time dummy variable. The *t*-statistics reported in parentheses are robust to heteroskedasticity. Statistical significance at the 10%, 5%, and 1% levels is indicated by the superscripts *, **, and ***, respectively.

4.3. Two-step system GMM

In addition to the 3SLS estimation, the two-step system GMM is used to provide additional robust evidence for the model, following Arellano and Bover (1995) and Blundell and Bond (1998). We re-estimate Equation (5) using banks' risk-taking variables as dependent variables, with

instruments derived from their lagged levels and differences. Specifically, we follow the standard approach of using the lagged levels of the endogenous variables as instruments for their differenced equations, and lagged differences as instruments for the level equations. Specifically, CEO duality, CEO ownership, and other potentially endogenous regressors (e.g., board and bank-specific characteristics) are instrumented using their own lagged values, assuming that past realizations of these variables are correlated with current levels but uncorrelated with the current error term. This dynamic panel data estimator is particularly suitable for our setting, where banks' risk-taking behaviors may be persistent over time, and where governance variables such as the CEOs' power could be endogenously determined by past outcomes or unobservable bank characteristics. Thus, the method allows for unobserved heterogeneity and simultaneity among the variables (if any). The Sargan, Hansen, and Arellano–Bond statistics were used to assess the validity of all instruments in the two-step system GMM.

In our estimations, the *p*-values of these tests are all above the common significance levels. We successfully rejected the null hypothesis of the Arellano–Bond test for first-order serial correlation and failed to reject other two test statistics. The *p*-values of Hansen's J-statistic range from 0.537 to 0.985, suggesting that the instruments are valid and do not suffer from over-identification. In short, all diagnostic tests suggest that our model is well-specified and that the instruments are valid.

Table 6 shows that the interpretation is quantitatively consistent with regression results reported using GLS RE and 3SLS. CEO duality continues to exhibit statistically significant negative coefficients for most risk-taking proxies, reinforcing our interpretation that CEO duality is associated with lower risk in Vietnam's banking sector. However, the effect of CEO ownership on risk-taking appears weaker in the dynamic specification, showing significance only for systematic and idiosyncratic risk proxies. These results further support the robustness of our main conclusions and provide stronger evidence for the causal relationship between CEOs' power and banks' risk-taking.

Table 5. Two-step system GMM regression results for banks' risk-taking.

Variables	TLR	SYSR	IDIOR	Z	ARR
CEODUAL	−0.0848**	−0.0209***	−0.0122*	4.565*	−0.0110***
	(−2.62)	(−4.19)	(−2.16)	(2.34)	(−4.06)
CEOOWN	−2.530	−1.398*	−0.919**	198.2	−0.0385
	(−0.94)	(−2.49)	(−2.60)	(1.31)	(−0.14)
BS	0.128	−0.0716**	0.0173	9.119*	0.00723
	(1.56)	(−3.25)	(1.14)	(2.18)	(0.75)
BINDEP	0.245*	0.0553	0.0746***	−12.65*	0.0351***
	(2.03)	(1.79)	(4.32)	(−2.05)	(3.70)
LNTA	−0.983***	−0.943***	−0.342	−0.637	−0.925***
	(−26.72)	(−4.73)	(−1.56)	(−0.06)	(−5.03)
CAP	−0.998	−0.164	−0.0521	70.51***	−0.0197
	(−1.31)	(−0.98)	(−0.86)	(4.23)	(−0.88)
CV	1.653**	0.140	0.0719	−83.62**	0.0467**
	(2.59)	(0.87)	(1.83)	(−3.00)	(3.21)
Constant	1.942***	−0.321	−0.0119	106.0**	−0.0329
	(3.52)	(−1.80)	(−0.34)	(2.85)	(−1.05)
Time	Yes	Yes	Yes	Yes	Yes
N	209	209	209	209	209
χ^2 statistic	25049.08	4899.69	13313.43	2009.66	1367.37
Π1	0.11	0.025	0	0.048	0.115
Π2	0.319	0.441	0.692	0.558	0.286
J-statistics	0.985	0.921	0.542	0.788	0.537

This table presents the re-estimates of Equation (5) with the two-step system GMM following Arellano and Bover (1995), and Blundell and Bond (1998).

〖ln (RISK)〗_(i,t)= ∝ + β_1 〖(CEODUAL)〗_(i,t) + β_2 (〖CEOOWN)〗_(i,t)+ δ_1 〖ln (BS)〗_(i,t)+ δ_2 〖(BINDEP)〗_(i,t)+ γ_1 〖(LNTA)〗_(i,t)+ γ_2 〖(CAP)〗_(i,t)+ γ_3 〖(CV)〗_(i,t)+ψ_t (YEAR)_t+ ε_(i,t)

The subscripts i represent individual commercial banks (i = 1, 2,… 19); t denotes the time period (t = 2011, 2012… 2021); ln is the natural logarithm; β,δ,γ,and ψ are the parameters to be estimated; and ε is the idiosyncratic error term. RISK, represented in Columns 1 to 5, indicates total risk (TLR), systematic risk (SYSR), idiosyncratic risk (IDIOR), insolvency risk (Z), and asset return risk (ARR). TLR is the standard deviation of daily stock returns (R_(i.t)) for each fiscal year from 2011 to 2021 (see Equation (1)). IDIOR is the standard deviation of the residuals of a single index market model following Anderson and Fraser (2000) (see Equation (2)). SYSR is the difference between TLR and IDIOR. Z is the distance to bankruptcy, which occurs when equity is insufficient to offset losses (Boyd et al., 1993) (see Equation (3)). ARR is the standard deviation of daily equity return in each fiscal year following Flannery and Rangan (2008) (see Equation (4)). CEODUAL takes the value of one if the CEO is also the chair of the board and zero otherwise. CEOOWN is the amount of CEO stockholding as a percentage of the total outstanding shares. BS is the number of directors on the board. BINDEP is the percentage of independent members on the board. LNTA is the natural logarithm of total bank assets at the end of each fiscal year. CAP is the ratio of total equity to total assets in percentage. CV is the bank's charter value calculated by dividing the book value of total assets by the market value of equity and the book value of liabilities following Keeley (1990). YEAR is a time dummy variable. The t-statistics reported in parentheses are robust to heteroskedasticity. Statistical significance at the 10%, 5%, and 1% levels is indicated by the superscripts *, **, and ***, respectively.

5. Robustness tests

This section conducts a series of robustness tests to verify the reliability of the main findings. Alternative measures, additional estimation techniques, and diagnostic checks are employed to ensure the consistency and validity of the results.

5.1. Controlling for the effects of outside directors

We also used outside directors (OUTDIR) as an alternative to board independence which is widely adopted in corporate governance studies (e.g. Hermalin and Weisbach, 1998; Lim and McCann, 2013; Tang, 2017). Outside directors must have three characteristics: They are not the company's employees, they provide strategic and operational advice based on their expert experience, and they ensure that executives act in the best interests of the shareholders (Larcker and Tayan, 2020). Outside directors tend to have no material relationship with the banks other than serving on the board. OUTDIR is the percentage of outside directors (nonexecutive directors) on the bank's board.

Table 6. GLS RE regression results of banks' risk-taking using outside directors.

Variables	TLR	SYSR	IDIOR	Z	ARR
CEODUAL	−0.315***	−1.110***	−0.187**	0.235***	−0.662***
	(−5.03)	(−5.47)	(−2.99)	(4.05)	(−3.45)
CEOOWN	−0.115***	−0.442***	−0.0535	0.140***	−0.168*
	(−4.92)	(−5.00)	(−1.81)	(5.94)	(−2.17)
BS	−0.568***	0.923	−1.136***	0.150	−2.634***
	(−3.31)	(1.18)	(−4.95)	(0.49)	(−5.04)
OUTDIR	0.0191**	0.00314	0.0329***	−0.0169	0.0938***
	(2.88)	(0.12)	(4.17)	(−1.33)	(4.64)
LNTA	−0.149***	0.00912	−0.0244**	0.205***	−0.116***
	(−6.24)	(0.26)	(−2.92)	(26.49)	(−5.53)
CAP	−0.112*	−0.344	0.102	0.808***	−0.517**
	(−2.03)	(−1.33)	(1.61)	(12.12)	(−3.02)
CV	1.187	4.409*	−2.542***	−7.415***	1.254
	(1.74)	(2.16)	(−3.52)	(−6.78)	(0.65)
Constant	1.095	−10.57***	1.235	3.468**	−0.429
	(1.17)	(−3.56)	(1.44)	(2.61)	(−0.19)

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Variables	TLR	SYSR	IDIOR	Z	ARR
Time	Yes	Yes	Yes	Yes	Yes
N	209	209	209	209	209
Within R^2	0.7763	0.5897	0.6027	0.9253	0.7604
Between R^2	0.4217	0.4456	0.6677	0.8781	0.5318
Overall R_2	0.7482	0.5652	0.6281	0.9173	0.7507
χ^2-statistics	124.78	50.69	72.63	476.76	129.51

This table presents the GLS RE estimates following the procedure of Baltagi and Wu (1999) (see Equation (5)) using outside directors ($OUTDIR$).

$$\ln(RISK)_{i,t} = \propto + \beta_1\,(\text{CEODUAL})_{i,t} + \beta_2\,(\text{CEOOWN})_{i,t} + \delta_1 \ln(BS)_{i,t} + \delta_2\,(\text{OUTDIR})_{i,t} + \gamma_1\,(LNTA)_{i,t} + \gamma_2\,(CAP)_{i,t} + \gamma_3\,(CV)_{i,t} + \psi_t\,(YEAR)_t + \varepsilon_{i,t}$$

The subscripts i represent individual commercial banks (i = 1, 2,… 19); t denotes the time period (t = 2011, 2012… 2021); ln is the natural logarithm; $\beta, \delta, \gamma,$ and ψ are the parameters to be estimated; and ε is the idiosyncratic error term. $RISK$, represented in Columns 1 to 5, indicates total risk (TLR), systematic risk ($SYSR$), idiosyncratic risk ($IDIOR$), insolvency risk (Z), and asset return risk (ARR). TLR is the standard deviation of daily stock returns ($R_{i.t}$) for each fiscal year from 2011 to 2021 (see Equation (1)). $IDIOR$ is the standard deviation of the residuals of a single index market model following Anderson and Fraser (2000) (see Equation (2)). $SYSR$ is the difference between TLR and $IDIOR$. Z is the distance to bankruptcy, which occurs when equity is insufficient to offset losses (Boyd et al., 1993) (see Equation (3)). ARR is the standard deviation of daily equity return in each fiscal year following Flannery and Rangan (2008) (see Equation (4)). $CEODUAL$ takes the value of 1 if the CEO is also the chair of the board and 0 otherwise. $CEOOWN$ is the amount of CEO stockholding as a percentage of the total outstanding shares. BS is the number of directors on the board. $OUTDIR$ is the total number of nonexecutive directors as a percentage. $LNTA$ is the natural logarithm of total bank assets at the end of each fiscal year. CAP is the ratio of total equity to total assets as a percentage. CV is the bank charter value calculated by dividing the book value of total assets by the market value of equity and the book value of liabilities following Keeley (1990). $YEAR$ is a time dummy variable. The *t*-statistics reported in parentheses are robust to heteroskedasticity. Statistical significance at the 10%, 5%, and 1% levels is indicated by the superscripts *, **, and ***, respectively.

Overall, the regression model results remain robust when OUTDIR is used instead of BINDEP. CEOs' power measures are negatively and significantly associated with bank risk-taking, controlling for the effect of outside directors. It is noteworthy that OUTDIR has a positive relationship with the majority of bank risk-taking proxies, including total risk, idiosyncratic risk, and asset return risk.

5.2. Glejser's (1969) heteroskedasticity tests

Following Adams et al. (2005) and Pathan (2009), Glejser (1969) heteroskedasticity tests are employed to re-examine the impacts of CEOs' power on banks' risk-taking. To conduct the Glejser heteroskedasticity test, absolute residuals are obtained from the pooled OLS regressions for ROA and ROE. ROA is calculated by dividing net income after tax by total assets, whereas ROE is calculated by dividing net income after tax by total shareholder equity. The absolute value of such residuals is used as an alternative for banks' risk proxies. As shown in Table 7, the coefficients of CEOOWN are consistent with the main findings. Although the result for CEO duality and banks' risk-taking is not

statistically significant, a similar conclusion is also demonstrated in previous literature (Pathan, 2009; Akins et al., 2016).

Table 7. Glejser (1969) heteroskedasticity test result for banks' risk-taking.

Variables	Absolute value of ROE residuals	Absolute value of ROA residuals
CEODUAL	−0.00603	0.000814
	(−0.55)	(1.02)
CEOOWN	−0.0144**	−0.0931**
	(−3.09)	(−2.72)
BS	−0.0357*	−0.00168
	(−2.01)	(−1.29)
BINDEP	0.0766	0.0109*
	(1.13)	(2.20)
LNTA	0.811	−0.196*
	(0.62)	(−2.04)
CAP	0.0453	0.0237*
	(0.31)	(2.22)
CV	−0.0435	−0.00611
	(−0.31)	(−0.56)
Constant	0.214	0.214
	(1.53)	(1.70)
N	209	209
Adjusted R^2	0.2797	0.262
Π: *F*-statistics	2.85	2.67
AVIF (max.)	2.08 (3.96)	2.08 (3.96)

This table presents Glejser's (1969) heteroskedasticity tests for Equation (5).

$$(\text{RISK})_{i,t} = \propto + \beta_1\,(\text{CEODUAL})_{i,t} + \beta_2\,(\text{CEOOWN})_{i,t} + \delta_1 \ln(BS)_{i,t} + \delta_2\,(\text{BINDEP})_{i,t} + \gamma_1\,(LNTA)_{i,t} + \gamma_2\,(CAP)_{i,t} + \gamma_3\,(CV)_{i,t} + \psi_t\,(YEAR)_t + \varepsilon_{i,t}$$

The subscripts i represent individual commercial banks (i = 1, 2,… 19); t denotes time period (t = 2011, 2012… 2021); ln is the natural logarithm; $\beta, \delta, \gamma,$ and ψ are the parameters to be estimated; and ε is the idiosyncratic error term. The proxies for risk-taking ($RISK$) are the absolute values of two residuals obtained from the pooled OLS regressions for ROA and ROE. ROA is determined by dividing net income after tax by the bank's total assets, and ROE is calculated by determining the net income after tax as a percentage of the bank's total shareholder equity. $CEODUAL$ takes the value of 1 if the CEO is also the chair of the board and 0 otherwise. $CEOOWN$ is the amount of CEO stockholding as a percentage of the total outstanding shares. BS is the number of directors on the board. $BINDEP$ is the percentage of independent members on the board. $LNTA$ is the natural logarithm of total bank assets at the end of each fiscal year. CAP is the ratio of total equity to total assets in percentage. CV is calculated by dividing the book value of total assets by the market value of equity and the book value of liabilities following Keeley (1990). $YEAR$ is a time dummy variable. The *t*-statistics reported in parentheses are robust to heteroskedasticity. Statistical significance at the 10%, 5%, and 1% levels is indicated by the superscripts *, **, and ***, respectively.

6. Conclusions

This study examines whether CEOs' power (measured by CEO duality and CEO ownership) is related to banks' risk-taking in Vietnam. Employing various bank risk-taking measures and estimation techniques, we show that CEO duality negatively affects banks' risk-taking proxies. This is explained by the fact that when CEOs also serve as board chairs, decisions made by the CEO and the board are consistent with the board's primary mission of effectively monitoring management and remuneration (Baysinger and Hoskisson, 1990). Furthermore, the greater the number of shares held by CEOs, the less often bank risk-taking is reported, as powerful CEOs can exert influence over the board's decisions in a way that reduces banks' risk-taking (Pathan, 2009). The findings are consistent with Houston and James (1995), Pathan (2009), and Victoravich et al. (2011) for developed countries.

Furthermore, a larger board results in less risk-taking by the bank. When a commercial bank's board includes many directors, such directors will make the best decisions for the bank's stability based on their knowledge and experience in the banking industry. This finding is also consistent with previous research (e.g., Cheng, 2008; Pathan, 2009; Nakano and Nguyen, 2012; Chen et al., 2006; Switzer and Wang, 2013). On the other hand, independent directors are associated with more bank risks because they are outsiders providing their expert views on the situation of commercial banks and thus tend to pursue riskier but higher-value projects.

These findings offer important implications for corporate governance reform and financial stability in Vietnam's banking sector. For regulators, the evidence suggests that CEO duality—contrary to conventional assumptions—may not inherently increase risk, particularly when paired with concentrated ownership and weak external monitoring. Rather than imposing blanket restrictions on duality, regulators should focus on strengthening board composition standards, such as increasing the proportion of independent or nonexecutive directors, and setting clear guidelines on CEOs' tenure to prevent entrenchment while preserving stability in the leadership. For banking supervisors and policymakers, our findings support reforms that enhance transparency and disclosure, especially regarding the CEO's role in strategic decision-making and risk oversight. Improved mandatory disclosures on board structure, CEOs' compensation, and risk exposure can help mitigate governance-related risk in a context where external enforcement mechanisms are still maturing. For investors, particularly institutional shareholders, the study emphasizes the value of monitoring CEOs' ownership levels and board effectiveness as part of risk-related due diligence. In markets like Vietnam where formal protections are limited, investor engagement and voting rights can be powerful tools to encourage responsible bank governance. Overall, the study highlights the need for a context-sensitive approach to governance reforms, recognizing that internal governance mechanisms such as CEOs' power can play a stabilizing role in emerging markets, if complemented by robust board oversight and transparent disclosure systems.

Author contributions

Conceptualization - Ngoc Anh Pham; Methodology - Ngoc Anh Pham; Investigation - Trang Quynh Ngo; Data Curation - Trang Quynh Ngo; Formal Analysis - Trang Quynh Ngo; Validation - Ngoc Anh Pham; Writing - Original Draft - Trang Quynh Ngo; Writing - Review & Editing - Ngoc Anh Pham; Supervision - Ngoc Anh Pham.

Use of AI tools declaration

The authors declare that no artificial intelligence (AI) tools were used in the creation of this article.

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Conflict of interest

All authors declare no conflicts of interest in this paper.

References

Adams RB, Mehran H (2008) Corporate performance, board structure, and their determinants in the banking industry. *Board Structure, and Their Determinants in the Banking Industry*. (Federal Reserve Bank of New York Staff Report No. 330). Federal Reserve Bank of New York. https://doi.org/10.2139/ssrn.1150266

Adams RB, Almeida H, Ferreira D (2005) Powerful CEOs and their impact on corporate performance. *Rev Financ Stud* 18: 1403–1432. https://doi.org/10.1093/rfs/hhi030

Akins B, Li L, Ng J, et al. (2016) Bank competition and financial stability: evidence from the financial crisis. *J Financ Quant Anal* 51: 1–28. https://doi.org/10.1017/S0022109016000090

Altunbaş Y, Thornton J, Uymaz Y (2020) The effect of CEO power on bank risk: Do boards and institutional investors matter? *Financ Res Lett* 33: 101202. https://doi.org/10.1016/j.frl.2019.05.020

Anderson RC, Fraser DR (2000) Corporate control, bank risk taking, and the health of the banking industry. *J Bank Financ* 24: 1383–1398. https://doi.org/10.1016/S0378-4266(99)00088-6

Anderson C, Galinsky AD (2006) Power, optimism, and risk-taking. *Eur J Soc Psychol* 36: 511–536. https://doi.org/10.1002/ejsp.324

Andres P, Vallelado E (2008) Corporate governance in banking: The role of the board of directors. *J Bank Financ* 32: 2570–2580. https://doi.org/10.1016/j.jbankfin.2008.05.008

Arellano M, Bover O (1995) Another look at the instrumental variable estimation of error-components models. *J Econometr* 68: 29–51. https://doi.org/10.1016/0304-4076(94)01642-D

Baltagi BH, Wu PX (1999) Unequally spaced panel data regressions with AR (1) disturbances. *Econometr Theory* 15: 814–823. https://doi.org/10.1017/S0266466699156020

Baysinger B, Hoskisson RE (1990) The composition of boards of directors and strategic control: Effects on corporate strategy. *Acad Manage Rev* 15: 72–87. https://doi.org/10.2307/258106

Bhagat S, Bolton B (2013) Director ownership, governance, and performance. *J Financ Quant Anal* 48: 105–135. https://doi.org/10.1017/S0022109013000045

Blundell R, Bond S (1998) Initial conditions and moment restrictions in dynamic panel data models. *J Econometr* 87: 115–143. https://doi.org/10.1016/S0304-4076(98)00009-8

Boyd BK (1994) Board control and CEO compensation. *Strateg Manage J* 15: 335–344. https://doi.org/10.1002/smj.4250150502

Boyd JH, Graham SL, Hewitt RS (1993) Bank holding company mergers with nonbank financial firms: Effects on the risk of failure. *J Bank Financ* 17: 43–63. https://doi.org/10.1016/0378-4266(93)90079-S

Brickley JA, Lease RC, Smith Jr CW (1988) Ownership structure and voting on antitakeover amendments. *J Financ Econ* 20: 267–291. https://doi.org/10.1016/0304-405X(88)90047-5

Carroll GR (1984) The specialist strategy. *Calif Manage Rev* 26: 126–137. https://doi.org/10.2307/41165084

Chen CR, Steiner TL, Whyte AM (2006) Does stock option-based executive compensation induce risk-taking? An analysis of the banking industry. *J Bank Financ* 30: 915–945. https://doi.org/10.1016/j.jbankfin.2005.08.006

Cheng S (2008) Board size and the variability of corporate performance. *J Financ Econ* 87: 157–176. https://doi.org/10.1016/j.jfineco.2006.10.006

Daily CM, Dalton DR (1994) Corporate governance and the bankrupt firm: An empirical assessment. *Strateg Manage J* 15: 643–654. https://doi.org/10.1002/smj.4250150804

Daily CM, Johnson JL (1997) Sources of CEO power and firm financial performance: A longitudinal assessment. *J Manage* 23: 97–117. https://doi.org/10.1177/014920639702300201

Davis JH, Schoorman FD, Donaldson L (1997) Toward a stewardship theory of management. *Acad Manage Rev* 22: 20–47. https://doi.org/10.5465/amr.1997.9707180258

Demsetz RS, Strahan PE (1997) Diversification, size, and risk at bank holding companies. *J Money Credit Bank,* 300–313. https://doi.org/10.2307/2953695

De Jonghe O, Öztekin Ö (2015) Bank capital management: International evidence. *J Financ Intermed* 24: 154–177. https://doi.org/10.1016/j.jfi.2014.11.005

Dinç IS (2005) Politicians and banks: Political influences on government-owned banks in emerging markets. *J Financ Econ* 77: 453–479. https://doi.org/10.1016/j.jfineco.2004.06.007

Dinh THT, Kleimeier S (2007) A credit scoring model for Vietnam's retail banking market. *Int Rev Financ Anal* 16: 471–495. https://doi.org/10.1016/j.irfa.2007.06.001

Eisenhardt KM, Schoonhoven CB (1990) Organizational growth: Linking founding team, strategy, environment, and growth among US semiconductor ventures, 1978–1988. *Adm Sci Q,* 504–529. https://doi.org/10.2307/2393315

Eisenhardt KM (1989) Agency theory: An assessment and review. *Acad Manage Rev* 14: 57–74. https://doi.org/10.5465/amr.1989.4279003

Elsilä A, Kallunki JP, Nilsson H, et al. (2013) CEO personal wealth, equity incentives and firm performance. *Corp Govern Int Rev* 21: 26–41. https://doi.org/10.1111/corg.12001

Fama EF, Jensen MC (1983) Separation of ownership and control. *J Law Econ* 26: 301–325. https://doi.org/10.1086/467037

Fang H, Lee JS, Chung CP, et al. (2020) Effect of CEO power and board strength on bank performance in China. *J Asian Econ* 69: 101215. https://doi.org/10.1016/j.asieco.2020.101215

Flannery MJ, Rangan KP (2008) What caused the bank capital build-up of the 1990s? *Rev Financ* 12: 391–429. https://doi.org/10.1093/rof/rfm007

Farag H, Mallin C (2017) Board diversity and financial fragility: Evidence from European banks. *Int Rev Financ Anal* 49: 98–112. https://doi.org/10.1016/j.irfa.2016.12.001

Fernandes C, Farinha J, Martins FV, et al. (2021) The impact of board characteristics and CEO power on banks' risk-taking: stable versus crisis periods. *J Bank Regul,* 1–23. https://doi.org/10.1057/s41261-021-00146-4

Finkelstein S, Hambrick DC, Cannella AA (1996) *Strategic leadership*, West Publishing.

Glejser H (1969) A new test for heteroskedasticity. *J Am Stat Assoc* 64: 316–323. https://doi.org/10.1080/01621459.1969.10500976

Golden BR, Zajac EJ (2001) When will boards influence strategy? Inclination× power= strategic change. *Strateg Manage J* 22: 1087–1111. https://doi.org/10.1002/smj.191

Furlong F, Kwan S (2005) Market-to-book, charter value and bank risk-taking: A recent perspective. In: *Basel Committee Research Task Force Conference, Vienna*.

Greene WH (2012) Econometric analysis. *J Boston: Pearson Education*, 803–806.

Haan J, Kooi WJ (2000) Does central bank independence really matter?: New evidence for developing countries using a new indicator. *J Bank Financ* 24: 643–664. https://doi.org/10.1016/S0378-4266(99)00073-4

Hartzell JC, Starks LT (2003) Institutional investors and executive compensation. *J Financ* 58: 2351–2374. https://doi.org/10.1046/j.1540-6261.2003.00608.x

Hermalin BE, Weisbach MS (1998) Endogenously chosen boards of directors and their monitoring of the CEO. *Am Econ Rev,* 96–118.

Houston JF, James C (1995) CEO compensation and bank risk Is compensation in banking structured to promote risk taking? *J Monet Econ* 36: 405–431. https://doi.org/10.1016/0304-3932(95)01219-2

Jensen MC, Meckling WH (1976) Theory of the firm: Managerial behavior, agency costs and ownership structure. *J Financ Econ* 3: 305–360. https://doi.org/10.1016/0304-405X(76)90026-X

Jokipii T, Milne A (2011) Bank capital buffer and risk adjustment decisions. *J Financ Stabil* 7: 165–178. https://doi.org/10.1016/j.jfs.2010.02.002

Karyani E, Utama S (2015) Ownership concentration and bank risk (A study on banking sectors in Indonesia). *J Econ Bus Account Ventura* 18: 189–200. https://doi.org/10.14414/jebav.v18i2.447

Keeley MC (1990). Deposit insurance, risk, and market power in banking. *Am Econ Rev,* 1183–1200.

Klomp J, De Haan J (2014) Bank regulation, the quality of institutions, and banking risk in emerging and developing countries: an empirical analysis. *Emerg Mark Financ Trade* 50: 19–40. https://doi.org/10.1080/1540496X.2014.1013874

Konishi M, Yasuda Y (2004). Factors affecting bank risk taking: Evidence from Japan. *J Bank Financ* 28: 215–232. https://doi.org/10.1016/S0378-4266(02)00405-3

Lane PR, Milesi-Ferretti GM (2011) The cross-country incidence of the global crisis. *IMF Econ Rev* 59: 77–110. https://doi.org/10.1057/imfer.2010.12

Larcker D, Tayan B (2020) *Corporate governance matters*, FT Press.

Lewellyn KB, Muller-Kahle MI (2012) CEO power and risk taking: Evidence from the subprime lending industry. *Corp Govern Int Rev* 20: 289–307. https://doi.org/10.1111/j.1467-8683.2011.00903.x

Lim EN, Mccann BT (2013) The influence of relative values of outside director stock options on firm strategic risk from a multiagent perspective. *Strateg Manage J* 34: 1568–1590. https://doi.org/10.1002/smj.2088

Lin KJ, Karim K, Hu R, et al. (2023) Fifty shades of CEO duality: CEO personal risk preference, duality and corporate risk-taking. *J Appl Account Res* 24: 425–441. https://doi.org/10.1108/JAAR-02-2022-0034

Linck JS, Netter JM, Yang T (2008) The determinants of board structure. *J Financ Econ* 87: 308–328. https://doi.org/10.1016/j.jfineco.2006.10.006

Lilienfeld-Toal UV, Ruenzi S (2014) CEO ownership, stock market performance, and managerial discretion. *J Financ* 69: 1013–1050. https://doi.org/10.1111/jofi.12139

Lu J, Boateng A (2018) Board composition, monitoring and credit risk: evidence from the UK banking industry. *Rev Quant Financ Account* 51: 1107–1128. https://doi.org/10.1007/s11156-017-0698-x

Mirzaei A, Moore T, Liu G (2013) Does market structure matter on banks' profitability and stability? Emerging vs. advanced economies. *J Bank Financ* 37: 2920–2937. https://doi.org/10.1016/j.jbankfin.2013.04.031

Nakano M, Nguyen P (2012) Board size and corporate risk taking: further evidence from Japan. *Corp Govern Int Rev* 20: 369–387. https://doi.org/10.1111/j.1467-8683.2012.00924.x

Palvia AA (2011) Banks and managerial discipline: Does regulatory monitoring play a role? *Q Rev Econ Financ* 51: 56–68. https://doi.org/10.1016/j.qref.2010.10.003

Pathan S (2009) Strong boards, CEO power and bank risk-taking. *J Bank Financ* 33: 1340–1350. https://doi.org/10.1016/j.jbankfin.2009.02.001

Pham DA, Hoang TPA (2022) Does corporate governance structure matter for firm financial performance? A system GMM panel analysis for Vietnam. *J Int Econ Manage* 20: 1–17. https://doi.org/10.38203/jiem.020.1.0001

Saadaoui Z (2011) Risk-based capital standards and bank behaviour in emerging and developed countries. *J Bank Regul* 12: 180–191. https://doi.org/10.1057/jbr.2010.26

Saunders A, Strock E, Travlos NG (1990) Ownership structure, deregulation, and bank risk taking. *J Financ* 45: 643–654. https://doi.org/10.1111/j.1540-6261.1990.tb03709.x

Sghaier A, Hamza T (2024) CEO power and risk taking: evidence from European banks mergers and acquisitions. *J Strategy Manage* 17: 655–687. https://doi.org/10.1108/JSMA-05-2024-0098

Srivastav A, Hagendorff J (2016) Corporate governance and bank risk-taking. *Corp Govern Int Rev* 24: 334–345. https://doi.org/10.1111/corg.12133

Stewart C, Matousek R, Nguyen TN (2016) Efficiency in the Vietnamese banking system: A DEA double bootstrap approach. *Res Int Bus Financ* 36: 96–111. https://doi.org/10.1016/j.ribaf.2015.09.006

Stiroh KJ (2006) A portfolio view of banking with interest and noninterest activities. *J Money Credit Bank,* 1351–1361.

Switzer LN, Wang J (2013) Default risk estimation, bank credit risk, and corporate governance. *Financ Mark Inst Instrum* 22: 91–112. https://doi.org/10.1111/fmii.12005

Tadele H, Kalyebara B (2020) CEO power and bank risk in the UAE. *Banks Bank Syst* 15: 117. https://doi.org/10.21511/bbs.15(3).2020.11

Tang J (2017) CEO duality and firm performance: The moderating roles of other executives and blockholding outside directors. *Eur Manage J* 35: 362–372. https://doi.org/10.1016/j.emj.2016.05.003

Tosi HL, Werner S, Katz JP, et al. (2000) How much does performance matter? A meta-analysis of CEO pay studies. *J Manage* 26: 301–339. https://doi.org/10.1177/014920630002600207

Useem M, Bowman EH, Myatt J, et al. (1993) US institutional investors look at corporate governance in the 1990s. *Eur Manage J* 11: 175–189. https://doi.org/10.1016/0263-2373(93)90041-F

Vallascas F, Hagendorff J (2013) CEO bonus compensation and bank default risk: evidence from the US and Europe. *Financ Mark Inst Instrum* 22: 47–89. https://doi.org/10.1111/fmii.12004

Victoravich L, Buslepp WL, Xu T, et al. (2011) CEO power, equity incentives, and bank risk taking. *Available at SSRN 1909547*. https://doi.org/10.2139/ssrn.1909547

Wooldridge JM (2002) Econometric analysis of cross section and panel data MIT press. *Cambridge, ma* 108: 245–254.

Yeyati EL, Micco A (2007) Concentration and foreign penetration in Latin American banking sectors: Impact on competition and risk. *J Bank Financ* 31: 1633–1647. https://doi.org/10.1016/j.jbankfin.2006.11.003

Zellner A, Theil H (1992) Three-stage least squares: simultaneous estimation of simultaneous equations, In: Raj, B., Koerts, J. (eds), *Henri Theil's contributions to economics and econometrics: econometric theory and methodology*, Springer, 147–178. https://doi.org/10.1007/978-94-011-2546-8_10

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