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The Impact of Derivatives and CEO Overpower on Bank Risk-Taking Behavior: Evidence from Vietnam

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Abstract

Purpose: This study investigates the impact of derivative instrument adoption and CEO overpower on bank risk-taking in Vietnam's emerging banking sector. It addresses a critical gap in the literature concerning how these combined factors influence bank risk profiles within the unique context of a developing financial market characterized by a nascent derivatives market and concentrated CEO influence.

Design/methodology/approach: Employing panel data from 38 Vietnamese commercial banks spanning 2009 to 2020, this research utilizes both Fixed Effect Models (FEM) and dynamic system Generalized Method of Moments (GMM) to analyze the nexus between financial derivatives, CEO overpower (proxied by salary, tenure, and ownership), and bank risk (measured by Z-score).

Findings: The empirical results indicate that increased use of derivatives is associated with reduced bank risk. Furthermore, higher CEO salaries and longer CEO tenures are found to discourage bank risk-taking. Conversely, greater CEO ownership correlates with increased bank risk. These core findings demonstrate robustness when tested with alternative risk proxies.

Research limitations/implications: While enhancing understanding of bank risk in an emerging market, this study is subject to data limitations stemming from the relatively small pool of publicly traded banks in Vietnam. This may affect the generalizability of the findings. Future cross-country analyses could address these constraints. Nevertheless, the study extends Corporate Hedging Theory and Agency Theory by providing empirical evidence from an under-researched transitional economy.

Practical Implications: The findings suggest two key policy directions: first, fostering transparent regulation and financial education to enable the effective use of derivatives for risk mitigation in Vietnam; second, implementing strong governance measures, including calibrated ownership thresholds and risk-aligned compensation and tenure practices, to manage the influence of CEO power on bank risk-taking.

Originality/value: This paper offers novel empirical evidence on the synergistic effects of derivatives and CEO overpower on bank risk within an emerging market. It contributes to decision sciences by providing nuanced insights into the complex decision-making processes, governance structures, and risk management practices pertinent to the banking industry in such economies, particularly where derivative markets are still developing.

Keywords: Derivatives; CEO Overpower; Bank Risk; GMM; Vietnam

JEL classifications: G20, G21, G28

1. Introduction

Effective risk management and robust corporate governance are paramount for banking sector stability, particularly in emerging economies undergoing rapid financial development and market liberalization. As these markets, such as Vietnam, integrate more sophisticated financial instruments like derivatives, understanding their interplay with existing governance structures, especially the influence of powerful Chief Executive Officers (CEOs), becomes critical. This study investigates the impact of derivative instrument usage and CEO overpower on bank risk-taking behavior within the specific context of Vietnam, an economy characterized by a nascent derivatives market and distinct corporate governance dynamics.

The Vietnamese banking sector has demonstrated a generally prudent approach to risk in recent years, navigating economic reforms and an evolving regulatory landscape (Vo, 2018). However, the introduction and increasing, albeit controlled, use of derivatives present both new opportunities for risk mitigation and potential challenges. Simultaneously, CEO characteristics such as substantial ownership, high compensation, or long tenure can significantly shape a bank's risk appetite. While extensive literature explores bank risk in developed markets, the combined influence of these nascent derivative markets and specific CEO power attributes on bank risk in transition economies like Vietnam remains significantly underexplored. This research gap motivates our investigation, as the unique institutional, economic, and regulatory environment in Vietnam may lead to risk-taking patterns distinct from those observed in more mature financial systems.

This study is further driven by the need for empirical evidence that can inform both academic theory and practical policy. Previous research has often examined derivatives or CEO power in isolation or focused predominantly on advanced economies with well-established regulatory frameworks and dispersed ownership (Acrey, et al., 2011; Bartram, et al., 2011). In contrast, Vietnam's developing derivatives market, evolving regulatory oversight, and instances of concentrated CEO ownership necessitate a tailored examination. By applying dynamic panel data analysis, specifically the Generalized Method of Moments (GMM), to a dataset of 38 Vietnamese commercial banks from 2009 to 2020, this study aims to provide robust empirical insights into how these interacting factors shape bank risk profiles, using the Z-score as a comprehensive measure of financial stability.

Our research makes several contributions to the existing literature. First, it provides novel empirical evidence on the synergistic effects of derivative usage and multiple dimensions of CEO overpower (salary, tenure, and ownership) on bank risk-taking specifically within the Vietnamese context. This fills a crucial void, as prior studies have largely overlooked this combined impact in similar emerging market settings. Second, by testing established theories such as Corporate Hedging Theory and Agency Theory in an underexplored institutional environment, our findings offer nuanced perspectives on their applicability and potential refinements for transitional economies. Third, the study employs robust econometric techniques (GMM) to address potential endogeneity and autocorrelation issues, enhancing the reliability of our findings, and utilizes liquidity risk as an alternative proxy to test the robustness of our main conclusions. From a decision sciences perspective, this research offers valuable insights into the complex decision-making processes underlying risk management and governance in banking, particularly when new financial instruments are introduced in evolving markets.

Practically, the findings of this study are pertinent for bank managers seeking to optimize risk management strategies involving derivatives and for policymakers aiming to design effective governance frameworks. Understanding how CEO power dynamics interact with derivative use can help in formulating policies that promote financial stability and responsible banking practices, mitigating excessive risk-taking stemming from concentrated CEO influence while encouraging prudent use of risk-mitigation tools.

The remainder of this paper is organized as follows: Section 2 reviews the relevant literature and develops our hypotheses. Section 3 describes the data and methodology. Section 4 presents and discusses the empirical results. Finally, Section 5 concludes the paper with a summary of findings, policy implications, and suggestions for future research.

2. Literature Review and Hypothesis Development

This section reviews the extant literature pertinent to bank risk-taking, the role of financial derivatives, and the influence of CEO characteristics. It synthesizes existing theories and empirical evidence to identify research gaps and provide the foundation for our hypotheses concerning the Vietnamese banking sector.

2.1. Measuring Bank Risk-Taking Behavior

The propensity for excessive risk-taking within the banking sector carries significant systemic implications, potentially leading to institutional failures and broader economic instability (García-Marco & Robles-Fernández, 2008). Consequently, the accurate quantification of bank risk-taking is a cornerstone of financial research. Various metrics have been employed in the literature. For instance, some studies utilize volatility-based measures such as the standard deviation of return on assets (SDROA) or return on equity (SDROE) to capture fluctuations in bank profitability as indicators of risk (e.g., Hamdi, et al., 2017). Other common proxies include non-performing loans (NPLs) to reflect credit risk (Tran, et al., 2022; Vuong & Nguyen, 2020).

However, a widely adopted and comprehensive measure, particularly for assessing insolvency risk, is the Z-score. The Z-score combines accounting data on profitability (ROA), leverage (equity-to-assets ratio), and earnings volatility (standard deviation of ROA) to estimate a bank's distance from insolvency (Khan, et al., 2017; Vo, 2018; Vuong, et al., 2023). A higher Z-score typically signifies greater financial stability and lower risk-taking. Given its comprehensive nature and construction from readily available accounting data, this study adopts the Z-score as its primary measure of bank risk, aligning with a significant stream of banking literature.

2.2. Derivatives and Bank Risk-Taking Behavior

The impact of financial derivatives on bank risk is a subject of ongoing debate, with theoretical arguments and empirical findings often diverging.

2.2.1. Derivatives as Risk-Reducing (Hedging) Instruments

Corporate Hedging Theory posits that firms, including banks, can use derivatives to mitigate various financial risks, thereby stabilizing cash flows and firm value (Candradewi et al., 2017). By hedging against market frictions such as interest rate volatility, exchange rate fluctuations, taxes, transaction costs, and information asymmetries, derivatives can reduce earnings volatility and overall risk exposure (Bartram et al., 2011; Zhang, 2009). Several empirical studies support this view, finding a negative correlation between derivative usage and firm risk (e.g., Bartram et al., 2011; Candradewi et al., 2017; Zhang, 2009). These studies suggest that the primary motivation for derivative use is hedging rather than speculation, particularly when considering the potential for firms with convex tax functions to smooth taxable income. This perspective implies that an increased and prudent use of derivatives should lead to a decrease in bank risk.

Based on Corporate Hedging Theory and the empirical evidence suggesting a risk-mitigating role for derivatives, we propose:

H1: There is a negative relationship between derivatives and bank risks in Vietnam.

2.2.2. Derivatives as Risk-Increasing (Speculative) Instruments

Conversely, some scholars argue that derivatives can also be used for speculative purposes, potentially amplifying a bank's risk exposure (Hairston & Brooks, 2019). If derivative positions are not appropriately matched with underlying assets or liabilities, they can introduce new, unhedged risks. Furthermore, the complexity of derivative instruments and their accounting treatment can reduce the transparency of financial reporting, making it challenging for investors and analysts to accurately assess a bank's true risk profile (Huan & Ghosh, 2017; Li & Marinč, 2014; Huan & Parbonetti, 2019). Inconsistencies in the application of derivative accounting rules and the potential for misinterpretation of derivative impacts can further exacerbate this issue. Studies by Huan and Parbonetti (2019) and Li and Marinč (2014), for example, found a positive association between derivative use and increased risk in banking institutions, highlighting these concerns. While our primary hypothesis aligns with the hedging perspective, acknowledging this alternative view is crucial for a balanced understanding.

2.3. CEO Overpower and Bank Risk-Taking Behavior

The influence of CEO power on corporate decision-making, including risk-taking, is a central theme in corporate governance research, often analyzed through the lens of Agency Theory. Agency theory highlights potential conflicts between managers (agents) and shareholders (principals), particularly regarding risk preferences. Managers, whose human capital and undiversified wealth are tied to the firm, may prefer lower risk than well-diversified shareholders who might favor higher-risk projects for greater returns (Pour, et al., 2023). However, a powerful CEO might be able to exert significant influence over the board and pursue strategies aligned with their personal risk preferences or incentives. We examine three key dimensions of CEO power: ownership, tenure, and salary.

2.3.1. CEO Ownership and Bank Risk

The "convergence of interests" hypothesis suggests that higher CEO share ownership aligns the CEO's financial interests with those of shareholders, incentivizing them to maximize firm value (Pathan, 2009). In some contexts, this alignment might lead CEOs to undertake riskier projects that offer higher potential returns, thereby increasing their own wealth alongside shareholder value. Pathan (2009) found a positive relationship between CEO ownership and bank risk, supporting this view. However, the effect of CEO ownership can be complex and context-dependent, potentially influenced by factors like institutional oversight and market conditions, which are particularly relevant in emerging economies like Vietnam.

Based on the "convergence of interests" hypothesis and supporting empirical evidence, we propose:

H2: There is a positive relationship between CEO ownership and bank risks in Vietnam.

2.3.2. CEO Tenure and Bank Risk

The impact of CEO tenure on risk-taking is ambiguous in the literature. Some studies suggest that longer-tenured CEOs, having accumulated firm-specific knowledge and power, might become entrenched and risk-averse to protect their established positions and accumulated wealth (Chen & Ebrahim, 2018, present an alternative view about younger CEOs). Conversely, Acrey, et al. (2011) found a positive effect of tenure on risk, perhaps as retiring CEOs focus on short-term gains. However, a compelling stream of research, consistent with aspects of agency theory, argues that longer-tenured CEOs build substantial influence over their boards, which can reduce the board's monitoring effectiveness but also grant managers the autonomy to pursue less risky strategies to preserve their long-term financial interests and reputation (Sheikh, 2019; Tadele & Kalyebara, 2020). This latter perspective suggests that increased managerial discretion, accrued through tenure, may lead to more cautious behavior.

Drawing from studies that find a risk-reducing effect of CEO tenure through increased managerial autonomy and wealth preservation incentives, we propose:

H3: There is a negative relationship between CEO tenure and bank risks in Vietnam.

2.3.3. CEO Salary and Bank Risk

CEO compensation structure, particularly the fixed component (salary), can also influence risk-taking. Agency theory suggests that managers with high fixed compensation may become more risk-averse to safeguard these guaranteed cash flows. Fortin, et al. (2010) found that higher CEO salaries are negatively related to bank risk, arguing that CEOs receiving larger fixed cash flows are more inclined to protect this income stream by undertaking less risk. This behavior aligns with the preferences of risk-averse individuals who prioritize stability when faced with uncertainty. Such a stance might lead to more prudent investment decisions and a reluctance to engage in high-risk ventures that could jeopardize their secure income. This implies that high base salaries might exacerbate agency problems if managers become less willing to take risks that diversified shareholders would prefer.

Based on agency theory and empirical findings such as Fortin et al. (2010), we propose:

H4: There is a negative relationship between CEO salary and bank risks in Vietnam.

3. Data and methodology

3.1 Data

Our dataset encompasses 38 Vietnamese banks spanning the period from 2009 to 2020. We collect information from reputable databases such as Vietstock and audited financial statements. We follow Vuong, et al. (2023) to winorize data at the 1st and 99th percentiles to overcome the outlier issues. Additionally, observations with insufficient data for requisite variable computation are excluded, adhering to the methodology of Duong, et al. (2023) and Vuong, et al. (2023). The final sample is an unbalanced panel with 239 annual observations.

Prior to estimation, we conducted Fisher-type panel unit root tests to assess the stationarity of all variables. The results indicate that all variables are integrated of order one (I(1)), meaning they are non-stationary at the level but become stationary after first differencing. To address this issue and avoid the risk of spurious regression, we transform all variables into their first-differenced form.

Accordingly, all variables used in the analysis, including the dependent variable (Z-score), the derivatives proxies (FX DERIVATIVE, FX_SWAP, INTEREST_SWAP), the CEO power proxies (CEOS, CEOO, CEOT), and the control variables (LEV, AGE, SIZE, and B_IND) are used in their first-differenced versions. We also re-estimated all relevant analyses, including descriptive statistics, the correlation matrix, and all regression models, based on the first-differenced data to ensure methodological consistency and robustness of inference.

3.2. Variable definitions

3.2.1 Z-score Index

According to Vuong, et al. (2023), Vo (2018), and Khan, et al. (2017), the Z-score is used to describe the financial condition of banks. These studies show that banks are more stable and less risky with a higher Z-score. Vuong, et al. (2023) also demonstrated that a higher Z-score indicates that banks are less risky and more stable. The Z-score, a well-known risk indicator representing the stability of banks, reflects the likelihood of a distinct institution's bankruptcy and is specifically used to estimate bankruptcy risk at the bank level. Furthermore, we follow Vuong, et al. (2023), who indicated that the Z-score is inversely related to bankruptcy risk, with a higher Z-score implying better bank stability and lower bankruptcy risk.

$$Z\text{-}score_{i,t} = \frac{ROA_{i,t} + \frac{TE_{i,t}}{TA_{i,t}}}{\sigma ROA_{i,t}}.$$

In this formula, $ROA_{i,t}$ and $\sigma ROA_{i,t}$ represent the return on assets and its standard deviation, respectively, for bank i at time t. TE and TA refer to the bank's total equity and assets, respectively.

3.2.2 Derivatives contract

Following Titova, et al. (2020), we define the futures derivative contract (DERI) as the initial value of the derivative contract divided by total assets. There are three derivative contracts: the FX derivatives contracts, FX Swap, and Interest rate Swap contracts (Bartram, et al., 2011; Zhang, 2009). Data on financial derivative contracts has been carefully collected from the annual reports of commercial banks in our study.

3.2.3 CEO Power Proxies

Following Duong, et al. (2023) and Duong, et al. (2024), we collect the three proxies of CEO power: CEO salary (CEOS), CEO ownership (CEOO), and CEO tenure (CEOT). The CEO's salary is the base salary scaled by the natural log of total assets (Fortin, et al., 2010). CEO ownership is the proportion of shares owned by the CEO of the bank (Pathan, 2009; Tadele & Kalyebara, 2020). The CEO tenure is the number of years since the appointment of the CEO (Tadele & Kalyebara, 2020). Duong, et al. (2023) and Duong, et al. (2024) argue that CEOs gain more power with a higher salary, ownership, and longer tenure.

3.2.4 Control variables

There are four control variables in this study. We follow Duong, et al. (2023) and Bierth, et al. (2015) to construct the leverage ratio (LEV) as the total Liabilities divided by Total Assets. The bank age (AGE) is the years after its establishment (Bansal & Singh, 2021; Vuong, et al., 2023). The bank size is estimated as the logarithm of total assets (Duong, et al., 2024; Laeven, et al., 2016; Tran, et al., 2022). Finally, the board independent variable (B_IND) is the number of independent directors in the board of directors (Marie, et al., 2021).

3.3 Model Construction

Ghosh (2017), Hairston and Brooks (2019), Huan and Parbonetti (2019), and Li and Marinč (2014) identified an elevated risk associated with an increase in derivatives usage. Conversely, Bartram, et al. (2011), Candradewi, et al. (2017), and Zhang (2009) have reported a contradictory negative correlation between these variables. Furthermore, Pathan (2009) found a statistically significant positive relationship between CEO ownership, CEO tenure, and bank risk, while Acrey, et al. (2011) and Chen and Ebrahim (2018) discovered that CEO tenure has a beneficial effect on risk. Consequently, we follow the above studies to construct the following models to examine the relationship between derivatives and bank risk:

$$\text{Z\_SCORE}_{i,t} = \beta_0 + \beta_1 \text{FX\_DERIVATIVE}_{i,t} + \beta_2 \text{CEOPOWER}_{i,t} + \sum \beta_q control_{i,t} + \gamma_i + \tau_t + \varepsilon_{i,t}; \quad (1)$$

$$\text{Z\_SCORE}_{i,t} = \beta_0 + \beta_1 \text{FX\_SWAP}_{i,t} + \beta_2 \text{CEOPOWER}_{i,t} + \sum \beta_q control_{i,t} + \gamma_i + \tau_t + \varepsilon_{i,t}; \quad (2)$$

$$\text{Z\_SCORE}_{i,t} = \beta_0 + \beta_1 \text{INTEREST\_SWAP}_{i,t} + \beta_2 \text{CEOPOWER}_{i,t} + \sum \beta_q control_{i,t} + \gamma_i + \tau_t + \varepsilon_{i,t}, \quad (3)$$

where Z-score represents the bank risk (Khan, et al., 2017). Independent variables are FX DERIVATIVE, FX SWAP, and INTEREST SWAP. CEOPOWER includes CEO salary (CEOS), CEO

ownership (CEOO), and CEO tenure (CEOT). The control variables are leveraging ratio (LEV), firm age (AGE), Firm size (SIZE), and the number of independent directors (B_IND). Furthermore, the subscript character "i" is firm-specific, and "t" is year-specific. β_0 is the intercept. γ_i is the firm fixed effect controls for the unique effect of firm-specific and time-invariant unobservables. τ_t is the year-fixed effect, which controls for factors changing each year common to all cities for a given year. ε_{it} is the residual value. Appendix A contains all variable definitions.

3.3. Estimation Methods

In this study, we utilize various estimation methods and diagnostic tests to ensure the robustness and validity of our analysis, all while drawing upon existing research as cited. Our primary estimation techniques encompass Ordinary Least Squares (OLS) for linear regression, the Fixed Effect Model (FEM) to account for unobservable entity-specific factors, and the Random Effect Model (REM) for instances where these factors are considered random. We employ the Hausman Test and Redundant Fixed Effects Tests, as suggested by Duong, et al. (2023), to guide our choice between FEM and REM. As a result, the Fixed Effect Model (FEM) is deemed more appropriate than the Random Effect Model (REM). Borenstein, et al. (2010) highlight limitations in FEM, particularly concerning low confidence intervals and dissimilarity in weights. We take precautions to address potential issues such as autocorrelation and heteroskedasticity through the Durbin-Watson and Wald tests.

Following Duong, et al. (2023), Tran, et al. (2022), and Vuong, et al. (2023), we also implement dynamic system Generalized Methods of Moments (GMM) estimations to mitigate concerns related to autocorrelation and heteroskedasticity. These GMM estimations are renowned for their robustness against failures in auxiliary distributional assumptions, which are not necessarily required to identify crucial parameters. Lastly, in alignment with Imbierowicz and Rauch (2014), we conduct an analysis involving dependent Liquidity risk to validate the consistency and accuracy of our obtained results across different dependent variables. Through this comprehensive methodological approach, we aim to ensure the reliability and integrity of our research findings.

4. Empirical Results and Discussion

4.1 Descriptive statistics

Table 1 shows the outcome variables' observations (N), mean, and median. The provided descriptive statistics offer insights into the central tendencies of various financial and governance variables. Table 1 presents the descriptive statistics for all variables, and there are 239 observations at 38 banks in Vietnam for the report after analysis. Notably, the average values highlight key attributes: FX_DERIVATIVE has a mean of 3.230, FX_SWAP stands at 17.802, and INTEREST_SWAP averages 0.658. On the governance front, CEO ownership is 1.463, CEO salary is 21.324, and CEO tenure averages 3.224 years. Financial structure indicators include a mean leverage of 0.913, while the banks' average age and size are 282.607 months and 14.061, respectively. Additionally, the dataset indicates an average number of independent directors of 0.958. This array of metrics furnishes a comprehensive snapshot of factors crucial to understanding the financial and governance landscape of the entities under examination, contributing to a holistic view of their risk dynamics.

Table 1. Descriptive statistics

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	N
Z_SCORE	27.202	20.672	200.725	3.063	29.784	239
FX_DERIVATIVE	3.230	0.000	172.348	0.000	38.236	239
FX_SWAP	17.802	0.000	421.828	0.000	81.664	239
INTEREST_SWAP	0.658	0.000	62.006	0.000	6.860	239
CEOO	1.463	0.010	24.090	0.000	4.061	239
CEOS	21.324	13.654	102.178	1.360	20.138	239
CEOT	3.224	3.000	11.710	0.000	0.420	239
LEV	0.913	0.920	1.523	0.420	0.121	239
AGE	282.607	276.000	726.360	24.000	24.000	239
SIZE	14.061	14.030	15.150	13.120	0.520	239
B_IND	0.958	1.000	3.000	0.000	0.571	239

Note: Table 1 presents the descriptive statistics of our variables. Our data set comprises 38 Vietnamese banks from 2009 to 2020, including 239 observations. All the variable definitions are in Appendix A.

4.2 Pearson Correlation Matrix

Table 2 displays the Pearson correlation matrix, examining the pairwise linear relationships between all variables in our study. All correlation coefficients are below 1, which confirms the absence of perfect linear dependencies among the variables. Notably, the highest positive correlation is 0.6722, observed between FX_DERIVATIVE and FX_SWAP, suggesting a relatively strong positive relationship between foreign exchange derivatives and foreign exchange swaps. While noticeable, this correlation remains below the commonly accepted threshold of 0.8, indicating that these variables are not so highly correlated that multicollinearity would be a significant concern. Additionally, the correlation matrix reveals some other relationships that are worth mentioning. For example, the correlations between FX_DERIVATIVE and FX_SWAP with bank size (SIZE) are also positive, as are the correlations between the three CEO power variables. Conversely, the correlation between Z-score and LEV is negative, indicating a negative relationship between leverage and bank stability.

To further assess multicollinearity, we employed the Variance Inflation Factor (VIF) test, and the results are reported in Table 3. VIF values, which measure how much the variance of a regression coefficient is inflated due to multicollinearity, range from a low of 1.076 (for FX_DERIVATIVE) to a high of 2.338 (for SIZE), with a mean VIF of 1.444. These VIF values are all well below the common thresholds of 5 or 10, which are often considered to indicate that multicollinearity is not a serious concern. Given these low VIF values, we conclude that our regression models are unlikely to be significantly impacted by multicollinearity issues, thereby supporting the robustness of our analysis. These findings are consistent with other studies in the literature, such as Duong, et al. (2023), Tran, et al. (2022), and Vuong, et al. (2023), that have used similar analytical approaches in financial settings.

Table 2. Pearson Correlation Matrix

Variable	Z_SCORE	LIQUIDITY_RISK	FX_DERIVATIVE	FX_SWAP	INTEREST_SWAP	CEOO	CEOS	CEOT	LEV	AGE	SIZE	B_IND
Z_SCORE	1											
LIQUIDITY_RISK	-0.0868	1										
	(0.1729)											
FX_DERIVATIVE	0.0240	0.0698	1									
	(0.7126)	(0.2835)										
FX_SWAP	-0.0470	0.0729	0.0276	1								
	(0.4700)	(0.2623)	(0.6722)									
INTEREST_SWAP	-0.0261*	0.0313	0.1166*	0.3084***	1							
	(0.0689)	(0.6306)	(0.0726)	(<0.001)								
CEOO	-0.0027	0.0541	0.0507	0.2443***	0.3143	1						
	(0.09665*)	(0.4059)	(0.4361)	(0.0001)	(<0.0001)							
CEOS	0.1835***	0.1062	0.0307	0.0606	0.0820	-0.0616	1					
	(0.0045)	(0.1022)	(0.6378)	(0.3521)	(0.2074)	(0.3439)						
CEOT	-0.1398 **	0.1001	0.0959	0.0302	0.0189*	-0.0397	0.1268 **	1				
	(0.0311)	(0.1235)	(0.1400)	(0.6467)	(0.07717)	(0.5421)	(0.0507)					
LEV	-0.2195 ***	0.0870	0.1560**	0.2299 ***	0.0233	-0.0411	0.0428	0.1690 ***	1			
	(0.0006)	(0.1809)	(0.0160)	(0.0003)	(0.7205)	(0.5276)	(0.5115)	(0.0090)				
AGE	-0.2410 ***	0.1266*	0.1757 ***	0.2033 ***	0.0115	0.0144	0.0455	0.1560 **	0.4778 ***	1		
	(0.0002)	(0.0511)	(0.0066)	(0.0016)	(0.08594)	(0.8247)	(0.4851)	(0.0160)	(<0.001)			
SIZE	0.0275	0.1468 **	0.1401 **	0.2803 ***	0.1390 **	0.2022 ***	0.2338 ***	-0.0717	0.3553 ***	0.6543 ***	1	
	(0.6631)	(0.0235)	(0.0308)	(<0.001)	(0.0321)	(0.0017)	(0.0003)	(0.2705)	(<0.001)	(<0.001)		
B_IND	-0.0964	-0.0562	-0.0005*	-0.0021*	-0.0130*	0.0399	0..3070 ***	0.0801	0.1376 **	0.1461 **	0.0966	1
	(0.168)	(0.3879)	(0.0993)	(0.0973)	(0.08419)	(0.5501)	(<0.001)	(0.2185)	(0.0338)	(0.0242)	(0.1375)	

Note: Table 2 reports the Pearson correlations between variables. All the variable definitions are in Appendix A. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. P-values are in parentheses.

Table 3. Variance Inflation Factors

Variable	Centered VIF
FX_DERIVATIVE	1.076
FX_SWAP	1.262
INTEREST_SWAP	1.240
CEOO	1.244
CEOS	1.313
CEOT	1.160
LEV	1.388
AGE	2.262
SIZE	2.338
B_IND	1.157

Note: Table 3 reports Variance Inflation Factors. All the variable definitions are in Appendix A.

4.3 The regression results using the Fixed Effects Models.

The regression results using the Fixed Effects Model (FEM) are presented in Table 4. Following Duong, et al. (2023) and Tran, et al. (2022), we employed essential diagnostic tests, including the Hausman and Redundant Fixed Effects tests, to determine the most appropriate estimation method. These test results, with p-values less than 0.001, strongly suggest that FEM is the most suitable estimation method compared to pooled OLS and Random Effects Models (REM)— The Adjusted R-squared values are considerably high in all three models (0.9605, 0.9604, and 0.9604 respectively), indicating that the models explain approximately 96% of the variance in bank risk (Z-score). These values reflect a strong goodness of fit and suggest that the independent variables capture most of the variation in the dependent variable. However, the low Durbin-Watson statistics and the implied Wald test results (reported in Table 4) suggest that FEM estimations may suffer from both heteroskedasticity and autocorrelation. To address this, we performed a unit root test, and the results are in Appendix B. The unit root test results, particularly those at the level, indicate that CEO power proxies (CEOO, CEOS, CEOT) and board independence (B_IND) are non-stationary at all levels. Thus, to address these issues, we re-estimated the models by employing the Generalized Method of Moments (GMM) estimation technique, as suggested by Duong, et al. (2023), Le, et al. (2023), Marie, et al. (2021), Tran, et al. (2022), and Vuong, et al. (2023).

Table 4. FEM estimation results

Variable	Model (1)	Model (2)	Model (3)
FX_DERIVATIVE	0.0072		
	(0.5217)		
FX_SWAP		0.0007*	
		(0.0801)	
INTEREST_SWAP			0.0044***
			(0.0003)
CEOO	-0.2448	-0.2503	-0.2414
	(0.3732)	(0.3774)	(0.3804)
CEOS	0.2540***	0.2597***	0.2620***

	(<0.0001)	(<0.0001)	(<0.0001)
CEOT	0.0365	0.0425	0.0415
	(0.8930)	(0.8756)	(0.8787)
LEV	-12.7731	-12.279	-12.3800
	(0.1045)	(0.1196)	(0.1148)
AGE	-0.0355	-0.0338	-0.0340
	(0.2190)	(0.2420)	(0.2386)
SIZE	-21.6442***	-21.9593***	-21.9858***
	(<0.0001)	(<0.0001)	(<0.0001)
B_IND	-0.1624	-0.2038	-0.2033
	(0.8608)	(0.8257)	(0.8263)
Hausman Test	<0.001	<0.001	<0.001
Redundant Fixed Effects Tests	<0.001	<0.001	<0.001
R-squared	0.9673	0.9672	0.9672
Adjusted R-squared	0.9605	0.9604	0.9604
F-statistic	142.1230	141.8296	141.8200
Prob(F-statistic)	<0.001	<0.001	<0.001
Durbin-Watson test	0.708	0.675	0.658
N	239	239	239
Wald test (Prob.)	<0.001	<0.001	<0.001
Durbin Watson Statistics	0.1702	0.1728	0.175

Note: This table represents the regression results using the Fixed Effects Model. All the variable definitions are in Appendix A. The symbols ***, **, and * represent the significant level at 1%, 5%, and 10%, respectively. The p-values are in parentheses.

4.4. Stationarity Tests

To ensure valid statistical inference and avoid spurious problems, we perform the stationarity tests of all variables prior to estimation. Wong and Yue (2024) and Wong and Pham (2025) report that combining variables of different integration orders may lead to spurious issues, and the traditional test statistics cannot be used, especially in panel data regressions. Wong et al. (2024) and Cheng et al. (2021, 2022) further highlight the importance of verifying integration properties to avoid misleading inferences in nearly non-stationary environments. We applied the Fisher-type unit root test based on the Phillips–Perron approach, which is suitable for unbalanced panels and accommodates cross-sectional heterogeneity. As all variables were found to be non-stationary at the level, we transformed them into their first differences. The results, reported in Table 5, indicate that all variables are stationary at first difference, confirming that they are integrated of order one (I(1)).

Table 5. Fisher-type test for variables

Variable	**Inverse χ^2 (p)**	**Inverse Z (p)**	**Inverse logit t (p)**	**Modified inv. χ^2 (p)**
Z_SCORE	252.217***	-3.535***	-7.119***	14.649***
FX_DERIVATIVE	179.475***	-7.489***	-10.768***	8.670***
FX_SWAP	245.321***	-9.012***	-14.432***	14.082***
INTEREST_SWAP	107.794***	-5.978***	-10.315***	2.777***
CEOO	300.158***	-6.022***	-15.607***	19.552***
CEOS	341.360***	-12.289***	-15.185***	21.976***
CEOT	241.081***	-3.872***	-8.081***	13.734***

LEV	375.890***	-7.200***	-16.109***	25.852***
AGE	2460.796***	-46.245***	-113.168***	196.193***
SIZE	120.243***	-4.643***	-5.580***	7.373***
B_IND	236.099***	-11.921***	-14.231***	13.324***

Note: All variables are in first differences. Unit root tests are based on the Fisher-type PP method. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The stationarity of all variables at their first-difference levels justifies the use of differenced data in the analysis. Consequently, the Generalized Method of Moments (GMM) estimator is employed to obtain consistent and efficient parameter estimates while addressing potential concerns related to endogeneity and dynamic panel bias inherent in the regression framework.

To assess the presence of autocorrelation prior to conducting residual-based stationarity tests, we calculated the Durbin–Watson (DW) statistic. Table 3 reports that the DW statistic has a value of 0.7088, 0.6758, and 0.6583 for Models 1, 2, and 3, respectively. This is substantially below the benchmark value of 2, indicating a high degree of positive serial correlation in the residuals. According to the time series econometrics literature, DW statistics that deviate considerably from 2, typically values below 1.5 or above 2.5, suggest the presence of serial correlation and, in some cases, may point to non-stationarity in the residual series. In light of these findings and consistent with the methodological approaches of Hui et al. (2017) and Cheng et al. (2021), we subsequently conducted panel unit root tests on the residuals to further assess the robustness and validity of the estimated models.

Table 6. Unit Root Test Results for Residuals of FEM estimations

Test Method	**Model 1**	**Model 2**	**Model 3**
Levin–Lin–Chu (LLC)	-141.138***	-139.799***	-135.449***
Im–Pesaran–Shin	-46.675***	-44.535***	-47.169***
ADF–Fisher	308.564***	304.744***	304.249***
PP–Fisher	346.647***	354.954***	337.590***

Note: This table reports the results of unit root tests applied to the residuals of three panel regression models. All tests are based on the Levin–Lin–Chu (LLC), Im–Pesaran–Shin (IPS), ADF–Fisher, and PP–Fisher methods. p-values are reported in parentheses. All significance levels are at 1%.

Table 6 shows that the residuals from all three models are stationary at level (I(0)). This confirms that the models are not affected by spurious regression and suggests the presence of cointegration relationships among the I(1) variables (Wong & Yue, 2024). Therefore, the use of differenced data in the analysis is statistically valid. Based on these findings, we proceed with the Generalized Method of Moments (GMM) estimation to address potential endogeneity and dynamic panel bias.

4.5. GMM Estimation Results

Table 7 reports the diagnostic results from the Generalized Method of Moments (GMM) estimations. The Hansen J-statistic p-values for Models 1, 2, and 3 are 0.246, 0.342, and 0.290, respectively, all exceeding the 10% significance threshold. These results suggest that the overidentifying restrictions are not rejected, thereby affirming the validity of the instrumental variables and indicating that endogeneity is unlikely to bias the estimations. The instruments employed include lagged values of Z-score, FX Derivative, FX Swap, Interest Swap, and CEO characteristics (CEOO, CEOS, and CEOT).

Furthermore, the Arellano-Bond test for first-order serial correlation [AR(1)] yields significant p-values, which is consistent with expectations due to first-differencing of the data. In contrast, the AR(2) test results are statistically insignificant, providing no evidence of second-order serial correlation and supporting the robustness of the model specification.

Table 7 shows a statistically significant positive relationship between the derivatives (FX Derivative, FX Swap, and Interest Swap) and the Z-score across all models. This indicates that increased derivative use is associated with decreased bank risk. These results align with the findings of Bartram, et al. (2011), Candradewi, et al. (2017), and Zhang (2009) and support the corporate hedging theory. These scholars maintain that firms may use derivatives to hedge against various market frictions, including taxes, transaction fees, information asymmetry, and agency issues. Moreover, firms employing a convex tax function can reduce expected tax liability by smoothing taxable income through hedging. Finally, their research shows that firms that use financial derivatives have lower cash flow volatility, total risk, and market risk. Taken together, these results support the view that, on average, firms use derivatives for hedging purposes rather than speculation (Bartram, et al., 2011). Therefore, our results support Hypothesis 1.

Table 7 also shows a negative association between CEO ownership and the Z-score (significant in models 1 and 2). This implies a positive association between CEO ownership and bank risk. This aligns with Pathan (2009) and the convergence of interests hypothesis. This theory suggests that higher CEO ownership aligns the CEO's economic interests with the shareholders, incentivizing the CEO to take on greater risk to maximize firm value and, thus, their holdings. Therefore, our results support Hypothesis 2.

Table 7. GMM estimation results

Variable	Model (1)	Model (2)	Model (3)
Z_SCORE(-1)	0.6183***	0.6310***	0.6512***
	(<0.001)	(<0.001)	(<0.001)
FX_DERIVATIVE	0.0247***		
	(0.0051)		
FX_SWAP		00.0154***	
		(0.0014)	
INTEREST_SWAP			0.0738*
			(0.0663)
CEOO	-0.2161***	-0.3760***	-0.4266
	(<0.001)	(<0.001)	(0.2117)
CEOS	0.1608**	0.2511***	0.2828***
	(0.0630)	(<0.001)	(<0.001)
CEOT	0.5573***	0.6151***	0.63304***
	(<0.001)	(<0.001)	(<0.001)
LEV	-42.9423***	-44.4900***	-44.996***
	(<0.001)	(<0.001)	(<0.001)
AGE	0.2260***	0.2063***	0.2251***
	(<0.001)	(<0.001)	(<0.001)
SIZE	-57.9719***	-56.507***	-60.7510***

	(<0.001)	(<0.001)	(<0.001)
B_IND	3.7102***	3.8192***	3.5604***
	(<0.001)	(<0.001)	(<0.001)
AR(1) test (p-value)	0.004	0.005	0.001
AR(2) test (p-value)	0.962	0.945	0.978
Cross-sectional fixed effect	Yes	Yes	Yes
J-statistic	25.384	25.0856	27.7632
Prob(J-statistic)	0.3851	0.4011	0.2701
N	203	203	203
Instrument Rank	33	33	33

Note: This table shows the GMM estimation results. All the variable definitions are in Appendix A. The symbol ***, **, and * represents the significant level at 1%, 5%, and 10%, respectively. The p-values are in parentheses.

Our research corroborates the findings of Sheikh (2019) and Tadele and Kalyebara (2020), who observed a notable decrease in risk associated with extended CEO tenure. This finding aligns with agency theory, implying that CEOs with prolonged tenures establish commanding influence within their boards, decreasing the board's regulatory power. Consequently, it enhances managerial independence and curtails CEO risk propensity, driven by the motivation to safeguard their financial stakes. Our results support Hypothesis 3.

Our study supports Fortin, et al. (2010), indicating a negative correlation between CEO salary and bank risk. This finding suggests that CEOs with higher fixed cash flows exhibit risk-averse behavior, aiming to protect their earnings. Similar to risk-averse individuals, these CEOs prioritize stability and approach uncertainty cautiously. Increased fixed cash flows, such as larger salaries, lead to a focus on income consistency. Banks led by risk-averse CEOs tend to make prudent decisions, avoiding high-risk ventures that could jeopardize fixed earnings. This result aligns with agency theory, implying that higher CEO base pay exacerbates the agency problem, causing managers to reduce risk. Our results support Hypothesis 4.

Table 7 demonstrates that increasing the leverage ratio leads to additional bank risks. Our findings align with Bierth, et al. (2015) and Chang, et al. (2018), who elucidate that the relationship is rooted in the understanding that leverage, representing the share of a bank's capital financed through debt, can amplify gains and magnify losses from the bank's underlying assets. They underscore the systemic consequences of this dynamic, suggesting that higher leverage in banks heightens the potential for adverse outcomes. This can propagate losses more extensively throughout the financial system due to interconnectedness and contagion effects.

The outcomes of this study put forward the notion that well-established companies tend to demonstrate diminished levels of risk attributed to their accrued experience in risk management practices. These findings are congruent with those of Akbar, et al. (2017) and Quaye, et al. (2014), who similarly identify a positive correlation between the age of a firm and its financial stability. This linkage between firm age and risk mitigation underscores the significance of experiential knowledge in enhancing an insurance firm's overall risk profile and financial resilience.

Table 7 demonstrates a positive association between larger bank size and elevated levels of risk. This finding aligns with the conclusions drawn by Laeven, et al. (2016), who identify a significant positive relationship between bank size and the propensity for risk. This phenomenon is attributed to the advantageous position of large banks to receive fail subsidies, which may lead to a diminished focus on risk management practices. This, in turn, could result in these banks displaying a propensity for risk-taking behavior. Notably, the potential for externalities emerges from such risk-taking tendencies, as distress within these larger banks could engender ripple effects with implications for the broader financial system. This correspondence underscores the empirical consistency and reinforces the notion that the size of a bank is intertwined with its approach to risk-taking and its potential impact on systemic stability.

Table 7 reveals a negative correlation between an increased number of independent directors and reduced levels of risk. These findings are congruent with the results of Frankel, et al. (2011), affirming the principles of agency theory. They argued that including independent directors within corporate boards is linked to heightened corporate transparency and enhanced monitoring mechanisms. This concurrence underscores the empirical alignment of our results. It highlights the agency theory's premise that independent directors contribute to lower corporate risk levels through improved organizational transparency and monitoring.

4.6. Robustness Test

In this section, we follow Imbierowicz and Rauch (2014) by using an alternative measure of risk, liquidity risk, calculated as the ratio of total loans to total deposits. This allows us to examine the robustness of our main findings. The results in Table 6 show that, consistent with the main findings, increases in the use of FX derivatives and FX swaps are associated with statistically significant increases in liquidity risk, which implies these derivatives are associated with increased risk. However, unlike the main results, using interest rate swaps is negatively associated with liquidity risk, but this is not statistically significant.

Regarding the CEO power variables, the findings are somewhat different. CEO ownership is negatively and significantly associated with liquidity risk in the two models. This analysis suggests that higher CEO ownership is associated with lower risk. Furthermore, while the main results indicated a negative relationship between CEO salary and risk, in this analysis, higher CEO salary is associated with higher liquidity risk, as shown by the positive and significant coefficients in Models 1 and 3. However, also inconsistent with the main results, we found that CEO tenure has a statistically significant negative association with liquidity risk, meaning higher CEO tenure is associated with lower risk.

Table 8. Robustness test results

Variables	Model (1)	Model (2)	Model (3)
LIQUIDITY_RISK (-1)	0.4633***	0.4515***	0.4918***
	(<0.001)	(<0.001)	(<0.001)
FX_DERIVATIVE	0.0006***		
	(<0.001)		
FX_SWAP		0.0002**	

		(0.0258)	
INTEREST_SWAP			-0.0034
			(0.886)
CEOO	-0.0382***	-0.0236**	-0.0079
	(<0.001)	(0.0301)	(0.5927)
CEOS	0.0031	0.0032	0.0070**
	(0.2460)	(0.2205)	(0.0159)
CEOT	-0.0219***	-0.0225***	-0.0259***
	(<0.001)	(0.0093)	(0.0089)
LEV	-0.8119***	-0.7479***	0.9751***
	(<0.001)	(0.0020)	(<0.001)
AGE	0.0017	0.0007	0.0008
	(0.1294)	(0.4348)	(0.3740)
SIZE	-0.5416***	-0.3411**	-0.4459***
	(0.0009)	(0.0155)	(<0.001)
B_IND	0.1454***	0.1334***	0.1409***
	(0.0009)	(0.0010)	(<0.001)
Cross-sectional fixed effect	Yes	Yes	Yes
J-statistic	20.9370	20.1870	27.3819
Prob(J-statistic)	0.6424	0.6861	0.2870
N	201	201	201
Instrument Rank	33	33	33

Note: This table shows the robustness result of the GMM regression method. All the variable definitions are in Appendix A. The symbol ***, **, and * represents the significant level at 1%, 5%, and 10%, respectively. The p-values are in parentheses.

5. Conclusions

This study investigated the complex interplay between derivative instrument utilization, CEO overpower, and bank risk-taking behavior within Vietnam's evolving banking sector, particularly during the early stages of its domestic derivatives market. Motivated by the unique socioeconomic and regulatory landscape of Vietnam and a scarcity of empirical research in this specific domain, we analyzed data from 38 Vietnamese commercial banks between 2009 and 2020 by using Fixed Effect Models and dynamic system GMM estimations.

Our empirical findings reveal several key insights. First, consistent with Corporate Hedging Theory, we find that increased usage of financial derivatives (FX Derivatives, FX Swaps, and Interest Swaps) is significantly associated with a reduction in bank risk, as measured by the Z-score. This suggests that, on average, Vietnamese banks utilize these instruments for hedging purposes rather than speculation. Second, regarding CEO influence, our results support the Agency Theory that higher CEO salaries and longer CEO tenures are correlated with lower bank risk-taking, indicating a preference for stability among more established and well-compensated executives. Conversely, and aligning with the 'convergence of interests' hypothesis in specific contexts, we find that greater CEO ownership is positively associated with increased bank risk, suggesting that substantial equity stakes may incentivize CEOs to pursue riskier strategies. These core findings largely hold when robustness is

tested by using an alternative liquidity risk proxy, although some nuances emerge, particularly concerning the CEO's salary's impact on liquidity risk.

Theoretically, this research enriches the literature by extending established theories to the context of an emerging market with a developing derivatives landscape. We provide evidence that the principles of corporate hedging can apply even in nascent markets and that the facets of CEO power—salary, tenure, and ownership—have distinct and sometimes countervailing impacts on bank risk, underscoring the need for context-specific applications of agency theory. Methodologically, the application of GMM addresses potential endogeneity and offers a robust approach for similar studies in data-constrained environments.

From a practical standpoint, our findings offer important policy implications. To effectively harness derivatives for risk reduction in Vietnam, policymakers should prioritize transparent regulation, promote inter-bank collaboration, and enhance financial education regarding these instruments. Furthermore, to mitigate potential risks associated with CEO influence, particularly ownership, strong corporate governance mechanisms are crucial. This includes potentially calibrated ownership thresholds, enhanced board oversight, and compensation and tenure structures aligned with prudent, long-term risk management practices rather than short-term profit maximization.

Despite its contributions, this study acknowledges certain limitations, primarily related to data availability for publicly traded banks in Vietnam, which is smaller than in more developed economies. This may temper the broad generalizability of our findings. Future research could aim to overcome these constraints through cross-country analyses within emerging markets. Moreover, future investigations could delve deeper into the moderating role of institutional quality on the observed relationships or examine the specific impact of different types of derivative contracts under varying governance and regulatory stringencies. Exploring the behavioral aspects influencing CEO risk preferences in such transitional economies would also be a valuable avenue for further study.

In sum, this research provides valuable empirical evidence on the determinants of bank risk-taking in Vietnam, offering a more nuanced understanding of how financial innovation and corporate governance interact in an emerging economy. The insights generated can contribute to fostering greater financial stability and promoting responsible banking practices as Vietnam's financial system continues to mature.

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Appendices

Appendix A. Variable definitions

Variables	Notation	Variable descriptions
Dependent variable		
Z-score	Z_SCORE	Z-score is the total return on assets plus equity to assets divided by the standard deviation (Vuong, et al., 2023; Vo, 2018; Khan, et al., 2017).
Independent variables		
Derivative	FX DERIVATIVE	FX DERIVATIVE according to contract value (Bartram, et al., 2011).
	FX_SWAP	FX SWAP according to contract value (Zhang, 2009)
	INTEREST_SWAP	The instrument of choice for interest rate derivatives according to contract value (Bartram, et al., 2011).
CEO power	CEOS	CEO salary is the base salary scaled by the natural log of total assets (Fortin, et al., 2010).
	CEOO	The proportion of shares owned by the CEO of the bank. (Pathan, 2009; Tadele & Kalyebara, 2020)
	CEOT	The number of years since the appointment of the CEO. (Tadele & Kalyebara, 2020)
Control variables		
Leverage	LEV	Total Liabilities divided by Total Assets (Bierth, et al., 2015; Duong, et al. 2023).
Bank age	AGE	The number of years of its establishment (Bansal & Singh, 2021; Vuong, et al., 2023).
Bank size	SIZE	The logarithm of total assets (Duong, et al., 2024; Laeven, et al., 2016; Tran, et al., 2022).
Board independent	B_IND	Number of independent directors (Marie, et al., 2021).

Appendix B. Unit root test results at first difference

Variables	Levin, Lin & Chu		ADF - Fisher	
	C	C&T	C	C&T
Z_SCORE	<0.001	<0.001	<0.001	<0.001
FX_DERIVATIVE	<0.001	<0.001	<0.001	<0.001
FX_SWAP	<0.001	<0.001	<0.001	<0.001
INTEREST_SWAP	<0.001	<0.001	<0.001	<0.001
CEOO	<0.001	<0.001	<0.001	<0.001
CEOS	<0.001	<0.001	<0.001	<0.001
CEOT	<0.001	<0.001	<0.001	<0.001
LEV	<0.001	<0.001	<0.001	<0.001
AGE	<0.001	<0.001	<0.001	<0.001
SIZE	<0.001	<0.001	<0.001	<0.001
B_IND	<0.001	<0.001	<0.001	<0.001

Note: This Appendix presents unit root tests of all variables. The definitions of variables are given in Appendix A.