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DOES FOREIGN OWNERSHIP DECREASE BANK RISK? EVIDENCE FROM VIETNAM

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ABSTRACT

Based on data from 23 Vietnamese commercial banks in the period 2012-2022, the study used the Bayesian method to provide evidence of the positive impact of the foreign investment capital ratio on bank stability. Specifically, increasing the foreign capital ratio enhances risk resilience and strengthens the banks' overall financial stability. This is significant for policymakers, who should consider relaxing regulations on the ceiling for foreign capital ratios. By attracting more foreign investment, banks can leverage strong financial resources and advanced management expertise from international investors. However, to achieve these benefits, flexible and appropriate policies are needed to facilitate the attraction of foreign investment. Policymakers must carefully consider the risks and benefits, ensuring that new regulations do not cause unintended instability in the banking system. In summary, increasing the foreign capital ratio is a crucial step towards enhancing Vietnamese commercial banks' stability and sustainable development.

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1. Introduction

The global economic integration trend has ushered in many opportunities for Vietnam. However, it has also brought about challenges for Vietnamese businesses, particularly impacting the commercial banking sector. Foreign financial institutions, benefiting from more outstanding capital and advanced technology, have placed considerable pressure on domestic banks. Vietnamese banks have engaged in partnerships by offering shares to foreign investors in order to address this situation. Methods from foreign partners are expected to enhance the competitiveness of Vietnamese banks. The sale of shares to strategic foreign bank shareholders has notably increased in the recent period. Foreign banks with ownership stakes in domestic banks have deployed their personnel to engage in the management and operations actively, offering invaluable support for human resource development and technology transfer. The aforementioned factor has positively contributed to enhancing the competitive edge of commercial banks in Vietnam.

There have been discourses within scientific forums regarding enhancing foreign equity investment at commercial banks. Experts recommend increasing the foreign ownership ratio in commercial banks from 30% to 49%, as the existing limit of 30% is viewed as unappealing to potential foreign investors. In the draft decree aimed at amending and supplementing several articles of Decree No. 01/2014/ND-CP, which regulates the purchase of shares by foreign investors in Vietnamese credit institutions, the State Bank, as the drafting authority, has put forth a proposal pertaining to special cases. Under this proposal, the Government may permit a temporary increase in the total shareholding limit for foreign investors in a credit institution undergoing compulsory transfer. Specifically, this limit may be raised from 30% to a maximum of 49% of the charter capital of the receiving institution, contingent upon the approval of the compulsory transfer plan. This approach is intended to bolster the stability of banks within the sector (Van, 2023). The increase in opportunities for foreign investment is an unavoidable development in the context of economic integration. However, conducting a thorough and meticulous study of this matter is crucial, particularly within the banking industry. It is imperative to consider the impact of foreign investment on the stability of the banking system.

The correlation between foreign ownership and banking risk has garnered significant attention from researchers. Nonetheless, the research findings have not been consistently aligned. Research by Lee (2008) and Saunders et al. (1990) showed that there is a positive relationship between foreign capital and bank risk. On the contrary, Boulanouar et al. (2021) and Micco et al. (2007) asserted that foreign shareholders play an essential role in improving operating efficiency and profitability ratios and managing operating costs, thereby enhancing the stability of banks. Mateev et al. (2023) found that there is no significant difference in risk between banks that have foreign investors and those that are solely supported by domestic investors. Meanwhile, Mateev et al. (2023) have concluded that there is no significant difference in risk associated with the involvement of foreign investors in domestic banks.

Utilizing the Monte Carlo data simulation method, regression analysis was conducted using Bayesian approaches on the data comprising information from 23 commercial banks listed on the Vietnamese stock market from 2012-2022. The study has presented compelling evidence suggesting that the foreign capital ratio contributes to enhancing the stability of the banking system.

The findings indicated that policymakers should consider increasing foreign ownership limits for publicly commercial banks. This measure would facilitate access to capital, technology, and modern management practices for domestic banks, thereby enhancing their competitiveness and contributing to the overall stability of the banking system.

2. Literature review

Numerous studies have been undertaken to assess the influence of foreign capital on the risks associated with banking operations. However, the outcomes of these studies have not yielded consistent conclusions. Research conducted by Allen et al. (2017), Giannetti and Laeven (2012), and Vogel and Winkler (2010) suggests that the involvement of foreign capital in banking institutions may lead to an increase in risk levels. Boulanouar et al. (2021), Giannetti and Ongena (2009), and Choi and Hasan (2005) present evidence indicating that the involvement of foreign investors in bank management contributes to enhanced stability within these institutions. The study conducted by Bakkar and Nyola (2021) indicates that the influence of foreign capital on bank stability is variable across different time periods.

Asymmetric information theory

Information asymmetry theory addresses scenarios where one party involved in a transaction possesses greater information than the other. This imbalance can lead to suboptimal decision-making and may result in challenges within the market. The theory encompasses two primary concepts: Adverse Selection occurs before the transaction when the party with less information struggles to distinguish between favorable and unfavorable options. Moral Hazard: This situation arises following the transaction when the party with less information finds it difficult to monitor the other party's actions. When domestic banks do not have sufficient information regarding the stability of foreign banks that contribute capital, the associated risks for the recipient banks can be elevated. Banks with high foreign ownership rates encounter the challenge of their financial stability being contingent upon the financial soundness of their foreign strategic shareholders. There are some main reasons as follows: (i) The headquarters has the option to "export" its risk management practices/policies to foreign affiliates. However, it is important to consider that these policies may not align with the local market (Berger & DeYoung, 2001); (ii) In the event of an adverse domestic shock experienced by parent banks, there may be a strategic reallocation of capital to the global headquarters to bolster capitalization or to avail of potential government relief support (Cetorelli & Goldberg, 2011). Consequently, these financial institutions may face the necessity of reducing loan portfolios, divesting long-term assets, extending internal credit facilities to distressed overseas partner banks, and potentially assuming direct control of high-risk assets transferred from their parent organizations. This chain of events has the potential to initiate a ripple effect within the corporation and undermine the stability of its overseas subsidiaries; (iii) The financial well-being of parent banks in the host country may have a bearing on the financing expenses of banks that are predominantly foreign-owned. In the event of adverse shocks leading to a decline in the parent bank's earnings or assets, the financing costs of the foreign banks under its ownership will increase. This, in turn, may cause losses or elevate the leverage risk of the parent banks (Allen et al., 2017; Giannetti & Laeven, 2012; Vogel & Winkler, 2010).

In addition, the "principal-agent problem" is a critical aspect of information asymmetry theory and is frequently referenced in discussions regarding the relationship between foreign equity and bank risk.

Principal - agent problem

The principal-agent problem arises when an individual or entity (referred to as the "agent") takes actions on behalf of another individual or entity (referred to as the "principal"), leading to conflicts of interest and priorities. This issue becomes more pronounced when there is a significant misalignment of interests and information between the principal and the agent, particularly when the principal lacks the capacity to sanction the agent. The divergence of the agent's actions from the principal's interests is termed "agency costs." Agency problems are prevalent within the banking industry, predominantly due to the separation of ownership and managerial control. This dichotomy often leads managers to prioritize their personal interests over those of shareholders, particularly foreign shareholders who may lack comprehensive insight into the host country's market dynamics (Jensen & Meckling, 2019; Gorton & Rosen, 1995). Monitoring the performance of subordinates from a distance poses a challenge for foreign shareholders. This situation may incentivize lower-level managers to take more risks, particularly if they could retain profits within the subsidiary while spreading losses across the corporation (Albertazzi & Bottero, 2014; Goetz et al., 2013).

However, many opinions posit that foreign ownership could effectively contribute to maintaining the financial stability of banks within the host country. A widely recognized theory among researchers is the Financial Integration Theory. This theory posits that increasing the proportion of foreign equity in domestic banks can contribute to their stability and resilience.

Financial Integration Theory

This theory posits that international financial integration provides a range of advantages, including access to abundant capital, reduced capital costs, and increased investment and economic growth. Additionally, foreign-owned banks have the opportunity to utilize international sources of capital, thereby enhancing their financial capacity and stability. Financial institutions with a significant ratio of foreign capital possess various advantages. *First,* these organizations possess abundant capital resources. *Second,* these banks could enhance their competitiveness by upgrading the quality of their current services or introducing new products originating from foreign banks. *Third,* they acquire contemporary technology and managerial expertise from international financial institutions per the agreement. *Fourth*, they could improve access to international capital markets. Furthermore, with the emergence of foreign factors, there will be an enhancement of the legal framework and amplification of supervision within the banking system to ensure alignment with international standards and practices. According to Giannetti and Ongena (2009), banks that possess a substantial proportion of foreign capital are expected to enhance their soundness financially due to these identified advantages. Unite and Sullivan (2003), Claessens et al. (2001), and Barajas et al. (2000) have each arrived at similar conclusions regarding the favorable impact of foreign ownership on the performance of banks. Choi and Hasan's (2005) findings indicated that foreign ownership exerts a notably positive and statistically significant influence on bank profitability and risk.

Learning through lending

The "learning through lending" theory serves as a significant framework within the fields of finance and banking. It elucidates how banks can effectively reduce the risks associated with asymmetric information throughout the lending process. This approach enhances the understanding of borrower behavior and improves decision-making, ultimately contributing to a more stable financial

environment. Foreign shareholders encounter an initial challenge in the form of limited access to information within the new market. Due to the extensive development process, domestic banks possess significant advantages in gathering information on the creditworthiness of borrowers compared to newly entered foreign investors in the market. Dell'Ariccia and Marquez (2004) stated that during the initial phases, banks in which foreign capital plays a decisive role in operational planning may experience a heightened incidence of non-performing loans. This could be attributed to engaging with a client base comprising many financially distressed customers from domestic partner banks. These financial institutions could address this limitation by implementing a "learning through lending" strategy. This approach entails utilizing the lending process to gather extensive customer information, thereby mitigating the impact of information asymmetry. As a result, the bank's risk exposure may diminish gradually as it establishes its presence in the local market. Consensus with this view, Boulanouar et al. (2021) conducted a comprehensive study of 76 banks operating within the Gulf Cooperation Council (GCC) markets from 2000 to 2013. The results of this research indicated that banks utilizing foreign capital sources exhibited higher stability than those relying exclusively on domestic capital.

According to a study by Laeven (1999) using data from East Asian countries, banks with a high proportion of foreign capital exhibited lower vulnerability to the financial crisis. Chou and Lin (2011) conducted a study using a sample of banks in Taiwan, while Tacneng (2015) utilized a sample of banks in the Philippines. Both studies concluded that the foreign capital ratio is positively correlated with the level of financial stability in banks. However, many studies have come to the opposite conclusion. Angkinand and Wihlborg (2010) argued that foreign ownership is associated with higher levels of risk-taking. According to several studies, foreign-owned banks may present higher risks compared to domestic banks, as evidenced by Yeyati and Micco (2007) in the context of Latin America.

The involvement of foreign investors in bank management yields different outcomes regarding bank risks, influenced by the specific research stage, even within the same area of study. Bakkar and Nyola (2021) conducted an insightful study utilizing a new cross-European dataset on bank internationalization, revealing interesting findings regarding the impact of foreign capital on bank stability. Their research indicates that, prior to the financial crisis (2005–2007), complex ownership structures in banks significantly reduced systemic risk and enhanced overall stability by promoting a more diversified risk profile. However, this relationship shifted during the crisis period (2008–2011) and continued into the post-crisis phase (2012–2013), suggesting that international banks faced challenges in effectively monitoring cross-border risks in times of stress. Notably, banks with intricate ownership structures, a history of mergers and acquisitions, and operating foreign branch networks demonstrated the ability to mitigate systemic risk during the crisis's acute and later stages.

A study conducted by Mateev et al. (2023) examined the banking sector in the Middle East and North Africa (MENA) region. The findings indicate that, under diligent supervision by regulatory authorities, there is no significant disparity in risk levels between foreign-invested banks and domestic banks.

Both theoretical and empirical research suggested a lack of uniformity in results when examining the relationship between foreign ownership and bank risk. The study was undertaken to assess the effects of foreign capital on bank risk levels at Vietnamese commercial

banks. The globalization process is progressing rapidly, and Vietnam is not exempt from this trend. As a result, the country must integrate more deeply across all sectors, including finance. Increasing the foreign ownership limit is an inevitable step, but it must be carried out carefully to maintain the stability of the banking system. Therefore, it is essential to study the impact of foreign capital on the stability of banks. The findings from this research can provide a foundation for proposing solutions that enhance the competitiveness of banks and ensure the stability of the Vietnamese financial system.

3. Research hypothesis and research model

The participation of foreign investors is anticipated to enhance the competitiveness of domestic banks significantly. These investors not only contribute valuable management expertise but also introduce advanced technologies, thereby fostering stronger development within domestic banking institutions. In fact, the correlation between foreign-owned financial institutions and their risk propensity continues to be a subject of ongoing debate, with comprehensive analysis undertaken in cross-country studies and research focusing on individual nations. However, research findings from both theoretical and empirical studies indicate inconsistencies in the impact of foreign equity on bank stability. As such, it is imperative to examine the effects of foreign capital on bank stability. This analysis would assist in formulating policies that effectively strengthen bank competitiveness while ensuring the stability of the overall banking system.

Previous studies have shown contradictory explanations for the relationship between foreign capital and risk, which vary depending on the scope of the research. This study would investigate the following two opposing hypotheses to determine the effect of foreign owners on risky banks.

Hypothesis 1: Foreign equity to total equity ratio increases bank risk.

Hypothesis 2: Foreign capital ratio helps reduce bank risk.

In addition to evaluating the impact of foreign capital on banking stability, the author also considers the influence of other controlling factors.

Anginer and Demirgüç-Kunt (2014) stated that equity is a capital cushion that helps banks absorb economic shocks, which will help reduce banks' risks. A robust capital adequacy ratio positions a bank to effectively absorb financial losses while maintaining its daily operations. This capacity is vital for ensuring stability during challenging economic conditions. Additionally, a bank characterized by a high capital adequacy ratio is generally regarded as having a sound financial foundation, which fosters confidence among investors and customers alike. Such trust can lead to increased capital and enhanced liquidity (Anginer & Demirgüç-Kunt, 2014). Berger and Bouwman (2013) provided empirical evidence elucidating the cumulative effect of equity on the resilience of small banks amidst the financial crisis.

Hypothesis 3: A equity/total capital ratio would enhance bank stability.

Operational diversification, as indicated by non-interest income, plays a significant role in influencing the stability of banks. Income diversification plays a crucial role in enhancing the stability of financial institutions for several important reasons. *Firstly*, it decreases dependency on a singular source of income, thereby mitigating risks associated with fluctuations in specific sectors (Adem, 2023). *Secondly*, a range of income sources including service fees, commissions, and trading revenues provides more stable and predictable cash flows, facilitating more effective financial management and operational

efficiency (Khemiri, 2023). Moreover, banks with diversified income streams demonstrate greater resilience in the face of economic shocks and financial crises, contributing positively to the overall stability of the banking system. *Finally*, income diversification enables banks to capitalize on various markets and services, ultimately strengthening their capital base and promoting enhanced financial stability (Octavianus & Fachrudin, 2022).

Hypothesis 4: Income diversification improves banking stability.

Credit growth presents notable risks for banking institutions. *Firstly*, when banks pursue rapid credit expansion, there is a tendency to lower lending standards in an effort to attract a broader customer base. This practice can lead to the extension of credit to borrowers with inadequate repayment capacity, ultimately compromising the quality of the bank's asset portfolio (Raddatz et al., 2024). *Secondly*, significant increases in credit can deplete a bank's capital reserves, resulting in liquidity risks, particularly if the institution encounters challenges in fulfilling customer withdrawal requests or meeting other financial obligations (Raddatz et al., 2024). *Lastly*, when multiple banks simultaneously engage in expanding credit, the potential for systemic risk escalates. A situation where a considerable number of borrowers are unable to meet their repayment obligations could precipitate a financial crisis, posing a threat to the stability of the entire banking system (Foos et al., 2010). Foos et al. (2010) examined the factors influencing credit risk at 16,000 banks across 16 countries with well-developed financial industries, including the US, Canada, Japan, and 13 European countries. The findings of this research confirmed that credit growth increases bank risk. According to these authors, the increase in lending by banks necessitates lowering loan standards, resulting in heightened credit risk and a compromise to the stability of banks.

Hypothesis 5: Credit growth increases bank risk.

Koehn and Santomero (1980) asserted that undercapitalized banks are purported to assume excessive risk in pursuit of maximizing shareholder value, potentially to the detriment of depositors. In practice, managers may utilize the deposit insurance scheme to engage in risky activities, as investors have confidence that their funds will remain secure. Based on the commonly applied analytical framework for evaluating bank risk and capital, the too-big-to-fail hypothesis has given rise to moral hazard behavior, which has led to excessively risky activities shielded by deposit insurance and government bailouts. According to research conducted by Sibindi (2018) in South Africa and Setyawati et al. (2019) in Indonesia, banks that accumulate more deposits tend to exhibit a greater propensity for risk-taking.

Hypothesis 6: The ratio of deposits to total deposits increases bank risk.

Basel III initiated new liquidity requirements, particularly for critical financial institutions (BIS, 2019). This agreement facilitated substantial reforms in the risk management practices of banks within supervisory and regulatory frameworks, aiming to mitigate liquidity risks (Vazquez & Federico, 2015). The liquidity ratio is a crucial indicator for banks, as it ensures they maintain sufficient liquid assets to fulfill their short-term financial obligations. This stability allows banks to effectively manage unexpected customer withdrawals and maturing loans without resorting to selling assets at suboptimal prices or incurring high borrowing costs. By upholding a strong liquidity ratio, institutions can mitigate the risk of cash shortages, enhance their financial stability, and reduce the likelihood of bankruptcy (Basell III) (BIS, 2013).

Hypothesis 7: Liquid ratio reduces bank risk.

For macroeconomic factors, the author would consider the impact of economic growth and inflation on banking risks. According to Kjosevski et al. (2019), economic growth typically results in higher and more stable incomes for both businesses and individuals, which enhances their capacity for debt repayment. This improvement effectively reduces credit risk for financial institutions, as the incidence of bad debts diminishes and the potential for debt recovery increases. Furthermore, periods of economic expansion are generally characterized by increased investment and consumption, facilitating an environment where banks can broaden their lending operations and enhance profitability. This, in turn, mitigates the banking sector's risks. On the contrary, Abuzayed et al. (2018) posited that rising inflation rates lead to an increase in the prices of goods and services, thereby eroding the purchasing power of consumers and businesses. This scenario can create challenges for businesses in maintaining profitability and fulfilling their debt obligations, ultimately heightening credit risk for banks. Additionally, elevated inflation is often associated with increased interest rates, which raise the cost of borrowing and further constrain the ability of customers to service their debts. As a result, this can contribute to a higher incidence of bad debts and a subsequent decline in bank profitability.

Hypothesis 8: Economic growth reduces bank risk.

Hypothesis 9: Inflation rate increases bank risk.

Due to the complexity of the concept, there is currently no consensus on the measurement of banking stability for commercial banks. Researchers have suggested assessing the banking system's stability by utilizing a straightforward indicator, which is the non-performing loan ratio. Another frequently cited measure of banking stability is the Z-score coefficient. This index was proposed by Roy (1952); it estimates the possibility of a bank losing liquidity, which occurs when losses in business operations exceed the bank's equity.

$$Z - score_t = \frac{ROA_t + \frac{E}{A_t}}{\sigma(ROA)_t}$$

where,

$Z - score_t$: Z coefficient – score in year t

ROA_t: Rate of return on total assets of banks in year t

$\sigma(ROA)_t$: the standard deviation of the bank's ROA for three years at the time t

$\frac{E}{A_t}$ ratio of equity capital to total bank assets in year t.

Assuming that the profits of commercial banks are normally distributed, the inverse Z-score can be employed to estimate the likelihood of a bank default. This statistical approach provides valuable insights into the risks associated with bank profitability (Goetz, 2018; Jiménez et al., 2013). A bank is deemed insolvent when its capital reserves are entirely exhausted due to sustained losses. This situation arises when the bank's profitability falls below a critical threshold, expressed as ROA < E/A. Under these circumstances, the bank would be classified as bankrupt. A higher Z-score reflects a greater level of stability within the bank. This ratio comprehensively evaluates bank stability by focusing on three critical dimensions of bank operations: capital adequacy, assessed through the equity-to-asset ratio; operating efficiency, measured by return on assets (ROA); and operating volatility, determined by the standard deviation of ROA (Laeven & Levine, 2009).

As per the research hypotheses, the author's research model takes the following form

Model (*see Appendix 1 online*):

$$Z - scroe_{i,t} = \beta_1 FORE_{i,t} + \beta_2 CAP_{i,t} + \beta_3 NITA_{i,t} + \beta_4 CRE_{i,t} + \beta_5 LIQ_{i,t} + \beta_6 DEP_{i,t} + \beta_7 GDP_{i,t} + \beta_8 INF_{i,t} + \varepsilon_{i,t}$$

Previous research has commonly relied on the traditional frequentist method to interpret statistical results. However, according to Briggs and Nguyen (2019), there is a growing consensus that the frequentist approach may no longer be appropriate for interpreting statistical results in many situations. Many studies have discussed the advantages and challenges of Bayesian approaches, highlighting their ability to address the issue of small sample sizes and provide a statistical interpretation suitable for the social sciences.

To evaluate the impact of foreign capital on the risk of Vietnamese commercial banks, the author uses data from 23 commercial banks from 2013-2023. Due to the predominant use of the frequentist method in prior studies, prior information is currently unavailable. In this case, Thach et al. (2021) have suggested a method for identifying standard Gaussian distributions with varying prior information. The proposal employs Bayes factor analysis to select the simulation most informed by prior information (*see Appendix 2 online*).

Following the completion of regression analysis for the five simulations above, the authors conducted Bayes factor analysis and Bayes test models to estimate the most appropriate simulation among the options considered.

4. Research results and discussion

The findings presented in Appendix 3 (*see Appendix 3 online*) indicate that Zscore has an average value of 2.9668, with a standard deviation of 0.3991. The lowest recorded score among the banks is 2.0521, while the highest is 4.2028. Additionally, Table 3 highlights that the bank with the highest foreign capital ratio stands at 30%, which reflects the regulatory ceiling established by the State Bank. Conversely, the bank with the lowest foreign capital ratio is at 0%. Throughout the research period, the average foreign capital ratio for the banks in question was 10.5%, with a standard deviation of 11.69%. This suggests a considerable variance in the extent of foreign investor participation within the banking sector.

The findings from the correlation analysis suggest that the LnZscore exhibits a negative correlation with the variables FORE, CAP, DEP, GDP, and INF. Conversely, it demonstrates a positive correlation with the variables NITA, CRE, and LIQ. It is important to note that while the correlation coefficient offers a general indication of the relationships between these variables, it does not capture the nuances of their interactions. To attain a more comprehensive understanding of these relationships, it is advisable to analyze them within the framework of control variables through regression models. (*see Appendix 4 online*).

Table 1. Posterior probability

	Chains	Avg DIC	Avg log(ML)	log(BF)	P(My)
Simulation 1.1	3	188.041	-114.269	1	0.312
Simulation 1.2	3	185.386	-113.483	0.7860	0.685
Simulation 1.3	3	179.861	-119.213	-4.944	0.002
Simulation 1.4	3	179.355	-127.630	-13.361	0.000
Simulation 1.5	3	179.358	-137.898	-23.627	0.000

Balov (2017, 2020) stated that in Bayes factor analysis, the ideal simulation is the one with the smallest average Deviance Information Criterion (DIC) and the highest log Marginal Likelihood (log(ML)) and average log Bayes Factor (log(BF)) values. Based on this criterion, in model 2, simulation 2.1 emerges as the most favorable option. However, the decision-making process for model 1 presents greater complexities. For Model 1, simulation 4 has the best DIC value; however, the log (ML) and log (BF) values are much lower than the remaining simulations. Simulation 1.1 has the highest log (BF) value, but DIC and Log (ML) values are not as good as simulation 2. Additionally, the posterior probability of simulation 1.2 surpasses that of the remaining simulations, thus offering a strong rationale for designating simulation 1.2 as the prior information for Model 1.

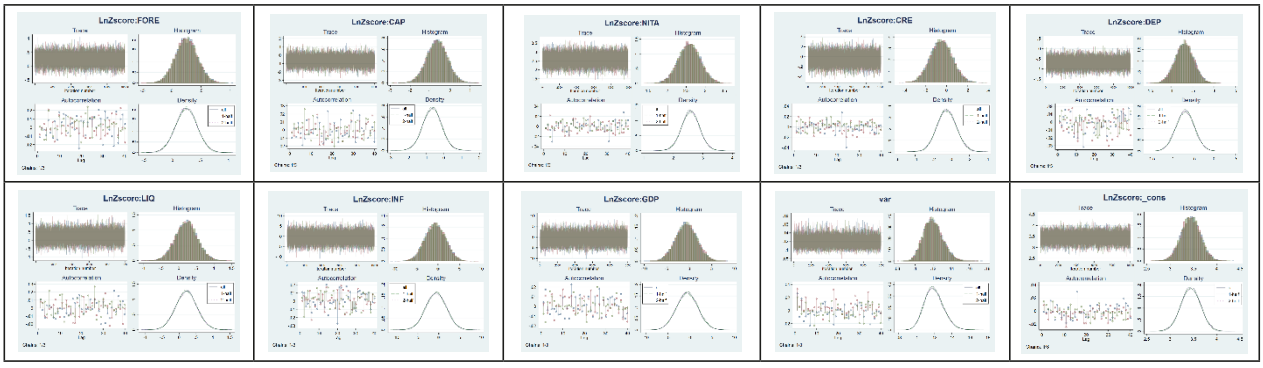

Figure 1. Convergence diagnostic graph

Figure 1 shows the convergence graph of Model 1. The trace plots and autocorrelation plots demonstrate a robust mix of MCMC chains. The autocorrelation coefficient in the plots fluctuates just below 0.02, signifying a strong fit to the distributed simulation density.

Table 2. Bayesian simulation outcomes

	Mean	Std. Dev.	MCSE	Median	Equal-tailed [95% Cred. Interval]	
FORE	0.2504	0.1916	0.0011	0.2523	-0.1271	0.6209
CAP	-0.6503	0.5275	0.0031	-0.6476	-1.6871	0.3772
NITA	2.5839	0.2960	0.0017	2.5838	2.0073	3.1703
CRE	-0.0499	0.1078	0.0006	-0.0503	-0.2620	0.1609
DEP	-0.6979	0.2183	0.0013	-0.6969	-1.1229	-0.2666
LIQ	0.2105	0.3142	0.0018	0.2114	-0.4045	0.8213
GDP	-0.6380	2.4157	0.0139	-0.6473	-5.3556	4.1181
INF	-0.6283	2.4087	0.0142	-0.6213	-5.3197	4.0799
_cons	3.4433	0.2090	0.0012	3.4422	3.0373	3.8539
var	0.1181	0.0108	0.0001	0.1175	0.0986	0.1410
Avg acceptance rate	1					
Avg efficiency: min	0.9168					
Max Gelman-Rubin Rc	1					

In addition to conducting a graphical convergence diagnosis, we could verify by examining the Average Acceptance Rate, Average Efficiency Min, and Max Gelman-Rubin Rc. These additional methods provide a comprehensive approach to verifying and validating the robustness of the Bayesian model. Table 2 indicates that the model's acceptance rate reaches 1, while the Efficiency Min stands impressively high at 0.99, surpassing the allowable threshold of 0.01. Moreover, the Max Gelman-Rubin Rc is 1. According to Gelman and Rubin (1992), any coefficient with a diagnostic Rc value exceeding 1.2 would be deemed non-convergent. The values in Table 2 demonstrate conclusively that the model's MCMC chains meet the convergence requirements.

The findings from the regression analysis presented in Table 2 demonstrate that the variables FORE, NITA, and LIQ contribute to enhancing stability within the banking system. Conversely, the variables CAP, CRE, DEP, GDP, and INF are associated with a reduction in the stability of banks. In contrast to the frequentist method, the Bayesian approach not only determines the sign of the regression coefficients but also enables us to compute the probability of these effects occurring.

Table 3. Probabilistic test

	LnZscore	
	Negative impact (-)	**Positive impact (+)**
FORE	9.70%	90.30%
CAP	69.80%	30.20%
NITA	0.00%	100%
CRE	71.10%	28.90%
LIQ	27.00%	73.00%
DEP	99.80%	0.20%
GDP	39.50%	60.50%
INF	39.70%	60.30%

The result presented in Table 3 indicates that foreign capital plays a constructive role in upholding the stability of commercial banks. The foreign capital contributes to a 90% probability of increasing the LnZscore. Hence, the Bayesian regression analysis underscores the critical role of foreign capital in enhancing the stability of Vietnamese commercial banks. Foreign equity capital, sourced from investors with robust financial backgrounds, enables banks to sustain operations and foster growth while mitigating financial risks. This result is consistent with the research of Tacneng (2015), Angkinand and Wihlborg (2010), Choi and Hasan (2005), Unite and Sullivan (2003), Claessens et al. (2001), and Barajas et al. (2000).

Foreign investors contribute significant management expertise and advanced technology from established markets, improving operational efficiency and risk management practices. The diversification of funding sources through foreign equity reduces reliance on domestic capital and increases resilience to financial fluctuations.

The involvement of foreign investors enhances a bank's reputation and credibility, attracting a broader customer base and fostering beneficial partnerships. This capital influx allows financial institutions to implement proactive capital mobilization strategies, maintain loan portfolio quality, manage non-performing loans, and stabilize profitability.

Moreover, foreign investors typically mandate adherence to international standards of management and financial reporting, promoting transparency and stability within financial institutions.

In summary, foreign equity provides essential capital and additional benefits, including improved management practices, access to advanced technology, better risk diversification, enhanced reputation, and compliance with international regulations. Collectively, these factors significantly contribute to the overall stability of banks.

The diversification factor (NITA) enhances the banking system's stability when the probability of a positive impact of this factor on LnZscore and reducing non-performing loans reaches 100%. Odesanmi and Wolfe (2007) assert that non-interest income within the banking sector may alleviate the reliance on credit activities. This strategic shift can mitigate operational risks, particularly credit risk, thereby decreasing the incidence of non-performing loans within banks. Odesanmi và Wolfe (2007) posited that augmenting non-interest income would enhance the stability of banks' revenue, rendering them less susceptible to fluctuations resulting from changes in monetary policy.

In relation to the deposit to total assets (DEP) variable, although the likelihood of its impact on the non-performing loans is only 55%, its negative effects on LnZscore are as high as 99.8%. Hence, we have sufficient evidence to conclude that the ratio of deposits to total assets harms banking stability. This finding is in line with the original hypothesis and is consistent with the research of Setyawati et al. (2019), Sibindi (2018), and Koehn and Santomero (1980).

The remaining factors, including the equity to total assets ratio (CAP), credit growth (CRE), liquid assets ratio (LIQ), economic growth rate (GDP), and inflation (INF), have a relatively weak impact on banking risk when the probability of these factors influencing the two dependent variables, LnZscore and non-performing loans, is relatively low.

Robustness test

Many studies, including those by Ghosh (2015), Beck et al. (2013), and Louzis et al. (2012), use the non-performing loan index alongside the Z-score coefficient to evaluate the stability of banks; the greater the amount of non-performing loans, the less stable the bank becomes. Hence, in this study, the authors will substitute the Z-score index with the non-performing loan index as the dependent variable to assess the model's stability.

$$NPL_{i,t} = \beta_1 FORE_{i,t} + \beta_2 CAP_{i,t} + \beta_3 NITA_{i,t} + \beta_4 CRE_{i,t} + \beta_5 LIQ_{i,t} + \beta_6 DEP_{i,t} + \beta_7 GDP_{i,t} + \beta_8 INF_{i,t} + \varepsilon_{i,t}$$

where NPL is Non-Performing Loan

Table 3. Posterior probability 2

	Chains	Avg DIC	Avg log(ML)	log(BF)	P(My)
NPL1	3	-1.52E+03	675.780	.	1.000
NPL2	3	-1.52E+03	666.018	-9.762	0.000
NPL3	3	-1.52E+03	655.812	-19.968	0.000
NPL4	3	-1.52E+03	645.241	-30.539	0.000
NPL5	3	-1.52E+03	634.909	-40.871	0.000

The results indicate that, for this model, simulation 1 is the most suitable choice to provide prior information for subsequent analyses. The research authors would next conduct a regression estimate of the posterior impact probability and compare the results of this model with those of the model that uses the Z-score coefficient as the dependent variable.

Table 4. Comparison of Bayesian simulation results

	LnZscore (model 1)			NPL (model 2)		
	Mean	**Std. Dev.**	**MCSE**	**Mean**	**Std. Dev.**	**MCSE**
FORE	0.2504	0.1916	0.0011	-0.016	0.008	0.000
CAP	-0.6503	0.5275	0.0031	-0.035	0.023	0.000
NITA	2.5839	0.2960	0.0017	-0.048	0.013	0.000
CRE	-0.0499	0.1078	0.0006	0.002	0.005	0.000
DEP	-0.6979	0.2183	0.0013	-0.009	0.009	0.000
LIQ	0.2105	0.3142	0.0018	-0.006	0.013	0.000
GDP	-0.6380	2.4157	0.0139	0.004	0.708	0.004
INF	-0.6283	2.4087	0.0142	-0.002	0.708	0.004
_cons	3.4433	0.2090	0.0012	0.034	0.009	0.000
var	0.1181	0.0108	0.0001	0.000	0.000	0.000
Avg acceptance rate	1			1		
Avg efficiency: min	0.9168			0.9331		
Max Gelman-Rubin Rc	1			1		

Table 4 indicates that the FORE, INTA, and LIQ factors have a positive influence on banking stability. Conversely, the CRE and GDP factors appear to contribute to an increase in risks associated with commercial banks. Table 9 illustrates that CAP, DEP, and Inflation INF exert conflicting effects on banking stability. While the impacts of CAP and INF on the Z-score are somewhat ambiguous, the effect of the DEP variable on the Z-score is nearly certain, with a probability close to 100%. Therefore, a more in-depth analysis of these effects is necessary, utilizing posterior probability estimates.

Table 5. Comparison of posterior probability estimates

	Model 1 (LnZscore)		Model 2 (NPL)	
	Negative impact (-)	**Positive impact (+)**	**Negative impact (-)**	**Positive impact (+)**
FORE	9.7%	90.3%	97.6%	2.4%
CAP	69.8%	30.2%	72.4%	27.6%
NITA	0.0%	100%	100%	0.0%
CRE	71.1%	28.9%	47.5%	52.5%
LIQ	27.0%	73.0%	81.6%	18.4%
DEP	99.8%	0.2%	44.4%	55.6%
GDP	39.5%	60.5%	50.2%	49.8%
INF	39.7%	60.3%	50.1%	49.9%

While there is a contradiction regarding the effects of CAP and INF on banking stability between the two models, the probability of these factors significantly impacting banking stability is very low. Therefore, it can be concluded that neither CAP nor INF is a critical factor to consider when assessing banking stability. For the DEP variable, the probability of its impact on NPL is only 47.5%, indicating a very low probability. This suggests that the difference in the impact of DEP on Z-score and NPL is insignificant. Therefore, we can conclude that DEP tends to have a positive effect on the stability of commercial banks. The analysis indicates that the Bayesian simulation results for both models demonstrate a high degree of similarity. This consistency leads us to conclude that the research model is stable and reliable.

5. Conclusion and policy implications

Based on an analysis of data from 23 commercial banks in 2013-2023, the study's findings demonstrated an association between increasing the proportion of foreign capital and enhancing the operational stability of banks. This finding suggests that policymakers may contemplate loosening regulations and elevating the foreign ownership ceilings at Vietnamese commercial banks. This, in turn, can facilitate the acquisition of managerial expertise by domestic banks and enable them to prudently manage risks by international standards, thereby enhancing the stability of the overall banking system.

Based on the findings from the study, raising the foreign equity ceiling in Vietnamese banks is both necessary and strategic. First and foremost, this change will help banks attract additional capital from foreign investors with strong and stable financial resources. This influx of capital will not only support the banks' operations but also facilitate their expansion and development while minimizing financial risks.

Moreover, foreign investors bring valuable management experience and advanced technology from developed markets, which can enhance operational efficiency and risk management within the banks. Increasing the ownership ratio of foreign investors will enable Vietnamese banks to adopt modern management practices and improve their overall efficiency.

Diversifying capital sources through foreign investment will also reduce reliance on domestic funding, increasing the banks' resilience to economic fluctuations. The involvement of foreign investors is often viewed as a positive indicator of a bank's reputation and credibility, which can attract more customers and business partners.

Additionally, foreign investors typically require banks to adhere to international standards regarding management and financial reporting. Increasing their ownership ratio will motivate Vietnamese banks to enhance transparency and comply with international regulations, thereby promoting stability and sustainable development.

In summary, raising the foreign equity capital ceiling will not only enhance the capital and financial capacity of Vietnamese banks but will also provide numerous additional benefits. These include improved management efficiency, diversified capital sources, enhanced reputation, and greater compliance with international standards. Collectively, these factors will significantly contribute to the stability and sustainable development of the Vietnamese banking system.

Limitations and future research direction

Despite its contributions, this study has several limitations. First, the dataset is limited to 23 listed commercial banks in Vietnam during the period from 2013 to 2023. Therefore, the findings may not fully reflect the diversity of

the entire banking sector, particularly smaller, unlisted, or foreign-owned banks operating in Vietnam. Second, the analysis primarily relies on two risk indicators Z-score and non-performing loan (NPL) ratio. Although these are widely accepted measures of bank stability, they may not capture other important dimensions of risk, such as liquidity risk or market risk. Third, the Bayesian estimation uses non-informative priors, which may reduce the accuracy of inference in small samples or when expert knowledge is available but not incorporated.

Future research could address these issues in several ways. One direction is to expand the sample to include non-listed banks, foreign bank branches, and non-bank financial institutions to enhance the generalizability of the results. Another approach is to adopt hierarchical Bayesian models that can account for heterogeneity among banks based on ownership structure, size, or geographic location. In addition, using informative priors derived from expert judgment or previous empirical findings could improve the reliability and interpretability of the model estimates. Lastly, examining the dynamic effects of foreign ownership on bank risk, especially through lagged relationships or panel vector autoregression models, could offer a deeper understanding of how foreign capital influences banking stability over time.

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