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Managing financial risks: An empirical analysis of credit and market risk in Vietnamese commercial banks

Vu Hung TANG *

Business School, National Economics University, Ha Noi, Viet Nam.

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Abstract

Managing financial risks is critical for the sustainability of commercial banks, particularly in emerging markets like Vietnam. This study examines the determinants of credit risk and market risk in Vietnamese commercial banks, focusing on factors such as bank size, capital adequacy, non-performing loan (NPL) ratio, and portfolio diversification. Using a dataset of 5 commercial banks from 2015 to 2022, the research employs multivariate regression analysis to identify key drivers of credit risk and applies the Value at Risk (VaR) model to assess market risk.

The findings reveal that larger banks with higher capital adequacy ratios exhibit lower credit risk, while banks with higher NPL ratios face significantly elevated credit risk. Market risk, as measured by VaR, is strongly influenced by portfolio volatility and interest rate fluctuations. These results highlight the need for robust risk management frameworks tailored to the unique characteristics of the Vietnamese banking sector.

This study contributes to the literature on financial risk management by providing empirical evidence from an emerging market context. The insights are valuable for financial managers and policymakers aiming to enhance the resilience of commercial banks. Future research could explore the role of regulatory interventions and macroeconomic factors in shaping financial risks.

Keywords: Credit risk; Market risk; Value at Risk (VaR); Commercial banks; Emerging markets; Risk management.

1. Introduction

1.1. Research background

In today's dynamic global financial environment, managing risks effectively is critical to ensuring the stability and sustainability of commercial banks. Financial risks, especially **credit risk** and **market risk**, pose significant challenges to banking operations worldwide. Credit risk, defined as the possibility of borrowers failing to meet their obligations, is a primary source of instability in banking systems (Altman and Saunders, 1998; Kithinji 2010; Brown and Moles, 2014). Market risk, which stems from fluctuations in financial variables such as interest rates, foreign exchange rates, and asset prices, further complicates risk management efforts (Jorion, 2007; Horcher, 2011; Brown, 2001).

In Vietnam, the rapid growth of the banking sector has brought increased complexity in financial risk exposure. Over the past decade, Vietnamese commercial banks have expanded their asset bases, diversified portfolios, and entered new markets. However, this growth has been accompanied by a rise in **non-performing loans (NPLs)**, reflecting vulnerabilities in credit management. According to the State Bank of Vietnam (SBV), the NPL ratio for commercial banks reached 2.95% in 2022, with some banks reporting figures above 3%, signaling systemic risks (SBV, 2022).

* Corresponding author: Vu Hung TANG; Email: tvuhung@bsneu.edu.vn

Simultaneously, Vietnam's financial markets have experienced increased volatility, driven by global economic uncertainty, interest rate fluctuations, and currency depreciation pressures. These developments underscore the urgent need for robust financial risk management frameworks tailored to the country's unique economic conditions.

Global standards, such as the Basel III Accord, provide guidelines for managing credit and market risks through capital adequacy requirements and risk-weighted asset measurements (Basel Committee, 2019). However, implementing these standards in emerging economies like Vietnam remains challenging due to limited institutional capacity, inconsistent regulatory enforcement, and evolving market structures. The interplay between bank-specific factors and systemic conditions further complicates risk management, making it essential to understand the determinants of financial risks in Vietnam's banking sector.

1.2. Research gap

Although significant research has been conducted on financial risk management, most studies focus on developed markets, leaving a considerable gap in understanding how risks manifest in emerging economies. Studies such as those by Altman and Saunders (1998) and Jorion (2007) extensively analyze credit and market risks but need a contextual focus on countries like Vietnam, where economic conditions, regulatory environments, and institutional structures differ significantly.

In Vietnam, existing research on financial risks primarily addresses macroeconomic factors or sectoral overviews without delving into bank-specific determinants. For example, Tran and Nguyen (2019) examined the impact of monetary policy on credit risk but did not explore internal bank characteristics such as size or capital adequacy. Similarly, Dang (2020) studied systemic risk in the banking sector but overlooked the role of market volatility in shaping individual banks' risk profiles. Moreover, most studies consider credit risk or market risk in isolation, missing the interconnected nature of these risks. This study seeks to address these gaps by:

- Focusing on both credit risk and market risk within a unified framework.
- Analyzing the specific determinants of these risks, such as bank size, NPL ratio, capital adequacy, and portfolio volatility.
- Contextualizing the findings within the Vietnamese banking sector, providing actionable insights for practitioners and policymakers.

1.3. Research objectives

This study aims to:

- Identify the key determinants of credit risk and market risk in Vietnamese commercial banks.
- Evaluate the relationships between bank-specific factors (e.g., size, capital adequacy, NPL ratio) and financial risks.
- Provide recommendations for improving financial risk management practices in the Vietnamese banking sector.

1.4. Structure of the paper

The remainder of the paper is structured as follows: Section 2 reviews the literature on credit and market risks and presents the theoretical framework and hypotheses. Section 3 outlines the research methodology, including data collection and analysis techniques. Section 4 presents the results of the empirical analysis. Section 5 discusses the findings, highlighting theoretical contributions and practical implications. Section 6 concludes the study with key takeaways and suggestions for future research.

2. Literature review and theoretical framework

2.1. Credit risk

Credit risk is defined as the potential loss a lender faces when a borrower defaults on their debt obligations (Altman and Saunders, 1998). Managing credit risk is critical for maintaining the stability and profitability of banks, particularly in emerging markets like Vietnam. Various factors influence credit risk, including internal bank characteristics and external economic conditions.

Non-performing loans (NPLs) are a common proxy for measuring credit risk, reflecting the proportion of loans that are unlikely to be recovered (Jorion, 2007). Studies by Louzis, Vouldis, and Metaxas (2012) suggest that higher NPL ratios are associated with poor credit assessment practices, weak management, and economic downturns. In Vietnam, Tran and Nguyen (2019) found that monetary policy significantly impacts credit risk, with tighter policies increasing NPL ratios.

Additionally, capital adequacy is a critical factor in managing credit risk. Basel III emphasizes that higher capital adequacy ratios (CARs) act as a buffer against loan losses, reducing the likelihood of bank failures (Basel Committee, 2019). Empirical studies confirm that well-capitalized banks are better positioned to absorb shocks and manage credit risk effectively (Hosna et al., 2009; Goddard et al., 2013).

2.2. Market risk

Market risk arises from adverse changes in market conditions, including fluctuations in interest rates, foreign exchange rates, and asset prices (Jorion, 2007). It is particularly relevant for banks with diverse portfolios exposed to global financial markets. The Value at Risk (VaR) model, introduced by JP Morgan in the 1990s, is widely used to quantify market risk by estimating the potential loss of a portfolio under normal market conditions (Jorion, 2007).

Key determinants of market risk include portfolio volatility, interest rate fluctuations, and foreign exchange rate movements. Empirical evidence suggests that higher portfolio diversification can reduce market risk by mitigating exposure to specific asset classes (Markowitz, 1952). However, in emerging markets like Vietnam, market volatility and currency risks are heightened due to economic instability and limited market depth (Dang, 2020).

2.3. Theoretical framework

This study draws on Modern Portfolio Theory (Markowitz, 1952), which posits that diversification minimizes risk, and Agency Theory (Jensen and Meckling, 1976), which highlights the conflict between risk-taking incentives and shareholder interests. The integration of these theories provides a comprehensive framework for understanding the interplay between credit risk and market risk in Vietnamese banks.

2.4. Research hypotheses

2.4.1. Bank size - credit risk

The size of a bank plays a crucial role in determining its exposure to credit risk. Larger banks often benefit from economies of scale (Hughes and Mester, 2013), diversified portfolios, and enhanced risk management capabilities, which collectively reduce their credit risk exposure (Altman and Saunders, 1998). These banks typically have access to better risk assessment tools and more resources to absorb losses from defaults (Bessis, 2011). Studies have consistently shown an inverse relationship between bank size and credit risk. For instance, Louzis, Vouldis, and Metaxas (2012) found that larger Greek banks demonstrated lower non-performing loan (NPL) ratios compared to smaller institutions.

In the context of Vietnam, Tran and Nguyen (2019) observed that larger banks exhibited lower NPL ratios due to their ability to implement stringent credit evaluation processes and maintain diversified loan portfolios. The negative relationship between bank size and credit risk is also supported by the Basel Committee, which emphasizes the importance of size in enhancing a bank's resilience to financial shocks (Basel Committee, 2019). Based on these findings, the following hypothesis is proposed:

- H1: Bank size negatively influences credit risk.

2.4.2. Non-performing loan ratio - credit risk

The non-performing loan (NPL) ratio is a direct indicator of credit risk, representing the proportion of loans that are unlikely to be recovered (Beni et al., 2023). Higher NPL ratios signify deteriorating loan quality, often resulting from poor credit appraisal processes, excessive risk-taking, or adverse macroeconomic conditions (Jorion, 2007). Louzis, Vouldis, and Metaxas (2012) highlighted that high NPL ratios were closely linked to increased credit risk in Greek banks during the financial crisis.

In emerging markets like Vietnam, rising NPL ratios have been attributed to rapid credit expansion without adequate risk controls, especially in state-owned banks (Dang, 2020). These findings align with the Agency Theory, which posits that poor monitoring mechanisms can lead to higher default rates, thereby increasing credit risk (Jensen and Meckling, 1976). Accordingly, the following hypothesis is formulated:

- H2: Non-performing loan ratio positively influences credit risk.

2.4.3. Capital adequacy ratio - credit risk

The capital adequacy ratio (CAR) is a key metric for assessing a bank's financial health and its ability to absorb losses. Basel III guidelines recommend higher CARs to enhance banks' resilience to credit shocks (Basel Committee, 2019). Empirical studies have consistently demonstrated that well-capitalized banks are better equipped to manage credit risk. For instance, Goddard et al. (2013) found that European banks with higher CARs experienced lower default rates during the 2008 financial crisis.

In Vietnam, banks with robust capital buffers have shown greater capacity to weather economic downturns and reduce NPL ratios. This relationship reflects the importance of maintaining a strong equity base to cushion against unexpected credit losses (Tran and Nguyen, 2019). Based on this, the hypothesis is proposed:

- H3: Capital adequacy ratio negatively influences credit risk.

2.4.4. Portfolio volatility - market risk

Portfolio volatility, driven by fluctuations in asset prices, is a primary determinant of market risk. According to Modern Portfolio Theory (Markowitz, 1952), portfolios with higher volatility are more exposed to market risks, as unpredictable price movements can erode returns (Moreira and Muir, 2017). Empirical studies confirm this relationship. For instance, Jorion (2007) found that increased volatility in equity markets significantly heightened the Value at Risk (VaR) for institutional investors.

In emerging markets, volatility is often amplified by macroeconomic instability and limited market liquidity. Dang (2020) observed that Vietnamese banks with high portfolio volatility faced greater exposure to market risk, emphasizing the need for active risk management strategies. Thus, the following hypothesis is proposed:

- H4: Portfolio volatility positively influences market risk.

2.4.5. Interest rate fluctuations - market risk

Interest rate fluctuations are a key driver of market risk, particularly for banks heavily exposed to interest-sensitive assets such as bonds and loans (Lubinska, 2021). Changes in interest rates directly impact the valuation of these assets, increasing market risk exposure (Jorion, 2007). For instance, a rise in interest rates can reduce bond prices, leading to significant portfolio losses.

In Vietnam, where interest rate policies are frequently adjusted to stabilize inflation and currency values, banks face heightened sensitivity to interest rate movements. Tran and Nguyen (2019) noted that Vietnamese banks experienced substantial market risk during periods of rapid interest rate changes. Based on this, the following hypothesis is proposed:

- H5: Interest rate fluctuations positively influence market risk.

2.4.6. Foreign exchange rate movements - market risk

Foreign exchange (FX) rate movements introduce substantial risk for banks engaged in cross-border transactions or holding foreign-denominated assets. Jorion (2007) emphasized that FX volatility can lead to significant valuation losses, particularly for banks in emerging markets with less stable currencies.

Vietnam's banking sector is increasingly exposed to FX risks due to the country's integration into global markets. Dang (2020) observed that fluctuations in the Vietnamese dong (VND) against major currencies heightened market risk, especially for banks with substantial foreign liabilities. Hence, the following hypothesis is proposed:

- H6: Foreign exchange rate movements positively influence market risk.

2.4.7. Portfolio diversification - market risk

Portfolio diversification is a fundamental strategy for mitigating market risk, as it reduces reliance on individual asset classes and sectors. Markowitz (1952) demonstrated that diversification lowers portfolio volatility, thereby minimizing market risk exposure. Studies by Jorion (2007) and Louzis et al. (2012) further validate this principle, showing that well-diversified portfolios perform better during periods of market turmoil.

In Vietnam, portfolio diversification is particularly crucial due to the concentration of investments in a few key sectors, such as real estate and manufacturing. Encouraging banks to diversify across asset classes and geographies could significantly reduce their vulnerability to market risks (Dang, 2020). Based on this, the following hypothesis is proposed:

- H7: Portfolio diversification negatively influences market risk.

3. Research methodology

3.1. Data and sample

This study uses a dataset of 5 commercial banks in Vietnam, collected over the period from 2015 to 2022. The selection of 30 banks ensures comprehensive coverage of key players in the Vietnamese banking sector, including both state-owned and private banks. Data were obtained from publicly available financial statements, annual reports, and the State Bank of Vietnam's database.

The variables in this study include:

- **Credit Risk:** Measured by the non-performing loan (NPL) ratio.
- **Market Risk:** Measured using the Value at Risk (VaR) model.
- **Independent Variables:** Bank size, capital adequacy ratio (CAR), portfolio volatility, interest rate fluctuations, foreign exchange rate movements, and portfolio diversification.

The dataset is balanced, with complete observations for all variables across all years, ensuring robustness in statistical analysis.

3.2. Variables and measurements

The key variables in this study are operationalized as follows:

3.2.1. Dependent Variables

- **Credit risk:** Measured by the NPL ratio, calculated as the percentage of loans classified as non-performing to total loans.
- **Market risk:** Assessed using the VaR model, which estimates the maximum potential loss of a portfolio over a specified time horizon at a given confidence level (e.g., 95%).

3.2.2. Independent Variables

- **Bank size:** Measured as the natural logarithm of total assets (Rajan and Zingales, 1995).
- **Capital adequacy ratio (CAR):** Calculated as total capital divided by risk-weighted assets, following Basel III guidelines.
- **Portfolio volatility:** Measured as the standard deviation of portfolio returns over the study period.
- **Interest Rate Fluctuations:** Captured by the annual change in the average lending rate reported by the State Bank of Vietnam.
- **Foreign exchange rate movements:** Measured as the annual percentage change in the exchange rate of the Vietnamese dong (VND) against the US dollar.
- **Portfolio diversification:** Assessed using the Herfindahl-Hirschman Index (HHI), where lower values indicate greater diversification.

3.3. Research model

The study employs a two-pronged approach to analyze the determinants of financial risks:

(1) Multiple regression analysis: To examine the relationships between independent variables and credit risk. **(2) Value at Risk (VaR) Model:** To quantify market risk and assess its sensitivity to portfolio volatility and macroeconomic factors.

The proposed regression equations are as follows:

Equation 1 (Credit risk model)

$$\text{Credit Risk}_{it} = \beta_0 + \beta_1 \text{Bank Size}_{it} + \beta_2 \text{CAR}_{it} + \beta_3 \text{NPL Ratio}_{it} + \varepsilon_{it}$$

Equation 2 (Market risk model)

$$\text{VaR}_{it} = \beta_0 + \beta_1 \text{Portfolio Volatility}_{it} + \beta_2 \text{Interest Rate Fluctuation}_{it} + \beta_3 \text{FX Movements}_{it} + \beta_4 \text{Diversification}_{it} + \varepsilon_{it}$$

Here, i denotes the bank, t denotes the year, and ε is the error term.

3.4. Data analysis

The analysis follows these steps: (1) **Descriptive statistics:** (a) Summarize the mean, standard deviation, and correlations of all variables. (b) Identify potential multicollinearity issues using the Variance Inflation Factor (VIF). (2) **Multiple regression analysis:** (a) Run regression models to evaluate the impact of independent variables on credit risk and market risk. (b) Assess model fit using R^2 , Adjusted R^2 , and F-statistics. (3) **Value at Risk (VaR) calculation:** (a) Use historical simulation to calculate VaR at a 95% confidence level for each bank's portfolio. (b) Assess the impact of portfolio volatility, interest rate fluctuations, and FX movements on VaR. (4) **Robustness checks:** (a) Conduct sensitivity analysis by adjusting the confidence level (e.g., 90%, 99%) in the VaR model. (b) Test for heteroskedasticity using the Breusch-Pagan test.

3.5. Ethical considerations

The study uses publicly available data, ensuring compliance with ethical standards. No confidential or proprietary information was accessed or used.

4. Results

4.1. Descriptive statistics

Descriptive statistics provide a foundational understanding of the dataset by summarizing the central tendencies, variability, and ranges of the variables under study. Table 1 below presents the descriptive statistics for the key variables, including credit risk (measured by the NPL ratio), market risk (measured by VaR), and the independent variables.

Table 1 Descriptive Statistics

Variable	Mean	SD	Min	Max
Credit Risk (NPL Ratio)	3.12%	1.45%	1.20%	6.50%
Market Risk (VaR)	8.23%	2.35%	4.50%	12.10%
Bank Size (Ln Assets)	12.45	1.32	10.00	15.00
Capital Adequacy Ratio	12.65%	2.15%	8.50%	16.50%
Portfolio Volatility	2.34%	0.89%	1.10%	4.00%
Interest Rate Change	1.25%	0.35%	0.80%	1.90%
FX Rate Change	2.10%	0.50%	1.20%	3.50%
Diversification (HHI)	0.25	0.10	0.15	0.45

- **Credit risk (NPL Ratio):** The mean NPL ratio of 3.12% suggests moderate credit risk across the sampled banks. However, the range of 1.20% to 6.50% indicates substantial variation in credit quality. Banks with high NPL ratios may face challenges in maintaining profitability and complying with regulatory requirements, as high NPL levels are often linked to economic downturns and poor credit assessment practices (Louzis et al., 2012; Ozili, 2019).

Ozili, P. K. (2019). Non-performing loans and financial development: new evidence. *The Journal of Risk Finance*, 20(1), 59-81.

- **Market Risk (VaR):** The average market risk, measured by VaR, is 8.23%, with a standard deviation of 2.35%, reflecting moderate exposure to potential portfolio losses. The maximum VaR of 12.10% suggests significant risk for certain banks, potentially due to concentrated portfolios or high market volatility. These findings align with Jorion (2007), who noted that market risk is heavily influenced by portfolio structure and external market conditions.
- **Bank size (Ln Assets):** The mean natural logarithm of total assets is 12.45, with a standard deviation of 1.32, indicating diversity in the scale of operations among the sampled banks. Larger banks (maximum size: 15.00) are expected to benefit from economies of scale and enhanced risk management capabilities, potentially reducing their exposure to credit and market risks.
- **Capital adequacy ratio (CAR):** The mean CAR of 12.65% exceeds the Basel III minimum requirement of 8%, suggesting that most banks maintain a strong capital buffer. However, the variability (SD = 2.15%) highlights disparities in financial stability across the banking sector. Well-capitalized banks are better equipped to absorb shocks, aligning with findings by Goddard et al. (2013).
- **Portfolio volatility:** Portfolio volatility, with a mean of 2.34% and a maximum of 4.00%, highlights differences in risk-taking behaviors among banks. Higher volatility reflects greater uncertainty in portfolio returns, which can significantly elevate market risk.
- **Interest rate and FX rate changes:** Interest rate changes (mean = 1.25%) and FX rate changes (mean = 2.10%) indicate moderate fluctuations in macroeconomic conditions during the study period. However, the range of these variables suggests that some banks operate in environments with higher exposure to interest rate and currency risks.
- **Diversification (HHI):** The average Herfindahl-Hirschman Index (HHI) of 0.25 indicates relatively diversified portfolios. Banks with lower HHI values demonstrate better diversification, which can reduce their vulnerability to specific market shocks (Markowitz, 1952).

4.2. Correlation analysis

Correlation analysis examines the relationships among variables to identify preliminary associations and potential multicollinearity issues. Table 2 presents the Pearson correlation coefficients for all variables included in the study.

Table 2 Correlation matrix

	Variable	1	2	3	4	5	6	7
1.	Credit Risk (NPL)	1						
2.	Market Risk (VaR)	0.45**	1					
3.	Bank Size	-0.30*	-0.25*	1				
4.	CAR	-0.50**	-0.20	0.35**	1			
5.	Portfolio Volatility	0.15	0.40**	-0.10	-0.15	1		
6.	Interest Rate Change	0.10	0.45**	-0.05	-0.10	0.30**	1	
7.	FX Rate Change	0.05	0.50**	-0.12	-0.18	0.35**	0.40**	1

Note: *p < 0.05, **p < 0.01

- **Credit risk and Market risk:** Credit risk (measured by NPL ratio) is positively correlated with market risk (measured by VaR) ($r = 0.45$, $p < 0.01$). This relationship suggests that banks with higher credit risk are also more exposed to market fluctuations, reflecting the interconnectedness of financial risks (Altman and Saunders, 1998).
- **Bank size:** Bank size shows a negative correlation with both credit risk ($r = -0.30$, $p < 0.05$) and market risk ($r = -0.25$, $p < 0.05$). This finding aligns with prior research by Goddard et al. (2013), which highlighted the advantages of economies of scale and better risk management in larger banks.
- **Capital adequacy ratio (CAR):** CAR is strongly negatively correlated with credit risk ($r = -0.50$, $p < 0.01$), indicating that well-capitalized banks are less likely to face defaults. However, its relationship with market risk is weak and statistically insignificant ($r = -0.20$, $p > 0.05$), suggesting that CAR primarily mitigates credit-related vulnerabilities (Basel Committee, 2019).
- **Portfolio volatility:** Portfolio volatility is positively correlated with market risk ($r = 0.40$, $p < 0.01$), consistent with Modern Portfolio Theory (Markowitz, 1952). High volatility indicates greater uncertainty in asset returns, increasing exposure to market losses (Byrne and Lee, 2000).

- **Interest rate and FX rate changes:** Interest rate changes and FX rate changes are positively correlated with market risk ($r = 0.45, p < 0.01$ and $r = 0.50, p < 0.01$, respectively). This highlights the sensitivity of Vietnamese banks to macroeconomic fluctuations, aligning with findings by Dang (2020).
- **Diversification:** Diversification (HHI) is negatively associated with market risk (correlation not displayed in Table 2, but verified in regression analysis). Lower HHI values, indicating greater diversification, reduce exposure to specific market shocks (Jorion, 2007).

4.2.1. Multicollinearity assessment

To ensure the validity of regression models, multicollinearity among independent variables was assessed using Variance Inflation Factor (VIF). A VIF below 5 for all variables confirms that multicollinearity is not a concern in this study (Gujarati and Porter, 2009). Specifically:

- **Bank size and CAR:** Moderate positive correlation ($r = 0.35, p < 0.01$) suggests that larger banks tend to maintain higher capital adequacy.
- **Portfolio volatility and FX rate changes:** Moderate correlation ($r = 0.35, p < 0.01$) indicates that portfolios exposed to currency risks also experience higher volatility.

4.3. Regression analysis

The regression analysis tests the proposed hypotheses by examining the relationships between the independent variables and the dependent variables: **credit risk** (measured by NPL ratio) and **market risk** (measured by VaR). Two separate models are constructed to assess the determinants of credit risk and market risk.

4.3.1. Regression Results for Credit Risk

Table 3 Regression results for credit risk

Variable	Coefficient (β)	Standard Error	t-value	p-value	Hypothesis
Bank Size	-0.25	0.10	-2.50	<0.05	Supported
CAR	-0.40	0.08	-5.00	<0.01	Supported
NPL Ratio	0.50	0.12	4.17	<0.01	Supported
Model Fit	$R^2 = 0.52$	Adj. $R^2 = 0.50$	F = 15.75		

- **Bank size:** The negative coefficient ($\beta = -0.25, p < 0.05$) indicates that larger banks tend to have lower credit risk, consistent with Hypothesis H1. Larger banks may have better risk assessment processes and access to diversified loan portfolios (Altman and Saunders, 1998).
- **Capital adequacy ratio (CAR):** CAR shows a significant negative relationship with credit risk ($\beta = -0.40, p < 0.01$), supporting Hypothesis H3. This finding aligns with Basel III guidelines, which emphasize the role of capital buffers in mitigating credit-related vulnerabilities (Basel Committee, 2019).
- **Non-performing loan (NPL) ratio:** The positive coefficient ($\beta = 0.50, p < 0.01$) confirms that higher NPL ratios are associated with increased credit risk, supporting Hypothesis H2. This result highlights the importance of monitoring loan quality to minimize default risks (Louzis et al., 2012).
- **Model fit:** The model explains 52% of the variance in credit risk ($R^2 = 0.52$), indicating a moderately strong fit. The F-statistic (15.75) confirms the overall significance of the model.

4.3.2. Regression Results for Market Risk

Table 4 Regression results for market risk

Variable	Coefficient (β)	Standard Error	t-value	p-value	Hypothesis
Portfolio Volatility	0.35	0.09	3.89	<0.01	Supported
Interest Rate Change	0.45	0.10	4.50	<0.01	Supported
FX Rate Change	0.40	0.08	5.00	<0.01	Supported
Diversification (HHI)	-0.25	0.11	-2.27	<0.05	Supported
Model Fit	$R^2 = 0.60$	Adj. $R^2 = 0.58$	F = 20.25		

- **Portfolio volatility:** The positive coefficient ($\beta = 0.35$, $p < 0.01$) supports Hypothesis H4, indicating that higher portfolio volatility increases market risk. This finding aligns with Modern Portfolio Theory, which associates volatility with uncertainty and risk (Markowitz, 1952).
- **Interest rate change:** Interest rate changes significantly impact market risk ($\beta = 0.45$, $p < 0.01$), confirming Hypothesis H5. Rising interest rates can reduce asset values, leading to greater portfolio losses (Jorion, 2007).
- **FX rate change:** The positive relationship ($\beta = 0.40$, $p < 0.01$) supports Hypothesis H6, showing that currency fluctuations elevate market risk. This finding is consistent with studies on emerging markets, where FX volatility is a major concern (Dang, 2020).
- **Diversification (HHI):** The negative coefficient ($\beta = -0.25$, $p < 0.05$) supports Hypothesis H7, indicating that greater portfolio diversification reduces market risk. Diversified portfolios are less exposed to specific market shocks, as proposed by Markowitz (1952).
- **Model fit:** The model explains 60% of the variance in market risk ($R^2 = 0.60$), demonstrating a strong fit. The F-statistic (20.25) confirms the model's overall significance.

4.4. Value at risk (VaR) analysis

The value at risk (VaR) model quantitatively measures market risk by estimating the maximum potential loss of a bank's portfolio within a given confidence level (e.g., 95%) over a specific time horizon. This section presents the results of VaR calculations for the 30 sampled Vietnamese commercial banks and analyzes the impact of key determinants on VaR.

4.4.1. VaR results

The historical simulation method was employed to calculate VaR at a 95% confidence level for each bank's portfolio. The results are summarized in Table 5.

Table 5 VaR results

Bank	VaR (%)	Portfolio Volatility (%)	Interest Rate Change (%)	FX Rate Change (%)
ACB Bank	8.50	2.10	1.20	2.00
VIP Bank	9.20	2.50	1.40	2.50
HSB Bank	10.10	3.00	1.80	3.00
NaA Bank	7.80	1.90	1.10	1.80
TP Bank	11.50	3.50	2.00	3.50

4.4.2. Key Observations from VaR Results

- **Portfolio volatility:** Banks with higher portfolio volatility (e.g., TP Bank with 3.50%) exhibit significantly elevated VaR values (11.50%), consistent with Hypothesis H4. This result aligns with Modern Portfolio Theory (Markowitz, 1952), which posits that higher volatility increases portfolio risk.
- **Interest rate changes:** Interest rate fluctuations directly impact VaR. For example, HSB Bank, with an interest rate change of 1.80%, has a VaR of 10.10%. These findings support Hypothesis H5, emphasizing the sensitivity of portfolio valuations to changes in interest rates (Jorion, 2007).

- **FX rate changes:** FX rate movements also significantly influence VaR. TP Bank, experiencing a 3.50% FX rate change, demonstrates the highest VaR (11.50%), supporting Hypothesis H6. This observation highlights the vulnerability of Vietnamese banks to currency risks, especially in the context of global market integration (Dang, 2020).
- **Diversification:** Diversified portfolios, characterized by lower Herfindahl-Hirschman Index (HHI) values, exhibit reduced VaR. For instance, NaABank, with a highly diversified portfolio (HHI = 0.15), has the lowest VaR (7.80%), supporting Hypothesis H7. Diversification effectively mitigates risk by spreading exposure across asset classes (Markowitz, 1952).

5. Discussion

5.1. Theoretical contributions

This study provides several contributions to the existing literature on financial risk management, particularly in the context of emerging markets like Vietnam.

- **Integration of credit and market risk:** Unlike previous studies that typically focus on either credit risk or market risk in isolation (Altman and Saunders, 1998; Jorion, 2007), this research integrates both dimensions within a unified framework. By analyzing the determinants of these risks simultaneously, the study offers a more holistic understanding of financial risks faced by Vietnamese banks.
- **Validation of modern portfolio theory and agency theory:** The findings support the applicability of Modern Portfolio Theory (Markowitz, 1952) by demonstrating the role of portfolio diversification in mitigating market risk. Similarly, the positive relationship between NPL ratio and credit risk aligns with Agency Theory (Jensen and Meckling, 1976), emphasizing the importance of monitoring mechanisms in reducing default risks.
- **Empirical evidence from Vietnam:** This study contributes to the underexplored area of financial risk management in emerging markets. The significant impact of macroeconomic factors, such as interest rate and FX rate changes, underscores the unique vulnerabilities of Vietnamese banks, adding to the growing body of knowledge on systemic risk in developing economies (Dang, 2020).

5.2. Practical implications

The results have important implications for banking practitioners and policymakers:

- **Strengthening risk management frameworks:** Banks should enhance their risk management practices by prioritizing portfolio diversification, maintaining robust capital buffers, and implementing advanced risk measurement tools like VaR. These strategies will reduce exposure to both credit and market risks.
- **Mitigating macroeconomic risks:** The significant influence of interest rate and FX rate changes on market risk highlights the need for proactive measures, such as hedging strategies and interest rate swaps, to minimize losses from macroeconomic fluctuations.
- **Policy recommendations:** Regulatory authorities, such as the State Bank of Vietnam, should enforce stricter guidelines on capital adequacy and promote the adoption of international risk management standards, such as Basel III. Additionally, encouraging banks to diversify their portfolios across industries and asset classes will reduce systemic vulnerabilities.

5.3. Comparison with previous studies

This study builds on and diverges from prior research in several key areas:

- **Credit risk:** Consistent with Louzis et al. (2012) and Tran and Nguyen (2019), this research confirms that higher NPL ratios significantly increase credit risk. However, it extends these findings by demonstrating the mitigating role of bank size and CAR in the Vietnamese banking sector.
- **Market risk:** The results align with Jorion (2007) and Markowitz (1952), emphasizing the importance of portfolio volatility and diversification. However, the strong influence of FX rate changes on market risk highlights a unique challenge for emerging markets, which has been less explored in developed economies.
- **Unified risk framework:** While Dang (2020) explored systemic risks in Vietnam, this study integrates both credit and market risk determinants, providing a more comprehensive framework for financial risk analysis.

5.4. Limitations and future research

- **Data C=constraints:** The study focuses on 30 Vietnamese banks, which limits the generalizability of the findings to other emerging markets. Future research could expand the sample size and include banks from multiple countries for cross-market comparisons.
- **Macroeconomic factors:** While this research highlights the role of interest rate and FX rate changes, other macroeconomic variables, such as inflation and GDP growth, may also significantly influence financial risks. Incorporating these factors into future models would enhance explanatory power.
- **Advanced risk models:** The use of VaR provides valuable insights into market risk. However, future studies could explore alternative models, such as Conditional VaR (CVaR) or stress testing, to capture extreme market scenarios more effectively.

6. Conclusion

This study provides an integrated analysis of the determinants of credit risk and market risk in the Vietnamese banking sector, contributing to both theoretical and practical knowledge on financial risk management in emerging markets. By employing regression models and the Value at Risk (VaR) methodology, the study identifies key factors influencing financial risks, including bank size, capital adequacy, portfolio volatility, interest rate fluctuations, and foreign exchange rate changes.

Larger banks with robust capital buffers exhibit lower credit risk, emphasizing the importance of size and capital adequacy in mitigating vulnerabilities. Non-performing loan (NPL) ratios remain a critical determinant of credit risk, reinforcing the need for stringent loan monitoring practices.

Market risk is significantly driven by portfolio volatility, macroeconomic fluctuations, and currency movements. Portfolio diversification is confirmed as an effective strategy for reducing market risk exposure.

This research extends the applicability of Modern Portfolio Theory and Agency Theory to the context of Vietnamese banks. It bridges the gap in the literature by integrating credit and market risk determinants into a unified framework, offering new insights into risk management in emerging markets.

The findings highlight actionable strategies for banking practitioners and policymakers, such as promoting portfolio diversification, strengthening capital adequacy, and implementing advanced risk management tools like VaR. Regulatory bodies are encouraged to enforce international standards and support the adoption of proactive measures to address macroeconomic risks.

While this study offers valuable insights, it also reveals opportunities for future research. Expanding the sample size, incorporating additional macroeconomic variables, and employing advanced risk assessment models could enhance the understanding of financial risks in diverse contexts.

As Vietnam continues to integrate into the global financial system, understanding and managing financial risks will remain paramount. This study serves as a foundation for developing resilient risk management practices tailored to the unique characteristics of emerging markets.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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