

Duong, Khoa Dang; Tran, Phuong Mai Duong; Nguyen, Phung Y Ngoc; Pham, Ha

Article

How do funding diversity and non-performing loans affect bank performance in different economic cycles?

Cogent Business & Management

Provided in Cooperation with:

Taylor & Francis Group

Suggested Citation: Duong, Khoa Dang; Tran, Phuong Mai Duong; Nguyen, Phung Y Ngoc; Pham, Ha (2023) : How do funding diversity and non-performing loans affect bank performance in different economic cycles?, Cogent Business & Management, ISSN 2331-1975, Taylor & Francis, Abingdon, Vol. 10, Iss. 2, pp. 1-21,
<https://doi.org/10.1080/23311975.2023.2215076>

This Version is available at:

<https://hdl.handle.net/10419/294455>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

How do funding diversity and non-performing loans affect bank performance in different economic cycles?

Khoa Dang Duong, Phuong Mai Duong Tran, Phung Y Ngoc Nguyen & Ha Pham

To cite this article: Khoa Dang Duong, Phuong Mai Duong Tran, Phung Y Ngoc Nguyen & Ha Pham (2023) How do funding diversity and non-performing loans affect bank performance in different economic cycles?, Cogent Business & Management, 10:2, 2215076, DOI: [10.1080/23311975.2023.2215076](https://doi.org/10.1080/23311975.2023.2215076)

To link to this article: <https://doi.org/10.1080/23311975.2023.2215076>



© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.



Published online: 25 May 2023.



Submit your article to this journal [↗](#)



Article views: 1616



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 1 View citing articles [↗](#)



Received: 28 June 2022
Accepted: 13 May 2023

*Corresponding author: Ha Pham,
Faculty of Finance and Banking, Ho
Chi Minh City Open University, 35-37
Ho Hao Hon Street, District 1, Ho Chi
Minh City 71000, Vietnam
E-mail: ha.p@ou.edu.vn

Reviewing editor:
David McMillan, Accounting and
Finance Department, University of
Stirling, Stirling, UK

Additional information is available at
the end of the article

BANKING & FINANCE | RESEARCH ARTICLE

How do funding diversity and non-performing loans affect bank performance in different economic cycles?

Khoa Dang Duong¹, Phuong Mai Duong Tran¹, Phung Y Ngoc Nguyen¹ and Ha Pham^{2*}

Abstract: This paper aims to study the impacts of bank funding diversity, non-performing loans (NPLs), and business cycles on bank performance. We employ Fixed Effect Models and the two-step system Generalized Method of Moments to examine a sample of 37 Vietnamese banks from 2005 to 2020. Our findings report that a one percentage point increase in the funding diversity index empowers ROA by 0.031 percentage points. Our results indicate that one positive standard deviation of real GDP from the trend calculated by the Hodrick-Prescott filter increases the ROA by 0.004 percentage points. However, a percentage point increase in non-performing loans reduces ROA by 0.075 percentage points. Our findings are also robust in various proxies of bank performance, economic cycles, and FED interest rate cycles. The findings help determine the optimal funding strategy for policy-makers and bank managers. These findings suggest that bank managers develop long-term credit policies to control NPLs, improving sustainable performance. Regulators closely monitor macroeconomic factors to maintain banking stability in different economic stages. Our findings align with the diversification theory, trade-off theory, and prior literature.

Subjects: Macroeconomics; Banking; Credit & Credit Institutions

Keywords: Funding diversity; non-performing loans; economic cycles; bank performance; uptrend; downtrend; Vietnam

ABOUT THE AUTHORS



Khoa Dang Duong

Khoa Dang Duong (duongdangkhoa@tdtu.edu.vn) is a senior lecturer at the Faculty of Finance and Banking at Ton Duc Thang University, Ho Chi Minh City, Vietnam. He obtained a Ph.D. degree in Finance from Fengchia University in 2019. His research topics are corporate governance, asset pricing, and commercial banks. He is teaching corporate finance and international finance courses.

Phuong Mai Duong Tran (b19h0285@student.tdtu.edu.vn) is an undergraduate student in an elite banking and finance program at Ton Duc Thang University, Ho Chi Minh City, Vietnam. She is interested in banking topics.

Phung Y Ngoc Nguyen Tran (b19h0281@student.tdtu.edu.vn) is an undergraduate student in an elite banking and finance program at Ton Duc Thang University, Ho Chi Minh City, Vietnam. She is interested in corporate governance topics.

Ha Pham (ha.p@ou.edu.vn) is a Dean of the Faculty of Finance and Banking at Ho Chi Minh Open University, Ho Chi Minh City, Vietnam. His research topics are corporate governance, economics, and investments. He is teaching corporate finance and financial management courses.

JEL classification: G20; G21; G28

1. Introduction

Banking institutions are essential to foster economic growth because they help facilitate the flow of credit in the manufacturing and service sectors. The performance of the banking sector over time ensures financial stability in all countries (Alnabulsi et al., 2022). X. Zhang and Daly (2014) showed a positive relationship between bank profitability and the business cycle because of better operating capability. L. Zhang et al. (2019) also indicated that the business cycle negatively affects bank performance because bank performance improved well thanks to government support during the economic downturn. J. Y. Lee and Kim (2013) show that the relationship between the business cycle and bank performance is significantly susceptible to GDP growth. The banking industry strongly influences economic growth (X. Zhang & Daly, 2014). In addition, the performance of the financial system is also negatively affected if the banking sector exhibits poor performance.

Dao et al. (2020) found that macroeconomic factors affect non-performing loans (NPLs) and bank performance. Partovi and Matousek (2019) found that banks needed to be more efficient after holding more NPLs. An increase in NPLs tends to reduce asset quality and decrease cost efficiency. Karim et al. (2010) illustrate that a high level of NPLs erodes bank performance because banks incur additional expenses from non-value-added activities, such as solving and monitoring the collection process of the NPLs (Assaf et al., 2013). Vinh (2017) shows that the impact of NPLs on bank performance is an essential topic in Vietnam. Vinh (2017) also indicates that NPLs in Vietnam increased from 1.799% to 3.7% from 2005 to 2012 and then reduced dramatically to 1.78% in 2015. Karim et al. (2010) show that the negative relationship between NPLs and bank performance is due to the impact of bank-specific characteristics. They suggest that further studies should be recommended to measure the effects of NPLs on bank performance in different phases of the economic cycle. In addition, Abbas and Ali (2021) indicate that credit activities vary in the various economic growth periods, which subsequently affects bank performance. While earlier papers usually focus on using data in countries with developed banking systems, a few studies explore this idea in Vietnam, a transition economy in Asia. Therefore, it is worth analyzing how the NPLs affect bank performance in different economic cycles.

Funding diversity refers to a bank's ability to access funding from various sources, including deposits, interbank borrowing, and capital markets. When a bank has a diverse funding base, it is less dependent on any one source of funding, making it more resilient to financial shocks. Prior studies document mixed impacts of bank funding diversification on bank performance. D. K. Pham et al. (2021); Nguyen (2018) report that maintaining diversified funding sources is costly, reducing commercial banks' profitability. On the other hand, Nguyen (2018) and D. K. Pham et al. (2021) discovered a positive relationship between bank funding diversity and profitability. Therefore, this study extends the studies of Nguyen (2018), D. K. Pham et al. (2021), and Dao et al. (2020) because it analyzes the impact of funding diversification, NPLs, and macroeconomic factors on bank performance in various economic cycles.

Juelsrud and Wold (2020) find that capital raising reduces risk-weighted assets. However, this risk reduction also reduces the bank's credit supply more than before. Therefore, the decrease in lending, the bank's main activity, will negatively affect the company's development. Following the capital requirements of the Basel III regulation, banks can meet not only a reduction in risk-weighted assets but also an increase in equity. Franck and Krausz (2007) argue that banks avoid illiquidity by increasing cash and that asset allocation is considered inefficient and a waste of resources. Reducing bank profits through reducing credit and improving cash flow will negatively affect economic development. The liquidity gap reflects the difference in maturities between assets and liabilities, indicating that the liquidity gap will arise when the mismatch between assets and liabilities becomes larger. To avoid a banking crisis, central banks across the globe stipulate

the minimum capital requirements and ratios of capital to risk-weighted assets in line with global best practices articulated by Basel regulations. Hence, this study must include “liquidity” and “Risk-weighted Assets” as control variables.

We conduct this study in Vietnam for the following reasons. Firstly, the NPLs ratio in Vietnam is the lowest compared to Southeast Asia countries. Our descriptive statistics report that the average NPLs ratio in Vietnam is around 1.78%, lower than neighboring countries such as Cambodia (2.4%), Indonesia (2.6%), and Thailand (3.1%). However, J. Lee and Rosenkranz (2020) suggest that the NPLs ratio in Vietnam is higher than in Malaysia (1.6%) and in the Philippines (1.6%). The NPLs ratio in Vietnam is generally stable for the banking industry because Dao et al. (2020) mentioned that the central bank issued National Assembly Resolution No. 42/2017/QH14 to monitor and supervise banks with high NPLs ratios to ensure the soundness of the financial system.

Secondly, there are many different sources of funds, such as outstanding deposits, borrowed capital, and shareholder funds. In contrast, the primary uses are loans and investments, defensive assets, and required reserves. In addition, there can also be debt from the government or the central bank, interbank deposits, and investment trust funds (Vo, 2020). One of those sources of capital, Leary (2009), indicates an increased competition between banks to attract deposits to generate more profitable loans. The supply of deposits creates more favorable conditions for banking activities and empowers bank performance. Large government-owned banks dominate the Vietnamese banking system. Competition among Vietnamese banks is becoming more intense. Because domestic banks not only compete for market share with each other but also compete with large foreign banks that are entering the Vietnamese market. Vo (2020) suggests diversity is crucial for bank operations and risk management. Banks with access to diversified funding sources can improve bank performance without increasing their risk-taking (M. H. Pham & Nguyen, 2023). Vo (2020) also indicated that the funding diversity index indicator ranges from zero to one. Higher values indicate greater diversification in funding sources. Moreover, our sample descriptive statistics report that the average value of bank funding diversity index in Vietnam is 0.5575, the highest among 6 Asian countries. Nguyen (2018) shows that Vietnam is the country with the highest funding diversity among 6 Asian countries, such as Cambodia (0.438), Indonesia (0.108), Malaysia (0.444), the Philippines (0.356), and Thailand (0.510). Nguyen (2018) also explains that commercial banks in Vietnam have a higher funding diversity index than in other countries because banking regulations in those countries seem to be tighter than in Vietnam. Meanwhile, B. T. Pham et al. (2020) also provide evidence that cyclical output in Vietnam is lower than the average of five ASEAN countries. B. T. Pham et al. (2020) also explained that the technological advancements that improve productivity output still needed to be improved to ensure sustainable development.

Finally, our descriptive statistics report that the ROA of Vietnamese banks has an average value of 1.03%, which is lower than Asian countries (Sari & Endri, 2019). Nguyen (2018) explains that holding diversified funding sources is costly, reducing profitability. The average value of NPLs is 1.78%, which is lower than other Southeast Asian countries such as Cambodia (2.4%), Indonesia (2.6%), and Thailand (3.1%). Additionally, J. Lee and Rosenkranz (2020) suggest that the NPLs ratio in Vietnam is higher than in neighboring countries, such as Malaysia (1.6%) and the Philippines (1.6%). Inspired by the above statistics, it is worth testing how funding diversity and NPLs affect bank performance under the different business cycles in Vietnam, a transition market in Asia.

We collect sample data from 37 commercial banks in Vietnam from 2005 to 2020. We use the deviations of real GDP from the trend as the proxy variable for the business cycle calculated by the Hodrick-Prescott filter (Hodrick & Prescott, 1997), which is suitable for examining bank performance (Kanas et al., 2012). We follow Duong et al. (2022) to estimate the NPLs as the ratio of non-performing loans to total loans. We follow Vo (2020) and Duong et al. (2022) to compute the bank funding diversity index. While our study employs various estimation methods, we focus on the estimation results from the two-step system GMM. The GMM estimations mitigate the

heteroskedasticity and endogeneity issues, providing more reliable results (O. K. T. Tran et al., 2022). We also perform several robustness tests to ensure that our findings are persistent.

Our study generates striking results. Firstly, empirical findings demonstrate that the diversification of the funding positively affects bank performance because a percentage point increase in the funding diversity index empowers ROA by 0.031 percentage points. The result also aligns with the diversification theory because bank funding diversity allows banks to extend their credit activities, enhancing profitability (Vo, 2020). Secondly, our findings report that cyclical output favorably affects bank performance. We figure out that one positive standard deviation of real GDP from the trend calculated by the Hodrick-Prescott filter increases the ROA by 0.00004 percentage points. Our finding aligns with J. Y. Lee and Kim (2013), X. Zhang and Daly (2014) because better operability and effectiveness of fund management policies could help improve bank performance. Finally, our finding indicates that a percentage point increase in NPLs reduces ROA by 0.075 percentage points. Banks with higher NPLs have increasing provision costs to cover the NPLs. They are subjected to strict supervising mechanisms from the government, which limit them from extending credit activities. Our finding is consistent with the trade-off theory. Our findings align with Vinh (2017) and Bolarinwa et al. (2021).

Our robustness test suggests that the main findings are robust even though we employ various proxies of bank performance, such as ROE and NIM. We further test the robustness of our main findings in subsamples by economic cycles, rising and falling FED interest rate periods, and quantitative easing policies. The results also remain robust during the recession period, which is in line with Dao et al. (2020), Abbas and Ali (2021), and L. Zhang et al. (2019). This finding aligns with Karim et al. (2010). However, our study shows that only cyclical output robustly affects the banks' performance across falling and rising FED interest rate periods. Moreover, non-performing loans only robustly influence bank performance during the rising FED interest rate periods. Finally, our main findings are only during the period without quantitative easing packages.

Our study is unique in the following ways. Firstly, we extend the study of Vinh (2017); Vo (2020); Nguyen (2018); D. K. Pham et al. (2021), and Dao et al. (2020) because we examine the impact of cyclical outputs, funding diversity, and NPLs on bank performance in different subsamples. We conduct robustness tests in four ways: alternative bank performance proxies, different cyclical outputs, rising and falling FED interest rate periods, and quantitative easing policies. Furthermore, our study differs from prior studies because we employ various proxies of bank performance, such as ROE and NIM, to test the robustness of our main findings. In addition, our study deviates from Kanas et al. (2012) and Karim et al. (2010) because these studies focus only on how NPLs and economic cycles affect bank performance.

Our study is also unique because it examines the impacts of Liquidity and risk-weighted assets on bank performance. Converting illiquid maturities will cause risks due to an imbalance at a certain confidence level in a certain period. Therefore, liquidity risk cannot be guaranteed by capital allocation. The liquidity gap reflects the difference in maturities between assets and liabilities, indicating that the liquidity gap will arise when the mismatch between assets and liabilities becomes larger. The core activity of banks is allocating customer deposits. Illiquidity makes banks challenging to make decisions about risk-taking, which reduces bank performance. To avoid a banking crisis, central banks across the globe stipulate the minimum capital requirements and ratios of capital to risk-weighted assets in line with global best practices articulated by Basel regulations. Hence, it becomes imperative to include "liquidity" and "Risk-weighted Assets" as control variables in this study.

The structure of our paper is as follows. Section 2 describes the literature review and developing hypotheses. Section 3 illustrates the data collection and methodology. Section 4 discusses our main findings and robustness findings. Finally, section 5 is the conclusion

2. Literature review

2.1. Theories

2.1.1. Trade-off theory

Bolarinwa et al. (2021) argue a trade-off between NPLs and bank performance. Although NPLs can reduce the efficiency of the bank's operations, banks also consider optimizing profits policies thanks to higher credit growth (Sufian, 2012). However, Dao et al. (2020) indicate that banks must reserve additional provisions to cover the problem of NPLs if they cannot control NPLs completely.

Eljelly (2004) indicates that maintaining Liquidity is a vital problem for commercial banks. Acharya et al. (2006) suggest that too much Liquidity erodes profits because excess Liquidity is expensive. However, holding inadequate Liquidity could restrain the banks from extending their business activities, reducing bank performance.

2.1.2. Diversification theory

Diversification is an exciting topic in banking studies. Abbas and Ali (2021) report that diversification of funding enhances bank stability even during a financial crisis. Banks could extend their credit activities when additional funding sources are available, so funding diversity encourages managers to pursue higher lending targets. Vo (2020) points out the necessity to expand sources of funds in the bank's administration policy, which is critical to preserving bank funding diversity and maximizing bank performance.

2.1.3. Pecking order theory

The Pecking Order Theory includes three sources of capital: retained earnings, debt, and equity, which are generated as asymmetric information. Frank and Goyal (2009) argue that retained earnings tend to be better in terms of stability and long-term than external sources of financing because if returns are insufficient, debt financing is substituted. Equity is said to be used only as a last resort because it poses a severe disadvantage.

2.2. Economic cycles and bank performance

X. Zhang and Daly (2014) indicate that the positive relationship between bank profitability and the business cycle results from better operating capability. J. Y. Lee and Kim (2013) found that the business cycle variable always positively affects bank performance due to the effectiveness of funds and fund management policies. However, Kanas et al. (2012) and L. Zhang et al. (2019) show that business cycles negatively affect bank performance during an economic recession because the profit-making behavior of banks is limited. L. Zhang et al. (2019) suggest that this negative relationship comes from reducing expected income. As there are mixed findings between cyclical output and bank performance, we propose the following hypothesis:

Hypothesis 1: *Cyclical outputs have a positive relationship with bank performance.*

2.3. NPLs and bank performance

Partovi and Matousek (2019) found that NPLs negatively affect bank efficiency and stability because they reduce bank asset quality. An increase in NPLs tends to lead to a decrease in cost efficiency. Assaf et al. (2013) also found that higher NPLs cause banks to increase spending on loan processing and may become more careful in managing existing loan portfolios. Several later studies also made this finding and provided supporting evidence for the argument that NPLs contribute to bank inefficiencies. Vinh (2017) and Karim et al. (2010) report that the NPLs ratio reduced bank performance because of declining interest revenue and increased provisions. Dao et al. (2020) also show a negative relationship between NPLs and bank performance because of the increased provisions for loan losses.

On the other hand, Sufian (2012) indicated that NPLs increase bank performance because of banks' profit maximization policies. Laryea et al. (2016) show that NPLs are positive for bank profitability because banks charge higher fees for debt with a high probability of not paying off. Bischof et al. (2022) explored that high levels of NPLs can imperil bank stability and constrain its lending and, ultimately, economic activity. Therefore, quickly handling non-performing loans is the key to promoting lending activities and maintaining the stability of banks. We propose the following hypothesis to examine the relationship between NPLs and bank performance.

Hypothesis 2: *NPLs ratio has a negative relationship with bank performance.*

2.4. Bank funding diversity and bank performance

Vo (2020) and D. K. Pham et al. (2021) recommend that banks with a high level of funding diversification have higher profits because of their ability to access different sources of funds. Thus, these banks could extend their credit activities to earn additional profits. Furthermore, banks can diversify funding sources to improve profitability by maintaining certainty about the bank's funding because capital uncertainty makes banks less confident in lending, thereby reducing bank profitability, especially in times of crisis (M. H. Pham & Nguyen, 2023). Nguyen (2018) also indicates that higher funding diversity positively affects bank performance because of long-term profit policies and increased bank stability in controlling losses. On the other hand, Abbas and Ali (2021) and Acharya et al. (2006) argue that funding diversity adversely affects bank profitability because of increasing administrative costs and funding costs from maintaining diversified funding sources. We propose the following hypothesis because there are mixed findings between funding diversity and bank performance.

Hypothesis 3: *Bank funding diversity has a positive relationship with bank performance.*

2.5. Other determinants of bank performance

2.5.1. Bank age

Beck et al. (2005) argue that bank age negatively affects performance in developing countries. Older banks have disadvantages in seizing the new opportunity compared with younger banks. Meanwhile, Talavera et al. (2018) found a positive effect of bank age on bank performance in a developed country because of mature operations in the old banks. Kwashie et al. (2022) also indicated that older banks have higher NPL risk management expertise and thus reduce the negative impact on their financial performance. This is because older banks will have more historical customer data, thereby evaluating potential borrowers against newer banks.

2.5.2. Operating cost

Naumovska and Cvetkoska (2016) report that increased operational costs negatively impact bank profitability. While Mergaerts and Vander Vennet (2016) argue that operating expenses still have a positive relationship with ROA because higher operating expenses imply business developments.

2.5.3. Inflation rate

X. Zhang and Daly (2014) show that the increased inflation rate negatively impacts the profitability of Chinese banks because increasing price levels are associated with higher operating costs. Sufian and Habibullah (2009) illustrate that the inflation rate positively affects bank performance because banks can predict future movement and adjust interest rates to improve income.

2.5.4. Provision for loan loss

Ahmed et al. (2014) stated that loan loss provisions reduce a bank's income. In contrast, Laeven and Majnoni (2003) showed that provisions positively affect bank earnings because of income-smoothing purposes.

2.5.5. Liquidity

Duan and Niu (2020) found that liability-side and off-balance sheet liquidity creation are positively related to profitability, while asset-side liquidity creation is negatively related to profitability. In addition, Abbas et al. (2019) indicated that the impact of asset-side Liquidity on the Asian developed economies' commercial banks is positive. Larger banks generate more profit against increased liquid assets than medium and small-size banks. V. T. Tran et al. (2016) also showed that banks often have low profitability if they have high Liquidity because banks with more liquid assets reduce the number of loans granted. Thus, they tend to have lower net profits and sales (King, 2013).

2.5.6. Risk-weighted asset

Fidanoski et al. (2018) stated that banks could boost their profitability measured by ROA by balancing equity and risk-weighted assets because a decrease in risk-weighted assets leads to an increase in capital adequacy ratio and therefore increase the profitability. However, Christopoulos et al. (2020) argued that there is a positive effect between the rise of the risk-weighted asset to total assets and banks' profitability measured by net income margin because of the adequate adjustment of the banks in their operating environment risks and they have succeeded in effectively managing the total asset in that case.

3. Data and method

3.1. Data

Our initial data sample has 38 banks in Vietnam from 2005 to 2020. We exclude Agribank because it is a policy bank rather than a commercial bank. We collect the data from the balance sheets, income statements, notes of financial statements, and annual reports from the banks and viet-stock.vn. The macroeconomic variables are collected from World Bank data. The cyclical output is calculated by Hodrick-Prescott (HP) filter (Kanas et al., 2012). We follow Acharya et al. (2006) to mitigate outliers by winsorizing our sample at 10% and 90% levels. We follow Duong et al. (2022) to exclude observations with insufficient data to calculate variables. Our final sample is a balanced panel with 463 annual observations from 37 commercial banks from 2005 to 2020.

3.2. Model construction

While X. Zhang and Daly (2014); J. Y. Lee and Kim (2013) found a positive correlation between the business cycle and bank performance, Kanas et al. (2012) and L. Zhang et al. (2019) argue the opposite results. We follow Kanas et al. (2012) to construct the baseline model (1) to examine the effect of cyclical output on bank performance:

$$\text{BANKPERFORMANCE}_{it} = \alpha + \beta \text{CO}_{it} + \sum \gamma h\text{BANKCHAI}_{it} + \alpha_i + \alpha_t + \varepsilon_{ie} \quad (1)$$

Model (2) focuses on investigating the impact of NPLs on bank profitability. Vinh (2017); Karim et al. (2010); Dao et al. (2020) show a negative relationship between NPLs and bank performance, while Sufian (2012); Laryea et al. (2016) indicate a positive effect. Therefore, we follow prior studies to add NPLs to the model (2):

$$\text{BANKPERFORMANCE}_{it} = \alpha + \beta \text{NPL}_{it} + \sum \gamma h\text{BANKCHAI}_{it} + \alpha_i + \alpha_t + \varepsilon_{ie} \quad (2)$$

Vo (2020), D. K. Pham et al. (2021), and Nguyen (2018) argue that there is a positive relationship between bank funding diversity (BFD) and bank performance. However, Abbas and Ali (2021);

Acharya et al. (2006) report a negative relationship. We follow prior literature to add BFD to the model (3):

$$\text{BANKPERFORMANCE}_{it} = \alpha + \beta \text{BFD}_{it} + \sum \gamma h \text{BANKCHA}_{it} + \alpha_i + \alpha_t + \varepsilon_{ie} \quad (3)$$

Finally, we combine all variables into the model (4) to examine the impact of bank funding diversity, NPLs, and economic cycles on bank performance:

$$\text{BANKPERFORMANCE}_{it} = \alpha + \beta \text{CO}_{it} + \beta \text{NPL}_{it} + \beta \text{BFD}_{it} + \sum \gamma h \text{BANKCHA}_{it} + \alpha_i + \alpha_t + \varepsilon_{ie} \quad (4)$$

Where i represent individual banks, and t represents time dimension indices.

We employ three popular performance proxies mentioned in prior literature: ROA, ROE, and NIM (D. K. Pham et al., 2021; J. Y. Lee & Kim, 2013; Mateev & Bachvarov, 2021). BANKCHA are other bank characteristic variables that serve as the control variables. All variables are explicitly described in Appendix A

3.3. Variable definitions

3.3.1. Bank performance proxies

D. K. Pham et al. (2021) indicate that Return on Assets (ROA) measures shareholder value considering the leverage effect. J. Y. Lee and Kim (2013) suggest that Return on Equity (ROE) estimates a shareholder's investment directly. Mateev and Bachvarov (2021) estimate Net Interest Income (NIM), the difference between interest earned on lending and paid deposits. Moreover, San and Heng (2013) suggested that ROA is the best measure to evaluate the overall performance of banks because the equity multiplier does not distort the ROA and demonstrates that banks manage effectively using assets that generate profits. Therefore, we choose ROA as the primary dependent variable, while ROE and NIM are used in robustness tests.

3.3.2. Bank funding diversity

We follow Abbas and Ali (2021), Vo (2018), and Acharya et al. (2006) to measure bank funding diversity by employing the Hirschman Herfindahl index (HHI). The HHI index is calculated as follows:

$$\text{HHI} = 1 - \left[\frac{(\text{EQ}/\text{Fund})^2 + (\text{GOV}/\text{Fund})^2 + (\text{ID}/\text{Fund})^2 + (\text{CD}/\text{Fund})^2 + (\text{DER}/\text{Fund})^2 + (\text{FIT}/\text{Fund})^2 + (\text{OTH}/\text{Fund})^2}{\text{Fund}^2} \right]$$

Where EQ is the total equity of the bank, GOV is debt from the government and central banks, ID is interbank deposits, the CD is total customer deposits, DER is derivatives instrument and other financial liabilities, FIT is the source of funds for investment trust, OTH is other sources of funding, and the Fund is the total funding of the bank. This HHI index ranges from zero to one, with higher values indicating higher funding diversity and vice versa.

3.4. Estimation methodologies

Initially, we employ standard panel estimation approaches such as OLS, FEM, and REM to estimate the results. Our study also applies Hausman and F-tests to select the most suitable standard estimation. However, Greene (2005) showed that the OLS, FEM, and REM might have biased results because of the heterogeneity issue. Therefore, we implement the Wald test to test for heteroscedasticity. If the test results indicate heteroskedasticity, we follow O. K. T. Tran et al. (2022) to employ a two-step dynamic system Generalized Method of Moments GMM regression to overcome unobserved heterogeneity and endogeneity. Prior studies also use the GMM to estimate the empirical results in banking studies, such as Vo (2020); D. K. Pham et al. (2021); Abbas and Ali (2021), O. K. T. Tran et al. (2022)

4. Empirical results and discussions

4.1. Descriptive statistics

Table 1 presents the descriptive statistics of the variables. As we can see, the average ROA of Vietnamese commercial banks is 1.03%, and the standard deviation value is 0.0066, aligned with D. K. Pham et al. (2021). Besides, the CO has an average value of -10.802, consistent with Kanas et al. (2012). The average CO is also lower than that of other countries in the ASEAN, according to B. T. Pham et al. (2020). Table 1 reports that the average value of BFD is 0.5575, the highest level in six ASEAN countries, confirmed by Nguyen (2018). The standard deviation of BFD is 0.0095, consistent with Vo (2020). The average value of NPLs is 1.78%, which is lower than other Southeast Asian countries such as Cambodia (2.4%), Indonesia (2.6%), and Thailand (3.1%). Additionally, J. Lee and Rosenkranz (2020) suggest that the NPLs ratio in Vietnam is higher than in neighboring countries, such as Malaysia (1.6%) and the Philippines (1.6%). Moreover, the average value of the NPLs ratio complies with the current circular regulated by the State Bank of Vietnam that the NPLs ratio should be less than 3% of total outstanding loans.

4.2. Pearson correlation matrix

Table 2 provides the correlation coefficient of all variables used in this paper to clarify our analysis. The maximum correlation between NPL and PLS is 0.503, a moderate relationship. Therefore, we examine the variance inflation factor (VIF) to test whether our sample has a multicollinearity issue. Table 2 reports that the maximum value of VIF is 1.4999, so our study does not have a multicollinearity problem (O. K. T. Tran et al., 2022).

4.3. Empirical results and discussion

After conducting the Hausman and F-tests, we employ the Fixed Effect Model (FEM). The Hausman test has a P-value of less than 1%, indicating that the FEM is more suitable than the REM. We also implement the F-test to check whether the OLS is more suitable than the REM. The F-test results report that the P-value is less than 1%, suggesting that the OLS is inappropriate. Table 3 reports that CO and BFD positively correlate with bank performance. The NPLs adversely reduce bank performance. Our findings are consistent with X. Zhang and Daly (2014), J. Y. Lee and Kim (2013), Vo (2020), D. K. Pham et al. (2021), Nguyen (2018), Vinh (2017), Karim et al. (2010), Dao et al. (2020).

Greene (2005) also argues that FEM may violate the heteroskedasticity assumption. The Wald test result suggests that FEM estimations have heteroskedasticity issues. O. K. T. Tran et al. (2022) argue that the GMM method can overcome heterogeneity and endogeneity. Therefore, we employ the two-step dynamic system GMM to analyze our main findings.

Table 4 reports a positive correlation between commercial banks' business cycles and ROA. Our findings indicate that one positive standard deviation of real GDP from the trend calculated by the Hodrick-Prescott (HP) filter increases the ROA by 0.004 percentage points. X. Zhang and Daly (2014) indicate a positive relationship between bank profitability and the business cycle because of better operability during growing periods. J. Y. Lee and Kim (2013) show that the positive coefficient of the business cycle on bank performance is because of the effectiveness of fund management policies. Our results are consistent with M. H. Pham and Nguyen (2023); X. Zhang and Daly (2014); J. Y. Lee and Kim (2013), while they are inconsistent with Kanas et al. (2012); L. Zhang et al. (2019). This outcome supports our hypothesis 1, suggesting that economic growth positively affects bank performance.

Table 4 shows a significant negative relationship between non-performing loans and ROA. Our findings imply that a percentage point increase in non-performing loans reduces ROA by 0.075 percentage points. This result aligns with Partovi and Matousek (2019) because they found that banks were less efficient after holding more NPLs. An increase in NPLs tends to reduce asset quality and decrease lending efficiency. If the NPLs are higher, banks must reserve higher provisions for loan

Table 1. Descriptive statistics

	Mean	Median	90%	10%	Std. Dev.	Observations
ROA	0.0103	0.0091	0.0214	0.0014	0.0066	463
CO	-10.8024	-19.7254	87.4589	-50.9225	41.3541	463
NPL	0.0178	0.0172	0.0341	0.0033	0.0095	463
BFD	0.5575	0.5596	0.6853	0.4268	0.0841	463
AGE	19.4190	19.000	29.000	10.000	5.9980	463
INF	0.0726	0.0659	0.1868	0.0267	0.0499	463
OCOST	0.0168	0.0166	0.0259	0.0083	0.0057	463
PLS	0.0113	0.0109	0.0197	0.0035	0.0047	463
LIQ	0.9047	0.9170	0.9620	0.8000	0.0522	463
RWA	0.6648	0.6398	0.8907	0.4593	0.1373	463

Note: Table 1 reports the descriptive statistics. Our sample includes 463 observations from 37 commercial banks in Vietnam from 2005 to 2020. All variable definitions are reported in Appendix A.

losses, eroding the bank's performance (Assaf et al., 2013). Karim et al. (2010) indicate that collecting overdue loans increases non-value-added expenses. Moreover, banks with higher NPLs must set aside higher provisions, reducing bank performance. The result aligns with the trade-off theory because expanding credit activities also lead to a higher NPLs ratio and vice versa (Bolarinwa et al., 2021). The result supports hypothesis 2, suggesting that NPL reduces bank performance.

Table 4 documents that bank funding diversity positively increases ROA. Our results indicate that a one percentage point increase in the bank funding diversity index empowers ROA by 0.031 percentage points. Vo (2020) and D. K. Pham et al. (2021) recommend that banks with a high level of funding diversification can access different sources of funds by extending their credit activities to earn additional profits. Our result is consistent with the diversification theory because banks could develop their credit activities due to additional funds. Diversified funding sources encourage managers to pursue higher lending targets to enhance profitability. While our findings are consistent with D. K. Pham et al. (2021); Vo (2020), they are inconsistent with Abbas and Ali (2021). This finding supports hypothesis 3, implying that BFD positively increases bank performance.

Table 4 illustrates a negative relationship between banks' age and bank performance. Our result is consistent with Beck et al. (2005) because of the advantages of younger banks in seizing potential opportunities over older rivals. Inflation negatively affects bank profit, consistent with X. Zhang and Daly (2014). The increasing price level increases operating costs if the banks maintain the nominal interest rate, reducing the effective interest rate. Moreover, this table shows that operating costs negatively affected bank performance, aligning with Naumovska and Cvetkoska (2016). A bank with a higher operating cost because of employee salary costs leads to higher expenses and decreased profit. In addition, Table 4 shows a negative relationship between loan loss provision and bank performance, consistent with Ahmed et al. (2014).

Table 4 reports that Liquidity has a negative and statistically insignificant relationship with bank performance. Banks create more Liquidity which can increase the risk of illiquidity and subsequently reduce the profitability of banks. Besides, banks with insufficient Liquidity may experience a reduction in lending income. As a result, the decrease in interest income reduces operational

Table 2. Pearson Correlation Matrix

	ROA	CO	NPL	BFD	AGES	INF	OCOST	PLS	LIQ	RWA	VIF
ROA	1										

CO	0.1534*** (0.0009)	1									1.1806
	---	---									
NPL	-0.267*** (<0.001)	-0.1596*** (0.0006)	1								1.4447
	---	---	---								
BFD	0.250*** (<0.001)	-0.226*** (<0.001)	-0.0099 (0.830)	1							1.1998
	---	---	---	---							
AGE	-0.222*** (<0.001)	0.183*** (0.0001)	0.209*** (<0.001)	-0.281*** (<0.001)	1						1.3863
	---	---	---	---	---						
INF	0.2763*** (<0.001)	-0.238*** (<0.001)	0.070 (0.131)	0.3305 (<0.001)	-0.300*** (<0.001)	1					1.2584
	---	---	---	---	---	---					
OCOST	-0.0438 (0.346)	-0.030 (0.509)	0.214*** (<0.001)	-0.071 (0.123)	0.238*** (<0.001)	-0.151*** (0.001)	1				1.1867
	---	---	---	---	---	---	---				
PLS	-0.225*** (<0.001)	-0.0991** (0.033)	0.503*** (<0.001)	-0.027 (0.556)	0.325*** (<0.001)	-0.047 (0.307)	0.2036*** (<0.001)	1			1.4999
	---	---	---	---	---	---	---	---			
LIQ	0.1199*** (0.001)	0.1401*** (0.003)	-0.007 (0.869)	-0.068 (0.141)	0.245*** (<0.001)	-0.173*** (0.0002)	0.177*** (<0.001)	0.173*** (0.0002)	1		1.1530
	---	---	---	---	---	---	---	---	---		
RWA	0.245*** (<0.001)	0.114*** (0.014)	0.0707 (0.129)	0.013 (0.769)	0.022 (0.630)	0.012 (0.798)	0.216*** (<0.001)	-0.015 (0.752)	0.152*** (0.001)	1	1.1026
	---	---	---	---	---	---	---	---	---	---	---

Note: Table 2 represents the Pearson correlation. Our sample includes 463 observations from 37 commercial banks in Vietnam from 2005 to 2020. All variable definitions are reported in Appendix A.

Table 3. Regression results using the FEM estimations

Variables	Model 1	Model 2	Model 3	Model 4
CO	0.00004*** (<0.001)			0.00004*** (<0.001)
NPL		-0.1720*** (<0.001)		-0.1302*** (<0.001)
BFD			0.015*** (<0.001)	0.0183*** (<0.001)
AGE	-0.0006*** (<0.001)	-0.0004*** (<0.001)	-0.0004*** (<0.001)	-0.0006*** (<0.001)
INF	0.0135** (0.0116)	0.0175*** (0.0014)	0.0075 (0.1906)	0.0086 (0.1061)
OCOST	0.0155 (0.7807)	-0.0432 (0.4339)	-0.0901 (0.109)	0.0114 (0.827)
PLS	-0.1700*** (0.0089)	-0.0761 (0.2963)	-0.274*** (<0.001)	-0.0116 (0.866)
LIQ	0.021*** (0.0043)	0.0242*** (0.0011)	0.0284*** (<0.001)	0.0169** (0.014)
RWA	0.0118*** (<0.001)	0.0151*** (<0.001)	0.0135*** (<0.001)	0.0116*** (<0.001)
R-squared	0.545	0.532	0.518	0.6002
Adjusted R-squared	0.502	0.488	0.473	0.560
F-statistic	12.634	12.020	11.362	15.014
Prob(F-statistic)	<0.001	<0.001	<0.001	<0.001
Hausman test (Prob)	<0.001	<0.001	<0.001	<0.001
F-Test (Prob)	<0.001	<0.001	<0.001	<0.001
Wald Test (Prob)	<0.001	<0.001	<0.001	<0.001
N	463	463	463	463

Note: Table 3 represents the estimation result from Fixed Effect Models. Our sample includes 463 observations from 37 commercial banks in Vietnam from 2005 to 2020. All variable definitions are reported in Appendix A. P-values are in parentheses. The symbol ***, **, and * represents the significant level at 1%, 5%, and 10%, respectively.

efficiency. Furthermore, reputation and customer confidence decline when withdrawal requests are not fulfilled. Our findings are consistent with V. T. Tran et al. (2016) and King (2013).

Finally, another finding in line with our expectations and prior studies (Fidanoski et al., 2018) is that risk-weighted assets have a positive and statistically insignificant relationship with bank performance. Banks could boost their ROA by balancing equity and risk-weighted assets because decreasing risk-weighted assets reduce reserves and provisions. Thus, banks have additional resources for credit activities, increasing profitability.

4.4. Robustness tests during an uptrend and downtrend period

We follow Guidara et al. (2013) to separate the data sample into two main stages: uptrend and downtrend. The cyclical output gap removes trends from time series variables. It provides a more detailed view of the bank's performance over each period.

Table 4. Regression results using the two-step dynamic system GMM

Variables	Model 1	Model 2	Model 3	Model 4
Lag of Dep. Var	0.4748*** (<0.001)	0.542*** (<0.001)	0.4245*** (<0.001)	0.2663*** (<0.001)
CO	0.000029** (0.0258)			0.00004** (0.0106)
NPL		−0.253*** (<0.001)		−0.0752* (0.0505)
BFD			0.029*** (<0.001)	0.031*** (<0.001)
AGE	−0.00046*** (<0.001)	−0.0003*** (0.0022)	−0.0002 (0.1713)	−0.0004*** (0.0035)
INF	−0.008*** (0.0048)	−0.003 (0.2158)	−0.0103*** (0.0063)	−0.0098** (0.0132)
OCOST	−0.179*** (<0.001)	−0.1078 (0.1315)	−0.108 (0.3082)	−0.107 (0.1602)
PLS	−0.037 (0.4828)	0.127** (0.0371)	−0.4465*** (0.0049)	−0.196** (0.0316)
LIQ	−0.0037 (0.8442)	0.027 (0.1846)	0.026** (0.0705)	−0.013 (0.4274)
RWA	0.004 (0.2095)	0.0129*** (0.0012)	0.0151*** (<0.001)	0.0038 (0.295)
Instrument rank	34	34	34	34
N	395	395	395	395
AR (1)	0.967	NA	NA	NA
AR (2)	0.984	NA	NA	0.991
J-statistic	28.083	23.767	23.317	21.804
Prob(J-statistic)	0.354	0.589	0.6149	0.5909

Note: Table 4 represents the GMM results. All variable definitions are reported in Appendix A. P-values are in parentheses. The symbol ***, **, and * represents the significant level at 1%, 5%, and 10%, respectively.

Regarding the downward economic cycle, we collect 308 observations from 37 banks between 2006 and 2017. Table 5 reports that CO positively affects ROA, ROE, and NIM. L. Zhang et al. (2019) indicate that bank performance improved thanks to the government's support during the economic downturn. This outcome does not support hypothesis 1, that the CO positively impacts ROA. Table 5 shows that NPL has negative relationships with ROA, ROE, and NIM. Dao et al. (2020) state that the economic downturn increases the NPLs, so banks with higher NPLs must keep higher provisions, which decreases their performance. Moreover, banks tighten their credit policies during the economic recession to control the NPLs, reducing credit activities and profitability.

Table 5 indicates that BFD positively impacts ROA and ROE. Abbas and Ali (2021) state that funding diversity reduces losses and supports the bank's performance in adverse times. However, Table 5 reports a negative relationship between BFD and NIM. It is because holding diversified funding sources is expensive, which erodes the NIM of commercial banks.

Table 5. Robustness test by analyzing different cyclical outputs

Variables	ROA		ROE		NIM	
	Downtrend	Uptrend	Downtrend	Uptrend	Downtrend	Uptrend
Lag of Dep. Var	0.210***	0.243**	0.106***	0.198	0.181***	−0.201***
	(<0.001)	(0.0277)	(0.1068)	(0.2523)	(<0.001)	(<0.001)
CO	0.00007***	0.000013	0.0007***	0.00008	0.000009	−0.00005***
	(<0.001)	(0.1363)	(0.0077)	(0.5742)	(0.6618)	(0.0011)
NPL	−0.051*	−0.162**	−2.507***	−0.547	−0.183***	0.046
	(0.2078)	(0.0259)	(<0.001)	(0.672)	(<0.001)	(0.7483)
BFD	0.035***	−0.026**	0.352***	−0.162**	−0.057***	0.345
	(<0.001)	(0.0115)	(<0.001)	(0.024)	(<0.001)	(0.3756)
AGE	−0.0004***	−0.0003	−0.0016	−0.0027	−0.0011***	0.007***
	(0.0089)	(0.4641)	(0.4149)	(0.6087)	(<0.001)	(<0.001)
INF	−0.012***	0.146**	−0.068	0.892**	0.0418***	0.345***
	(0.0051)	(0.0349)	(0.315)	(0.527)	(<0.001)	(0.0009)
OCOST	−0.156**	0.488***	−0.892	3.263*	0.082*	−1.023***
	(0.0423)	(0.0046)	(0.5755)	(0.0615)	(0.0697)	(<0.001)
PLS	−0.114	−0.068	1.222	1.352	0.4278	0.154
	(0.1956)	(0.7305)	(0.1515)	(0.683)	(<0.001)	(0.5344)
LIQ	−0.017	0.023	0.182	0.841**	0.022*	−0.037*
	(0.3168)	(0.1527)	(0.4959)	(0.0132)	(0.0501)	(0.0607)
RWA	0.0023	0.0076***	0.125***	0.029	0.0009	−0.004
	(0.4935)	(0.0018)	(0.0016)	(0.6776)	(0.7252)	(0.6494)
N	308	87	308	87	308	87
Instrument	34	29	34	29	34	29
F Test	26.041	12.637	18.382	11.581	17.037	6.344
Sagan/ Hansen Test	21.220	18.173	19.584	20.638	22.588	22.425
Prob (J-statistic)	0.6257	0.511	0.72	0.357	0.544	0.263

Note: Table 5 represents GMM regression results in different cyclical outputs. All variable definitions are reported in Appendix A. P-values are in parentheses. The symbol ***, **, and * represents the significant level at 1%, 5%, and 10%, respectively.

Table 5 also represents the GMM estimations during an uptrend period. The data sample consists of 87 annual observations from 37 commercial banks from 2018 to 2020. Table 5 shows that BFD has a negative relationship with ROA and ROE. It is because holding excess funding sources is expensive during economic growth. The CO positively impacts NIM during an uptrend, consistent with our primary finding. However, the NPLs ratio positively affects NIM during the uptrend because banks relax their lending policies to earn additional profits during the economic growth stage.

4.5. Robustness test by employing alternative performance proxies

We follow J. Y. Lee and Kim (2013) and Batten and Vo (2019) to employ alternative performance proxies such as ROE and NIM to test the robustness of our main findings. Specifically, we also apply

Table 6. Robustness test by using alternative performance proxies

Variable	ROA	ROE	NIM
Lag of Dep. Var	0.2663*** (<0.001)	0.161** (0.0227)	0.275*** (<0.001)
CO	0.00004** (0.0106)	0.00031 (0.1353)	0.00003 (0.1012)
NPL	-0.0752* (0.0505)	-2.286*** (<0.001)	-0.138*** (0.001)
BFD	0.031*** (<0.001)	0.317*** (<0.001)	-0.0478*** (<0.001)
AGE	-0.0004*** (0.0035)	-0.002 (0.2258)	-0.00053** (0.0226)
INF	-0.0098** (0.0132)	-0.049 (0.4722)	0.0469*** (<0.001)
OCOST	-0.107 (0.1602)	-1.707 (0.3248)	-0.187*** (0.001)
PLS	-0.196** (0.0316)	-0.037 (0.9768)	0.359*** (<0.001)
LIQ	-0.013 (0.4274)	0.194 (0.5086)	0.0115* (0.0924)
RWA	0.0038 (0.295)	0.115*** (0.0083)	0.0035*** (0.2239)
N	395	395	395
Instrument	34	34	34
F-Test	23.096	18.475	17.395
Sagan/Hansen Test	21.804	20.219	25.230
Prob(J-statistic)	0.5909	0.361	0.239

Note: Table 6 represents the robustness test by employing alternative proxies of bank performance. All variable definitions are reported in Appendix A. P-values are in parentheses. The symbol ***, **, and * represents the significant level at 1%, 5%, and 10%, respectively.

a two-step system GMM to examine the impact of funding diversity, NPLs, and economic cycles on bank performance.

Table 6 shows that the BFD robustly impacts ROA and ROE. This result aligns with Abbas and Ali (2021), Vo (2020), D. K. Pham et al. (2021), and Nguyen (2018). However, the results show a negative relationship between BFD and NIM. It is because holding diversified funding sources is costly, reducing the NIM of commercial banks. Table 6 indicates the robust impacts of CO on all bank performance proxies. This finding aligns with Kanas et al. (2012), X. Zhang and Daly (2014), J. Y. Lee and Kim (2013). Table 6 also documents a negative and robust effect of NPL on all performance proxies. These outcomes are also consistent with Vinh (2017), Karim et al. (2010), and Dao et al. (2020). Therefore, our main findings are robust even though we employ different proxies of bank performance.

Table 7. Robustness test by analyzing FED interest rate cycles

Variable	Full sample	Rising FED rate	Falling FED rate
ROA (-1)	0.2663*** (<0.001)	0.2166 (0.1449)	-0.3621 (0.2599)
CO	0.00004** (0.0106)	0.00005*** (0.0003)	0.00006*** (0.0007)
NPL	-0.0752* (0.0505)	-0.3832*** (0.015)	0.1612 (0.4425)
BFD	0.031*** (<0.001)	-0.0296*** (0.015)	0.00695 (0.7008)
AGE	-0.0004*** (0.0035)	-0.0007* (0.0782)	-0.0007 (0.3436)
INF	-0.0098** (0.0132)	0.0512*** (<0.001)	0.1515 (0.1451)
OCOST	-0.107 (0.1602)	0.04725 (0.8914)	0.3458 (0.3426)
PLS	-0.196** (0.0316)	0.3883 (0.1188)	-1.294 (0.1151)
LIQ	-0.013 (0.4274)	-0.029 (0.3862)	-0.0289 (0.8026)
RWA	0.0038 (0.295)	-0.0202 (0.0645)	0.0207* (0.0986)
N	395	188	141
Instrument	34	28	15
J-statistics	21.804	18.855	2.0043
Prob(J-statistic)	0.5909	0.4008	0.8485

Notes: Table 7 represents the robustness test by analyzing the interest cycle. All variables are reported in Appendix A. The symbol ***, **, and * represents the significant level at 1%, 5%, and 10%, respectively

4.6. Robustness test by analyzing FED interest rate cycles and quantitative easing policies

We note that global Liquidity and availability of foreign funds play a vital role in overall financial costs, especially for a developing economy like Vietnam. Therefore, we test the role of Quantitative easing policies and Fed interest rate cycles on our main findings.

Table 7 shows the changing pattern witnessed in funding diversification separately for the “Rising” and “Falling” interest rate cycles. The result indicates that cyclical output has a robustly positive effect on ROA in rising and falling FED rate cycles. Banks with higher NPL or BFD have lower ROA during the rising Fed rates period. It is costly for commercial banks to maintain diversified funding sources. At the same time, there are fewer borrowers in the rising interest rate period (Nguyen, 2018). In contrast, bank funding diversity and NPL have positive and statistically insignificant relationships with ROA during the decreasing Fed interest rates period.

To test robustness by analyzing quantitative easing policies, we separated the sample into “Quantitative Easing period” if the State Bank of Vietnam implements quantitative Easing policy in a specific year and 0 otherwise. This robustness test examines whether our main findings are robust after controlling for quantitative Easing policy.

Table 8 shows that cyclical output, non-performing loans, and bank funding diversity have robust impacts on ROA during the period without quantitative easing policies. However, our main findings are not robust during the quantitative easing period.

Table 8. Robustness test during quantitative easing policies

Variable	Full Sample	Quantitative Easing period	No Quantitative Easing period
ROA (−1)	0.2663*** (<0.001)	0.1738 (0.942)	0.0526 (0.5948)
CO	0.00004** (0.0106)	0.0002 (0.8718)	0.000045*** (0.001)
NPL	−0.0752* (0.0505)	0.8772 (0.8521)	−0.3339*** (0.0001)
BFD	0.031*** (<0.001)	0.0704 (0.7613)	0.0451*** (0.0001)
AGE	−0.0004*** (0.0035)	−0.0026 (0.9241)	−0.0006*** (0.0002)
INF	−0.0098** (0.0132)	−0.1362 (0.9531)	−0.0119 (0.1251)
OCOST	−0.107 (0.1602)	0.7590 (0.8588)	−0.3433 (0.1257)
PLS	−0.196** (0.0316)	−2.7459 (0.8805)	0.5289* (0.0634)
LIQ	−0.013 (0.4274)	−0.0727 (0.8212)	−0.0318 (0.5356)
RWA	0.0038 (0.295)	−0.0231 (0.8597)	−0.0127** (0.0428)
N	395	110	218
Instrument	34	10	33
J-statistics	21.804	6.91E−22	19.5590
Prob(J-statistic)	0.5909	0.7135	0.6683

Table 8 represents the robustness test by analyzing the impact of quantitative easing packages. All variables are reported in Appendix A. The symbol ***, **, and * represents the significant level at 1%, 5%, and 10%, respectively.

5. Conclusion

Bank performance plays an essential role in the economy and financial system, and the NPLs ratio is a bottleneck that reduces the efficiency of commercial banks. D. K. Pham et al. (2021) and Nguyen (2018) argue that the NPLs and funding diversity are also different in Vietnam under different business cycles. Therefore, it is worth testing the impacts of NPLs, funding diversity, and the business cycle on bank performance.

We employ the two-step GMM estimations to analyze the data sample of 37 Vietnamese commercial banks from 2005 to 2020. We find that cyclical output positively affects bank performance in all periods, consistent with X. Zhang and Daly (2014). Secondly, NPLs adversely reduce bank performance because banks must reserve higher provisions and tighten credit policies to control the NPLs. Our findings align with Vinh (2017) and Karim et al. (2010). Finally, banks with a higher level of funding diversification have access to potential sources of funds to expand earnings. Our results align with Vo (2020) and D. K. Pham et al. (2021). Our findings also support the trade-off theory, diversification theory, and prior literature.

Our results provide the following practical implications for bank managers in emerging markets. Vo (2020) suggests that diversification in bank funding is essential in emerging countries. Banks should aim to diversify their funding sources to reduce their dependence on any one source. These suggestions include expanding their deposit base, accessing interbank

markets, issuing bonds or other debt securities, and raising capital from investors. This recommendation can help banks manage funding costs and liquidity risk, critical in economic downturns when funding sources become scarce. Research shows the vital role of prudential regulation in improving bank profitability and a stable banking system. Banks need to be better equipped to manage risk-generating components and that banks are more diversified and capitalized. Besides, the higher NPL ratio reduces the bank's profit. Banks having to expand their credit activities also lead to higher NPL ratios, consistent with the trade-off theory. Therefore, managers should continue to enhance their risk management practices, including credit risk assessment, loan monitoring, and capital management. This can help to identify and mitigate risks before they become significant problems. Additionally, we agreed with Bolarinwa et al. (2021) that banks should pay close attention to the sectors in which they have significant exposure and adjust lending practices and risk management practices as needed to manage the impact of potential NPLs. Managing large NPLs can divert critical management resources from core operations and deliver more profitability.

These results contribute important policy implications for policymakers, suggesting that the usual capitalization rules are adopted and addressed by regulators to increase bank capitalization. We agree with Vinh (2017) suggesting that long-term policies demand Vietnamese commercial banks take safeguards against NPLs, improve bank performance, execute credit analysis based on cash flow, and monitor borrowers' solvency in different stages of the economy. We also make the same proposal as Kanas et al. (2012) argue that policymakers must make a strategy to monitor the banking system depending on a macro-prudential framework. Regulators must control a portfolio of macroeconomic and banking variables to achieve sustainable performance. They should regularly stress-test their balance sheets to identify potential vulnerabilities and test their resilience to various shocks, including changes in funding conditions and increases in non-performing loans. This can help banks better to manage their funding sources and NPLs during economic cycles.

Although our study contributes to the growing literature on diversification in the banking sector, it has the following limitations. Our report has the main limitation in data because Vietnam is a transition economy with few commercial banks. Future studies could be conducted to study the impact of bank funding on bank profitability in different business cycle stages more clearly or through subsamples of bank size and the COVID-19 pandemic (Alnabulsi et al., 2022; Bischof et al., 2022; M. H. Pham & Nguyen, 2023)

Acknowledgments

The authors thank the anonymous reviewers for their constructive comments, which helped us complete this paper. We also thank Mr. Bien Huu An and Mr. Truong Huu Phuc, undergraduate students from the Faculty of Finance and Banking, at Ton Duc Thang University, for helping us in the early stage of the paper. We also thank Mr. Diep Van Nguyen, Faculty of Finance and Banking, Ho Chi Minh City Open University, for helping us in the early stage of the paper.

Funding

This study is supported by Ton Duc Thang University and Ho Chi Minh City Open University.

Author details

Khoa Dang Duong¹
E-mail: duongdangkhoo@tdtu.edu.vn
ORCID ID: <http://orcid.org/0000-0001-9855-3751>
Phuong Mai Duong Tran¹
E-mail: b19h0285@student.tdtu.edu.vn
Phung Y Ngoc Nguyen¹
E-mail: b19h0281@student.tdtu.edu.vn
Ha Pham²

E-mail: ha.p@ou.edu.vn

ORCID ID: <http://orcid.org/0000-0003-2810-7646>

¹ Faculty of Finance and Banking, Ton Duc Thang University, Ho Chi Minh City, Vietnam.

² Faculty of Finance and Banking, Ho Chi Minh City Open University, Ho Chi Minh City, Vietnam.

Author contributions

Khoa Dang Duong (duongdangkhoo@tdtu.edu.vn): conceived and designed the experiments, performed the experiments, analyzed and interpreted the data, and wrote the first draft of the manuscript.
Phuong Mai Duong Tran (b19h0285@student.tdtu.edu.vn) performed the experiments, contributed reagents, materials, analysis tools, or data
Phung Y Ngoc Nguyen (b19h0281@student.tdtu.edu.vn): performed the experiments and contributed reagents, materials, analysis tools, or data.
Ha Pham (ha.p@ou.edu.vn): analyzed and interpreted the data and wrote the first and final drafts of the manuscript.

Disclosure statement

No potential conflict of interest was reported by the authors.

Correction

This article has been corrected with minor changes. These changes do not impact the academic content of the article.

Citation information

Cite this article as: How do funding diversity and non-performing loans affect bank performance in different economic cycles?, Khoa Dang Duong, Phuong Mai Duong Tran, Phung Y Ngoc Nguyen & Ha Pham, *Cogent Business & Management* (2023), 10: 2215076.

References

- Abbas, F., & Ali, S. (2021). Dynamics of diversification and banks' risk-taking and stability: Empirical analysis of commercial banks. *Managerial and Decision Economics*, 43(4), 1–15. <https://doi.org/10.1002/mde.3434>
- Abbas, F., Iqbal, S., & Aziz, B. (2019). The impact of bank capital, bank liquidity and credit risk on profitability in postcrisis period: a comparative study of US and Asia. *Cogent Economics & Finance*, 7(1), 1605683. <https://doi.org/10.1080/23322039.2019.1605683>
- Acharya, V. V., Hasan, I., & Saunders, A. (2006). Should Banks Be Diversified? Evidence from Individual Bank Loan Portfolios. *The Journal of Business*, 79(3), 1355–1412. <https://doi.org/10.1086/500679>
- Ahmed, A., Mohammed, A., & Adisa, A. (2014). Loan Loss Provision and Earnings Management in Nigerian Deposit Money Banks. *Mediterranean Journal of Social Sciences*, 5(17), 49. <https://doi.org/10.5901/mjss.2014.v5n7p346>
- Alnabulsi, K., Kozarević, E., & Hakimi, A. (2022). Assessing the determinants of non-performing loans under financial crisis and health crisis: Evidence from the MENA banks. *Cogent Economics & Finance*, 10(1), 2124665. <https://doi.org/10.1080/23322039.2022.2124665>
- Assaf, A. G., Matousek, R., & Tsionas, E. G. (2013). Turkish bank efficiency: Bayesian estimation with undesirable outputs. *Journal of Banking & Finance*, 37(2), 506–517. <https://doi.org/10.1016/j.jbankfin.2012.09.009>
- Batten, J., & Vo, X. V. (2019). Determinants of bank profitability—Evidence from Vietnam. *Emerging Markets Finance & Trade*, 55(6), 1417–1428. <https://doi.org/10.1080/1540496X.2018.1524326>
- Beck, T., Cull, R., & Jerome, A. (2005). Bank privatization and performance: Empirical evidence from Nigeria. *Journal of Banking & Finance*, 29(8–9), 2355–2379. <https://doi.org/10.1016/j.jbankfin.2005.03.018>
- Bischof, J., Rudolf, N., & Schmudt, W. (2022). How do non-performing loans evolve along the economic cycle? The role of macroeconomic conditions and legal efficiency. *European Accounting Review*, 31(5), 1149–1174. <https://doi.org/10.1080/09638180.2022.2071960>
- Bolarinwa, S. T., Olayeni, R. O., & Vo, X. V. (2021). Is there a nonlinear relationship between non-performing loans and bank profitability? Evidence from dynamic panel threshold. *Managerial and Decision Economics*, 42(3), 649–661. <https://doi.org/10.1002/mde.3262>
- Christopoulos, A. G., Dokas, I. G., Katsimardou, S., & Spyromitros, E. (2020). Assessing banking sectors' efficiency of financially troubled Eurozone countries. *Research in International Business and Finance*, 52, 101121. <https://doi.org/10.1016/j.ribaf.2019.101121>
- Dao, K. O., Nguyen, T. Y., Hussain, S., & Nguyen, V. C. (2020). Factors affecting non-performing loans of commercial banks: The role of bank performance and credit growth (No. 6ykd8). *Center for Open Science*, 15(3), 44–54. <https://doi.org/10.31219/osf.io/6ykd8>
- Duan, Y., & Niu, J. (2020). Liquidity creation and bank profitability. *The North American Journal of Economics & Finance*, 54, 101250. <https://doi.org/10.1016/j.najef.2020.101250>
- Duong, K. D., Vu, D. N., Le, K. D., & Nguyen, D. V. (2022). Do Political Connections and Bank Funding Diversity Increase Non-Performing Loans: New Evidence from the Bayesian Approach. *Montenegrin Journal of Economics*, 18(4), 79–92. <https://doi.org/10.14254/1800-5845/2022.18-4.8>
- Eljelly, A. M. (2004). Liquidity-profitability trade-off: An empirical investigation in an emerging market. *International Journal of Commerce & Management*, 14(2), 48–61. <https://doi.org/10.1108/10569210480000179>
- Fidanoski, F., Choudhry, M., Davidović, M., & Sergi, B. S. (2018). What does affect profitability of banks in Croatia? *Competitiveness Review: An International Business Journal*, 28(4), 338–367. <https://doi.org/10.1108/CR-09-2016-0058>
- Franck, R., & Krausz, M. (2007). Liquidity risk and bank portfolio allocation. *International Review of Economics & Finance*, 16(1), 60–77. <https://doi.org/10.1016/j.iref.2004.09.007>
- Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? *Financial Management*, 38(1), 1–37. <https://doi.org/10.1111/j.1755-053X.2009.01026.x>
- Greene, W. (2005). Fixed and random effects in stochastic frontier models. *Journal of Productivity Analysis*, 23(1), 7–32. <https://doi.org/10.1007/s11123-004-8545-1>
- Guidara, A., Soumaré, I., & Tchana, F. T. (2013). Banks' capital buffer, risk and performance in the Canadian banking system: Impact of business cycles and regulatory changes. *Journal of Banking & Finance*, 37(9), 3373–3387. <https://doi.org/10.1016/j.jbankfin.2013.05.012>
- Hodrick, R. J., & Prescott, E. C. (1997). Postwar US business cycles: An empirical investigation. *Journal of Money, Credit, and Banking*, 29(1), 1–16. <https://doi.org/10.2307/2953682>
- Juelsrud, R. E., & Wold, E. G. (2020). Risk-weighted capital requirements and portfolio rebalancing. *Journal of Financial Intermediation*, 41, 100806. <https://doi.org/10.1016/j.jfi.2018.10.002>
- Kanas, A., Vasilioi, D., & Eriotis, N. (2012). Revisiting bank profitability: A semi-parametric approach. *Journal of International Financial Markets, Institutions and Money*, 22(4), 990–1005. <https://doi.org/10.1016/j.intfin.2011.10.003>
- Karim, M. Z. A., Chan, S., & Hassan, S. (2010). Bank Efficiency and Non-Performing Loans: Evidence from Malaysia and Singapore. *Prague Economic Papers*, 19(2), 118–132. <https://doi.org/10.18267/j.pep.367>
- King, M. R. (2013). The Basel III net stable funding ratio and bank net interest margins. *Journal of Banking & Finance*, 37(11), 4144–4156. <https://doi.org/10.1016/j.jbankfin.2013.07.017>
- Kwashie, A. A., Baidoo, S. T., & Ayasu, E. K. (2022). Investigating the impact of credit risk on financial performance of commercial banks in Ghana. *Cogent Economics & Finance*, 10(1), 2109281. <https://doi.org/10.1080/23322039.2022.2109281>
- Laeven, L., & Majnoni, G. (2003). Loan loss provisioning and economic slowdowns: Too much, too late? *Journal of Financial Intermediation*, 12(2), 178–197. [https://doi.org/10.1016/S1042-9573\(03\)00016-0](https://doi.org/10.1016/S1042-9573(03)00016-0)
- Laryea, E., Ntow-Gyamfi, M., & Alu, A. A. (2016). Non-performing loans and bank profitability: Evidence from an emerging market. *African Journal of*

- Economic and Management Studies*, 7(4), 462–481. <https://doi.org/10.1108/AJEMS-07-2015-0088>
- Leary, M. T. (2009). Bank loan supply, lender choice, and corporate capital structure. *The Journal of Finance*, 64(3), 1143–1185. <https://doi.org/10.1111/j.1540-6261.2009.01461.x>
- Lee, J. Y., & Kim, D. (2013). Bank performance and its determinants in Korea. *Japan and the World Economy*, 27, 83–94. <https://doi.org/10.1016/j.japwor.2013.05.001>
- Lee, J., & Rosenkranz, P. (2020). Non-performing loans in Asia: Determinants and macrofinancial linkages. *International Finance Review*, 33–53. <https://doi.org/10.1108/S1569-376720200000021003>
- Mateev, M., & Bachvarov, P. (2021). Regulation, ownership and bank performance in the MENA region: Evidence for Islamic and conventional banks. *Emerging Markets Review*, 47, 100789. <https://doi.org/10.1016/j.ememar.2020.100789>
- Mergaerts, F., & Vander Vennet, R. (2016). Business models and bank performance: A long-term perspective. *Journal of Financial Stability*, 22, 57–75. <https://doi.org/10.1016/j.jfs.2015.12.002>
- Naumovska, E., & Cvetkoska, V. (2016). Efficiency of the Macedonian banking sector. *Yugoslav Journal of Operations Research*, 26(3), 317–329. <https://doi.org/10.2298/YJOR150228019N>
- Nguyen, T. L. A. (2018). Diversification and bank efficiency in six ASEAN countries. *Global Finance Journal*, 37, 57–78. <https://doi.org/10.1016/j.gfj.2018.04.004>
- Partovi, E., & Matousek, R. (2019). Bank efficiency and non-performing loans: Evidence from Turkey. *Research in International Business and Finance*, 48, 287–309. <https://doi.org/10.1016/j.ribaf.2018.12.011>
- Pham, D. K., Ngo, V. M., Nguyen, H. H., & Le, T. L. V. (2021). Financial crisis and diversification strategies: The impact on bank risk and performance. *Economics & Business Letters*, 10(3), 249–261. <https://doi.org/10.17811/eb.10.3.2021.249-261>
- Pham, M. H., & Nguyen, N. M. (2023). Bank funding diversity, risk and profitability: Evidence from Vietnam in the context of the Covid-19 pandemic. *Cogent Business & Management*, 10(1), 2191305. <https://doi.org/10.1080/23311975.2023.2191305>
- Pham, B. T., Sala, H., & Silva, J. I. (2020). Growth and real business cycles in Vietnam and the Asean-5. Does the trend shock matter? *Economic Systems*, 44(1), 100730. <https://doi.org/10.1016/j.ecosys.2019.100730>
- San, O. T., & Heng, T. B. (2013). Factors affecting the profitability of Malaysian commercial banks. *African Journal of Business Management*, 7(8), 649–660. <https://doi.org/10.25115/ee.v39i10.5337>
- Sari, F. N., & Endri, E. (2019). Determinants of Return on Assets (ROA) on Conventional Banks Listed on Indonesian Stock Exchange (IDX) Period 2013–2017. *IOSR Journal of Business and Management (IOSR-JBM)*, 21(4), 52–62.
- Sufian, F. (2012). Determinants of bank profitability in developing economies: Empirical evidence from the South Asian banking sectors. *Contemporary South Asia*, 20(3), 375–399. <https://doi.org/10.1080/09584935.2012.696089>
- Sufian, F., & Habibullah, M. S. (2009). Bank specific and macroeconomic determinants of bank profitability: Empirical evidence from the China banking sector. *Frontiers of Economics in China*, 4(2), 274–291. <https://doi.org/10.1007/s11459-009-0016-1>
- Talavera, O., Yin, S., & Zhang, M. (2018). Age diversity, directors' personal values, and bank performance. *International Review of Financial Analysis*, 55, 60–79. <https://doi.org/10.1016/j.irfa.2017.10.007>
- Tran, V. T., Lin, C. T., & Nguyen, H. (2016). Liquidity creation, regulatory capital, and bank profitability. *International Review of Financial Analysis*, 48, 98–109. <https://doi.org/10.1016/j.irfa.2016.09.010>
- Tran, O. K. T., Nguyen, D. V., & Duong, K. D. (2022). How market concentration and Liquidity affect non-performing loans: Evidence from Vietnam. *Polish Journal of Management Studies*, 26(1), 325–337. <https://doi.org/10.17512/pjms.2022.26.1.20>
- Vinh, N. T. H. (2017). The impact of non-performing loans on bank profitability and lending behavior: Evidence from Vietnam. *Journal of Economic Development JED*, 24(3), 27–44. <https://doi.org/10.24311/JED/2017.24.3.06>
- Vo, X. V. (2020). The role of bank funding diversity: Evidence from Vietnam. *International Review of Finance*, 20(2), 529–536. <https://doi.org/10.1111/irfi.12215>
- Zhang, X., & Daly, K. (2014). The impact of bank-specific and macroeconomic factors on China's bank performance. *The Chinese Economy*, 47(5–6), 5–28.
- Zhang, L., Zhang, S., & Guo, Y. (2019). The effects of equity financing and debt financing on technological innovation: Evidence from developed countries. *Baltic Journal of Management*, 14(4), 698–715. <https://doi.org/10.1108/BJM-01-2019-0011>

Appendix A. Variable definitions

Variables	Notation	Definition	Reference
Dependent variables			
Return on Asset	ROA	Net income/average total assets	D. K. Pham et al. (2021)
Return on Equity	ROE	Net income/average total equities	J. Y. Lee and Kim (2013)
Net Interest Margin	NIM	The difference between the loans rate and deposits rate divided by total income	Mateev and Bachvarov (2021)
Independent variables			
Bank Funding Diversity	BFD	HHI_Funding	Vo (2022)
Cyclical Output	CO	The deviation of real GDP from the trend calculated by the Hodrick-Prescott (HP) filter	Kanas et al. (2012).
Non-performing Loans	NPL	Non-performing loan to gross loan	Duong et al. (2022)
Control variables			
Bank Age	AGE	The number of years from the day bank is established.	Talavera et al. (2018)
Inflation Rate	INF	Annual inflation rate	X. Zhang and Daly (2014)
Operating Cost	OCOST	operating costs to total assets	Naumovska and Cvetkoska (2016)
Provision for Loan Loss	PLS	The ratio of loan loss provision to gross loans	Ahmed et al. (2014)
Liquidity	LIQ	Liquid assets to total assets ratio	Abbas et al. (2019)
Risk-weighted asset ratio	RWA	Risk-weighted assets to total assets ratio	Christopoulos et al. (2020)