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Article

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BANKING & FINANCE | RESEARCH ARTICLE

The impact of capital structure on bank profitability: evidence from Vietnam

Nam Hai Pham¹, Tri M. Hoang² and Nhung Thi Hong Pham³

Abstract: The purpose of this research is to determine the effect of capital structure on the profitability of Vietnamese commercial banks. Specifically, it investigates the relationship between capital structure and profitability using an imbalanced panel data set of Vietnamese commercial banks from 2012 to 2018, a critical period for implementing the Prime Minister's decision (254/QĐ-TTg) on restructuring the Vietnamese commercial banking system. To depict the capital structure of Vietnamese commercial banks, the authors employ customer deposits and non-deposit liabilities. The study findings, based on a dataset of 30 Vietnamese commercial banks, indicate that customer deposits have a negative effect on bank profitability, whereas non-deposit liabilities have a positive effect on bank profitability. Study findings imply that Vietnamese commercial banks should conduct more thorough and equitable evaluations before lending to assure the quality of both assets and loans. Additionally, it is essential to conduct a more thorough analysis of investment projects and long-term loans to assure the bank's asset quality. This study contributes to the existing literature by examining how capital structure affects the profitability of Vietnamese commercial banks, an area where prior research has been deficient.

Subjects: Economics; Finance; Banking

Keywords: Capital structure; profitability; commercial bank; panel data; Vietnam

JEL Classification: G20; G21; C23

1. Introduction

Because many highly leveraged banking institutions collapsed or had to be bailed out by authorities, the financial crisis has reignited interest in the function of bank capital. Bank collapses result in high social costs, which explains capital requirements for financial organizations (Berger et al., 1995). Increased capital levels enable banks to withstand greater disruptions and reduce shareholders' motivation to take on unnecessary risks. Since The Prime Minister (2006) approved a scheme to develop Vietnam's banking sector, Basel II has been an essential goal for banks to set out and fulfill. According to Circular no. 41/2016/TT-NHNN (The State Bank Of Vietnam, 2016), commercial banks and foreign bank branches must comply with Basel II's capital adequacy ratio of at least 8%. In 2018, The State Bank Of Vietnam (2018) issued Circular no. 13/2018/TT-NHNN to regulate the internal control system of commercial banks and foreign bank branches in compliance with the Basel II standards. Until 2021, 13 major banks complete the Basel II requirements and embark on the Basel

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About the author Tri M. Hoang is a Ph.D. student at the University of Economics Ho Chi Minh City, Vietnam. He is also a lecturer at Vietnam's Ho Chi Minh City University of Technology (HUTECH). His research interests include behavioral finance and markets, as well as empirical asset pricing. Nam Hai Pham is a lecturer at Banking University Ho Chi Minh City. His research interest includes bank risk management and bank governance.

III implementations (Nhue Man, 2021). The Basel III agreements, in particular, provide a more stringent framework for bank capital standards. By demanding larger amounts of common equity, this policy enforces an improvement in capital quality. It also mandates a minimum leverage ratio that takes into consideration the overall assets of institutions as well as off-balance-sheet entities. Such capital restrictions are justified as being socially beneficial since they minimize financial volatility in the economy. According to Carney (2013), only well-capitalized banks can satisfy the actual economy's demands to generate strong, long-term expansion. Banking institutions and economies have succeeded when capital has indeed been restored and balance sheets reconstructed.

Conversely, such capital demands may force the economy to make trade-offs. Excessive capital standards, banks contend, will imperil their profitability. This may happen, for instance, if the cost of funding for banks rises dramatically as a result of increased capital holdings. Higher finance costs may translate into a reduced return on investment (ROI) for banks, as well as a disruption in lending. Economic theory is ineffective in resolving this argument since there is no agreement on the impact of capital structure on bank profitability. Furthermore, as the current financial crisis has shown, greater risk—which can be related to greater leverage—is generally linked to higher potential (Admati et al., 2013), therefore the ROE assessment should account for risk-taking.

Different perspectives on capital structure can be found in the literature. Modigliani and Miller's (1958) theorem, which is based on the notion of perfect markets, states that a bank's capital structure choice has little bearing on its total value. Another body of research focuses on the disciplinary effect of debt on managers (Diamond & Rajan, 2000; Hart & Moore, 1995). As a result, expanding capital may cause managers to lose their discipline, resulting in poor performance. Lastly, the third point of view contends that optimal capital structure reduces the moral hazard between shareholders and debtholders (Diamond, 1984). Monitoring, on the other hand, is expensive, and banks require inducement to monitor on behalf of their debtors. Greater amounts of capital, according to this theory, improve the banks' interests to supervise their debtors as shareholders will receive a bigger proportion of asset payoffs and suffer further in the event of failure. This illustrates why capital ratios may have a favorable impact on the profitability of banks. Larger margins, either from improved efficiency or from increased market dominance, could be used to generate such a rise in ROE and ROA. Our empirical technique is to look at the numerous factors that influence the ROE and ROA and see if the leverage ratios play a role. Yet, it is beyond the scope of this study to discuss how the ROE and ROA might change.

This research adds to the body of knowledge in several ways. First, the paper is the first to examine what determines the bank capital structure in Vietnam. The conventional textbook response is that banks' financing choices do not have to be investigated because capital regulation is the overarching divergence from Modigliani and Miller's hypotheses. For example, due to the high expenses of retaining capital, bank management frequently desires to maintain less bank capital than the regulated amount. The level of bank capital required in this situation is defined by the bank capital standards (Mishkin, 2016). Interpreted correctly, this means that the leverage ratio of banks subject to the Basel I regulatory framework may have little cross-sectional change, as it mandates a consistent capital ratio. The capital ratios of banks vary, but the average number has dipped from 9.931% (2012) to 7.825% (2019), which is below the minimum capital adequacy ratio (8%), according to the Circular no. 41/2016/TT-NHNN (International Monetary Fund, 2021). The figures suggest that the capital structure of banks should be investigated thoroughly. Second, according to J. A. J. A. Batten and Vo (2016), Vietnamese banks are under stress to diversify their sources of non-traditional revenue. Income differentiation, on the other hand, necessitates modifications in the capital structure of the bank. Greenlaw et al. (2008) believe that rather than legal restraints, banks' active control of their capital structures in connection to internal value-at-risk was a primary destabilizing element. Aside from current concerns over high levels of non-performing loans, the traditional practices of Vietnamese commercial banks are also causing worry among many stakeholders (J. J. Batten & Vo, 2019). It is interesting to investigate how bank capital structure supports income diversification and

complies with authority regulations. Finally, while the State Bank of Vietnam is still a central bank, it is now regarded as a ministerial-level institution of the Vietnamese government (Vo, 2016), raising concerns about giving state-owned banks preferential treatment over other banks. Such incentives assist state-owned banks in becoming preferred lenders for public infrastructure projects, which may be a significant source of revenue. As a result, state-owned banks may have a different capital structure than other banks to sustain their operations and investments and create profits. Banks can better meet their debt obligations with Basel II and Basel III of CAR regulations. With a higher CAR ratio, the bank's capital structure is financed with more bank capital and is safer to operate. However, too high or too low a CAR ratio is not good, and a reasonable CAR ratio is needed for banks (Nguyen et al., 2021). In Vietnam, 92.4% of the banks have the optimal CAR higher than the minimum ratio of 10.5% defined in BASEL III (Nguyen et al., 2021). It means that Vietnamese banks need to increase capital and reduce debt in their capital structure for better profits and safer operations.

2. Literature review

2.1. Theoretical perspectives

There is a large theoretical literature on the impact of capital on bank worth. There are three points of view, each leading to an opposite conclusion. The first is built on Modigliani and Miller (1958)'s framework (hereinafter referred to as M&M), which states that the ratio of capital to assets has little or no influence on the value of banks. The second hypothesis is that too much capital will depreciate the value of banks. A third contends, on the other hand, that more capital has a favorable impact on bank profitability, resulting in increased value. Assessing the relationship between capital and bank performance remains an empirical topic owing to such diverse beliefs (Berger & Bouwman, 2013; Oyetade et al., 2021).

Financing options have no impact on asset cash flows under the M&M framework. As a result, altering the equity/debt balance does not influence the firm value. When equity financing is increased, the cost of equity drops as asset risk and leverage reduce. This impact illustrates why, notwithstanding that the cost of stock is higher than the cost of debt, the funding composition is neutral for the firm value. Miller (1995) questions the applicability of this approach to banks and claims that nothing stops the cost of capital from falling as capital rises. He further points out that deviations from the M&M hypotheses, which are based on taxes and agency problems, do not justify the varying capital levels of enterprises across sectors in a systematic way. Besides, the conventional opinion is that capital regulation represents an extra, overriding divergence from the Modigliani-Miller irrelevance argument when it comes to bank capital structures (Begenau, 2020; Berger et al., 1995; Miller, 1995; Santos, 2001). Deposits in commercial banks are guaranteed to safeguard depositors and maintain financial stability. Commercial banks must be compelled to keep a minimum level of capital to offset the moral hazard of this coverage. The study sample comprises major commercial banks in Vietnam that offer unambiguous deposit protection throughout the implementation of Basel I's standard capital requirement. In the end, traditional corporate finance variables should have no predictive power for the capital structure of the banks in our sample when it comes to regulation.

According to the second view, Berger and Bouwman (2013) point out that banks frequently claim that adopting stricter capital requirements will result in a drop in banking performance. This viewpoint has received some support in the literature. Agency tensions between managers and shareholders can be increased with additional bank capital, according to Jensen and Meckling (1976) and Schwert (2018). The disciplinary role of debt is well-documented in the field of corporate finance (Crouzet, 2018; Hart & Moore, 1995). By developing an equity buffer, the manager might attempt to detach herself from market discipline. On the other hand, debt financing forces management to make effective decisions to pay back creditors regularly. Due to the presence of information asymmetries, debt may offer benefits over the capital. Executives may have access to confidential information about the progression of a company's yields or investment prospects. By issuing debt, the company

demonstrates to outside investors its capacity to settle the principal and debt interest, as well as its financial stability (Leland & Pyle, 1977; Ross, 1977; Zeitun & Goaid, 2022).

Bank debt, on the contrary, is distinct from corporate debt. In truth, a significant portion is owned by minor insured depositors who lack the motivation or capacity to oversee institutions (Bertomeu et al., 2022; Dewatripont & Tirole, 1994). Hence, bank debt may not have as strong a disciplinary effect as corporate debt indicates in the literature. Diamond and Rajan (2001) provide a banking model called “fragile financial structure” (i.e. funding based on a substantial percentage of deposits) that is required for a bank to legitimately pledge to extract all of the benefits from its partnership lendings. The bank might decide not to supervise after lending on a whim. Yet, the theory predicts that in that situation, depositors can run on the bank, forcing it to keep an eye on the debtor. In this situation, expanding capital could result in lower loan valuation and lower liquidity formation.

The third view states that banks holding capital cushions see their profitability and value increase. Banks keep excessive (cushioned) capital, or discretionary capital, over the regulatory minimum to prevent the burden of getting to issue new shares on an urgent basis (Ayuso et al., 2004; Migueis, 2019; Peura & Keppo, 2006). As a result, banks that must issue stock at a greater cost might be less leveraged. According to Myers and Majluf (1984) and Himmelberg and Tsyplakov (2020), firms keep cushioned capital because asymmetric information increases the cost of raising capital. Because dividend-paying banks, banks with larger profits, or banks with higher market-to-book ratios are either better recognized by external investors and have more financial flexibility, they should anticipate experiencing reduced costs of issuing stock. The impact of bank size on cushion size is unclear. If larger banks are more known in the market, they may have lower cushions. Major banks, on the other hand, may keep more cushions if their operations are more complicated, making asymmetric information more valuable. Cushion sizes should be determined by the likelihood of going underneath the regulatory level.

Besides, the moral hazard between shareholders and debt holders explains the third view in two ways. The first channel depends on the debt holders’ risk premium. Due to the limited liability of shares, the possible shortfall of equity investors is restricted. Risk-taking, on the other hand, increases gains. This encourages people to take unnecessary risks at the cost of the other stakeholders. Debt holders expect this action and demand a higher interest rate from banks to finance them. As a result, debtors’ market discipline drives banks to hold positive capital reserves (Anderson et al., 2021; Calomiris & Kahn, 1991). Increased capital decreases shareholders’ readiness to assume unnecessary risks. Besides, when the bank is better funded, debt holders want a smaller premium. Finally, increased capital requirements mean lower financing costs, resulting in a higher ROE. The presence of a deposit protection plan, which makes deposits risk-free, diminishes the efficiency of this mechanism since covered depositors do not need to pay a premium when the bank’s risk level rises. This method might still work via uninsured borrowers if they don’t believe the bank is too large to collapse. The second route is built on the bank’s surveillance activities. The (expensive) monitoring effort is reliant on bank capital: larger capital embodies the expected losses associated with insufficient monitoring. As a result, the bank has more motivation to keep track of its capital ratio as it rises. Bank’s capital structure is expected to influence asset cash flows because monitoring impacts loan payoffs. Holmstrom and Tirole (1997) propose a model in which the monitoring activities of banks are proportional to their capital ratio. Mehran and Thakor (2011) provide a dynamic framework that incorporates the costs and advantages of increasing capital ratios. Holding capital is expensive in their model, although the marginal cost varies for every bank. Monitoring is a function of capital ratio: banks have a greater motivation to monitor if they have more capital. Allen et al. (2011) propose a model in which the capital ratio encourages the bank to assess the situation more closely. Higher capital ratios result in excess banking relationships. They find a rationale for the presence of capital buffers in addition to the regulator’s requirements. Rising capital ratios are thus compatible with profit creation. Yet, it is logical to believe that increased capital yields lower marginal returns, hence the beneficial effects of rising capital ratios on ROA and ROE would not last above a certain level.

2.2. Empirical evidence

After the empirical investigation of Short (1979), Molyneux and Thornton (1992), Angbazo (1997), and Michelle Clark and David (1997), a large body of research looked at the variables that impact bank performance for a variety of economies and nations throughout the globe. Performance is determined by the individual features of banks, sectors, and nations. Others researched areas and territories (Athanasoglou et al., 2008; Berger & Bonaccorsi Di Patti, 2006; Demirgüç-Kunt & Huizinga, 1999; Oyetade et al., 2021), while others focused on a single country (Amidu, 2007; Athanasoglou et al., 2008; Nguyen et al., 2021; Saona, 2016).

Considering that profitability is driven by unique features of banks, sectors, and nations (A et al., 2013; Molyneux et al., 2019), another class of studies aimed to assess the importance of capital structure factors on bank-level performance indices (Ayalew & McMillan, 2021; Berger & Bonaccorsi Di Patti, 2006; Berger & Bouwman, 2013). Unfortunately, these previous studies produced inconsistent results about the effect of capital structure on the bank performance (in respect of sign, degree, and importance), resulting in the lack of a coherent and shared view of the ideal capital decision for banks.

Over the period 1990–1997, Demirgüç-Kunt and Huizinga (1999) discover a positive and substantial association between capitalization and bank performance in the OECD and developing nations. Better capitalized banks, in particular, experience reduced bankruptcy costs, lowering capital costs and increasing profitability. Recent studies confirm evidence when they examine banks in the Sub-Saharan region from 2000 to 2006 and find that capital structure does not influence bank effectiveness, whereas profitability has a negative and significant impact on capital structure (Adesina et al., 2015; Sufian & Habibullah, 2009). Similarly, Amidu (2007) looked at 19 Ghanaian banks from 1998 to 2003 and discovered that short-term debt hurt profitability, meaning that competitive banks have less short-term debt on their financial statements. According to Gupta and Mahakud (2020), bank scale, non-performing loan ratio, and income dispersion are the primary factors of the success of commercial banks in India via an examination of 19 years for 64 Indian commercial banks. In addition, the data demonstrate that the influence of bank size, bank age, labor productivity, and income dispersion on the profitability of Indian banks throughout the crisis period is substantial. The increased non-government shareholding improves the efficiency of India's commercial banks. The bank's efficiency improves as its capital adequacy increases. The bigger banks generate fewer profits. The findings give a deeper understanding of the factors that influence the performance of Indian banks. According to Mohanty and Lin (2021), the expense and revenue effectiveness of the Chinese banking business has increased dramatically from the pre-Basel II period, between 1996 and 2006, to the Basel II era, between 2007 and 2017. Subperiod evaluations indicate that the risk-based capital ratio is positively related to profitability between 1996 and 2017.

2.3. Hypothesis development

Empirical data on the relationship between capital structure and bank profitability yields conflicting and inconsistent conclusions and few studies on frontier markets have been done. Furthermore, whereas most theories and empirical data about bank capital structure done in advanced nations assume a positive relationship between capital structure and bank profitability, research undertaken in emerging and frontier markets has indicated mixed results. Specifically, Berger and Bonaccorsi Di Patti (2006) demonstrate that data from the banking industry supports the corporate governance theory that leverage impacts agency costs and hence improves bank performance. Besides, banks have a distinct capital structure than non-financial businesses since their capital is primarily supported by client deposits (Gropp & Heider, 2010). The capacity of a bank to raise capital on a routine basis is shown by customer deposits. In the entire capital structure of commercial banks, this is the greatest source of capital. Gropp and Heider (2010) use the data of the U.S banks and European banks to confirm the positive relationship between customer deposits/non-deposit liabilities and bank profitability. Anderson et al. (2021) examine banks in Ethiopia and find that higher profitability measures are positively related to total and short-term leverage ratios.

However, Amidu (2007) and Adesina et al. (2015) examine banks in the Sub-Saharan region and find a negative relationship between bank profitability and capital structure. Using Vietnam as a typical frontier market, we formulate the hypothesis as follows:

H1: There is a positive relationship between leverage and bank profitability in Vietnamese commercial banks.

H1a: There is a positive relationship between the customer deposit and bank profitability in Vietnamese commercial banks.

H1b: There is a positive relationship between the non-deposit liabilities and bank profitability in Vietnamese commercial banks.

3. Methodology

3.1. Data

The study uses unbalanced panel data from 2012 to 2018. The data is collected from the financial statements of 30 Vietnamese commercial banks, and the macroeconomic data is collected from the General Statistics Office of Vietnam. The commencement date for the data was selected due to significant problems in gathering adequate data before 2007, as well as the effects of State Bank of Vietnam's Decision No. 457/2005/Q-NHNN, Circular no. 41/2016/TT-NHNN, and Circular no. 13/2018/TT-NHNN requiring Vietnamese banks to apply the Basel I and II. In 2018, Vietnamese banks that complete the implementation of Basel II embarks on the Basel III application.

The data were organized in a panel format to make use of the benefits of estimating with a larger set of observations or degrees of freedom, hence enhancing estimator efficiency. Furthermore, panel data analysis allows for the management of unobserved time-invariant heterogeneity such as cultural variables or variations among organizations; and it allows for the assessment of the dynamics of individual behaviors that cannot be calculated using cross-sectional data. Lastly, using panel data, instrument variables are simpler to get to tackle endogeneity, which is a prevalent issue in studies-in particular, exogenous factors in prior periods used as instruments for endogenous variables in the present period Arellano and Bond (1991). As a result, panel data give a plethora of instruments.

3.2. The variables

3.2.1. Measure of bank profitability

Financial ratios determined from financial statements, firm market value, and Tobin's q , which combines market and accounting valuation, were all employed in previous studies (Berger & Bonaccorsi Di Patti, 2006). When market ratios are harder to achieve, academics turn to book performance ratios like return on assets (ROA), return on equity (ROE), earnings per share (EPS), and net interest margin (NIM). ROA and ROE are also employed in banking research (Ercegovac et al., 2020; Flamini et al., 2009; Obamuyi, 2013; Zeitun, 2012; Zeitun & Goaied, 2022). Given the comparatively low equity of banks in developing countries, ROA, frequently combined with ROE, is the most often used measure of bank performance (Flamini et al., 2009; Saona, 2016; Sufian, 2011; Zeitun, 2012; Zeitun & Goaied, 2022). ROA represents the capacity of management to gain from bank assets (Obamuyi, 2013). The return on equity (ROE) is a financial statistic that assesses a bank's earnings from its equity. The figure demonstrates how well the bank's management is utilizing the shareholders' funds.

This study employs ROA because Vietnamese banks have limited off-balance sheet operations that relate directly to their profitability, as indicated by the low share of investment in total assets

(Trujillo-Ponce, 2013). The ROE is used as a secondary measure to ROA because it disregards the financial risk of leverage (Athanasoglou et al., 2008).

3.2.2. Measure of capital structure

Banks have a distinct capital structure than non-financial businesses since their capital is primarily supported by client deposits (Gropp & Heider, 2010). Bank capital structure can be represented by different proxies, including total debt ratio (TD)-the total debt to total asset and short-term debt ratio (SDT)- the short-term debt to the total asset (Ayalew & McMillan, 2021), customer deposits-total deposits to total assets and non-deposit liabilities to total assets (Gropp & Heider, 2010; Al-Qudah, 2014 #1337). This research uses customer deposits and non-deposit liabilities as capital structure measures.

3.2.3. Measure of control variables

Based on the work of J. J. Batten and Vo (2019), D. V. Tran et al. (2020), Nguyen and Nguyen (2016), and other studies, this study included a variety of control factors. Table 1 summarizes the control variables employed in this investigation, as well as their measures.

3.3. Data analysis

For the panel data regression model, three commonly used methods are (1) The least-squares estimator (Pooled OLS); (2) the Fixed Effect Model (FEM); and (3) Random Effect Model (REM; Zdaniuk, 2014). Considering the factors in the study, the OLS model is:

$$x_{it} = \alpha + y_{it}\beta + \mu_{it}$$

where i is bank and t is time and

x_{it} : the dependent variable of bank i in year t

y_{it} : $K \times 1$ vector of explanatory variables

β : $K \times 1$ vector of constants

μ_{it} : error term

However, the OLS model considers banks as homogeneous, all observations are grouped regardless of whether there are differences between banks. This often does not reflect reality because each bank is an entity with its characteristics. Thus, the OLS model can lead to biased estimates when these individual effects are not taken into account. With REM and FEM models, we can control these separate effects, specifically as follows:

$$x_{it} = \alpha + y_{it}\beta + w_{it}$$

Where $w_{it} = u_i + \mu_{it}$, where u_i represents the discrete effects that do not change over time and are unobserved for each bank i . The main difference between OLS and the two models REM & FEM is the existence of index u_i . While OLS does not consider this factor, REM and FEM allow and control

Table 1. Control variables employed in this study

Control variables	Definition	Expected results
Bank size	Natural logarithm of total assets	+
Bank loans	Total loans/total assets	+
Operating costs	Operating costs/total assets	-
Inflation	Annual inflation rate	-
GDP growth	Annual GDP growth	+

its existence. However, there is also a difference between FEM and REM when considering u_i from different angles, both admit the existence of u_i , but if these separate effects are correlated with the independent variables then the most suitable method is FEM, otherwise, if u_i does not correlate with the independent variable ($u_i \sim (0, \sigma^2)$) then REM is more suitable.

To determine which model is better, an F-test for the FEM model, the Breusch-Pagan Lagrange Multiplier (LM) test for REM (Breusch & Pagan, 1980), and the Hausman test (Hausman, 1978) for both fixed and random models were conducted. At the same time, to increase the reliability and relevance of the research results, model tests are performed. The Wald test was used to check for groupwise heteroskedasticity (Baum, 2001), while the Wooldridge test was used to assess autocorrelation (Wooldridge, 2010). If heteroskedasticity and autocorrelation exist in the model, the FGLS model will be performed (Cotte Poveda, 2011).

Although the FGLS model can deal with heteroskedasticity problems and autocorrelation, bias relating to endogeneity still exists. Then, the SGMM method will be applied. The SGMM method proposed by Arellano and Bond (1991) is suitable because it solves the defects of the panel data model such as autocorrelation, heteroscedasticity, and endogeneity. The Sargan test (or Hansen test) will be used in this study. The Sargan/Hansen test determines the appropriateness of the instrument variables in the GMM model. This is an over-identifying restrictions or tool variable conformance test. Arellano—Bond (AR) test was proposed by Arellano and Bond (1991) to test the autocorrelation of variance in the form of first difference. Therefore, the differential series has a first-order correlation, AR(1), so the test results are ignored. Second-order autocorrelation, AR(2) to detect the second-order autocorrelation of residuals. The hypothesis H_0 of the Arellano—Bond test is that there is no second-order autocorrelation for the residuals and hence the larger the p-value of the AR(2) test, the greater the absence of second-order autocorrelation for the residuals.

3.4. Empirical model

To test the relationship between capital structure and bank profitability, this research used the following model:

$$BP_{i,t} = \alpha_0 + \alpha_1 CS_{i,t} + \alpha_2 Z_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $BP_{i,t}$ is the profitability of bank i at time t and measured by ROA, ROE; $CS_{i,t}$ is a capital structure of bank i at time t and measured by the ratios of total deposits and non-deposit liabilities to book value of total assets; $Z_{i,t}$ is a vector of control variables.

According to hypothesis H_1 , leverage would have a beneficial influence on bank profitability, hence a positive sign on α_1 was predicted in the model (1). This study used the relevant models to capture industry- and year-specific fixed effects:

$$BP_{i,t} = \alpha_0 + \alpha_1 CS_{i,t} + \alpha_2 Z_{i,t} + i.industry + \varepsilon_{i,t} \quad (2)$$

$$BP_{i,t} = \alpha_0 + \alpha_1 CS_{i,t} + \alpha_2 Z_{i,t} + i.year + \varepsilon_{i,t} \quad (3)$$

3.5. Control variables in the model

3.5.1. Bank size

Larger banks can diversify their lending and investment portfolios, develop their network, spend heavily on technology, and maintain a good reputation and high degree of consumer and investor confidence (Tarek Al-Kayed et al., 2014). As a result, the scale of a bank has a significant and beneficial impact on its profitability. Furthermore, by specializing, major banks may lower their input and operational expenses (Gupta & Mahakud, 2020; Nguyen & Nguyen, 2016; Sufian, 2011).

3.5.2. Bank loans

Because lending is a high-yielding asset, banks with a high loan-to-total-assets ratio are less liquid but also more lucrative. Since lending is the major source of income for Vietnamese commercial banks, banks can make more profit when deposits are turned into loans (Le, 2017). Moreover, lending aids banks in lowering intermediary costs, which improves bank profitability.

3.5.3. Operating costs

Personnel, management, depreciation, advertising, and other expenditures are included in operating costs, reflecting the capacity of commercial banks to control costs. The greater this ratio is the less effective the company is in controlling operational expenses, and vice versa. According to J. J. Batten and Vo (2019), Sufian (2011), and Kosmidou (2008), operating costs have a negative association with bank profitability.

3.5.4. Inflation

Inflation has a significant influence on bank profits. Banks may charge greater loan rates when inflation is excessive (Rahman et al., 2015). The rise in the interest rate, on the other side, will put a strain on the debt repayment budget. As a result, clients' repayment ability will dwindle, significantly impacting commercial banks' income. Furthermore, when inflation is severe, clients will withdraw money from banks to offset their expenditures, causing bank deposits and loans to decline (Hunjra et al., 2020). High inflation also makes it possible for the central bank to execute a restrictive monetary policy to control inflation (Bikker & Vervliet, 2018), lowering aggregate demand and lowering loan demand, severely impacting commercial bank profits.

3.5.5. GDP growth

Since a robust economy would enhance consumption and investment demand, as well as drive additional borrowing, high GDP growth is projected to have a beneficial influence on bank profitability (Hunjra et al., 2020). Throughout a period of strong economic development, consumers' repayment ability increases, bad debts diminish, the cost of providing for credit risks falls, and profits rise as a consequence (Nguyen & Nguyen, 2016). Furthermore, the bank's operations, such as capital mobilization, lending, and providing financial services, will grow more active, causing a rise in income and profit for the bank.

4. Research results and discussion

4.1. Descriptive statistics

This analysis examines the effect of capital structure on the profitability of Vietnamese commercial banks, using a balanced panel of 30 banks over the period of seven years from 2012–2018. Table 2 depicts the summary of descriptive statistics of the capital structure and bank profitability measures along with the control variables.

Return on total assets (ROA) of Vietnamese commercial banks in the period 2012–2018 reached an average of 0.6%, the highest was 2.64% and the lowest was approximately 0%. During this period, return on equity (ROE) averaged 7.4%, ranging from 0.06% to 24.44%.

Customer deposits (DEP) in this period averaged 66.92%, the lowest value was 41.4% and the highest was 89.37%. The average non-deposit liabilities (NONDEP) of banks were 23.83%, fluctuating between 2.59% and 50.67%, showing a huge disparity between banks in terms of non-deposit liabilities.

Bank size (SIZE) in this period still has great volatility with a standard deviation up to 1.0855. This shows that the difference in asset size between Vietnamese banks is quite large, there are banks with very large asset market shares that can lead the market.

Table 2. Descriptive statistics of the bank profitability (BP) and capital structure (CS)

Variable	Obs.	Mean	Std.dev	Min	Max
Bank profitability					
ROA	206	0.006	0.0049	0.0001	0.0264
ROE	206	0.0704	0.0567	0.0006	0.2444
Capital Structure					
DEP	206	0.6692	0.1065	0.414	0.8937
NONDEP	206	0.2383	0.1052	0.0259	0.5067
Control variables					
SIZE	206	32.2511	1.0855	30.2178	34.8111
LOAN	206	0.5543	0.1171	0.2223	0.753
OPE	206	0.0166	0.0052	0.0037	0.0328
INFLAT	206	0.0457	0.0248	0.0063	0.0921
GGDP	206	0.0621	0.0064	0.0525	0.0708

Bank loan (LOAN) measures the lending size of banks, with an average value of 55.34%, indicating that the average proportion of lending assets of banks accounts for 55.34% of total assets.

The average operating costs (OPE) of banks during this period was 1.66% of total assets. The highest value is 3.28% and the lowest is 0.37%.

Inflation (INFLAT) was generally quite low during this period, with an average of 4.57%, the lowest is 0.63% and the highest is 9.21%. The average GDP (GDP) growth rate is 6.21%, the lowest is 5.25% and the highest is 7.08%.

4.2. Correlation analysis

The correlation coefficients between variables used in the regression models are presented in Table 3. It can be observed that the correlation of customer deposits ratio and Non-deposit liabilities ratio used as proxies of capital structure are high. In particular, the correlation coefficient between the customer deposits ratio (DEP) and the Non-deposit liabilities ratio (NONDEP) is -0.9313 . Therefore, instead of combining both ratios in only one regression, this research separately examined the effect of each type of ratio on bank profitability to minimize the multicollinearity problem. Other correlation coefficients are quite small (below 0.5), implying that other variables are suitable in the regression models.

4.3. Pooled OLS regression

First, the OLS regression (pooled OLS) was performed. Table 4 presents the pooled OLS results for the bank profitability equation using ROA and ROE as dependent variables, respectively.

$$BP_{i,t} = \mu_0 + \mu_1 CS_{i,t} + \mu_2 Z_{i,t} + \varepsilon_{i,t}$$

This table reports the results of examining the relationships between capital structure and bank profitability, which were estimated by pooled OLS estimators. Statistics are based on annual data for the years 2012–2018. The capital structure is measured by customer deposits to total assets (DEP) and Non-deposit liabilities to total assets (NONDEP), and bank profitability is measured by ROA and ROE. Statistics were based on annual data for the years 2012–2018. Columns 1 and 2 examined the effects respectively of DEP and NONDEP on return on assets (ROA). Columns 3 and 4

Table 3. Correlation coefficients between measures of capital structure and bank profitability

	ROA	ROE	DEP	NONDEP	SIZE	LOAN	OPE	INFLAT	GGDP
ROA	1.0000								
ROE	0.8472*	1.0000							
DEP	-0.096	0.007	1.0000						
NONDEP	0.0120	0.0741	-0.9313*	1.0000					
SIZE	0.1853*	0.5086*	0.2651*	-0.0158	1.0000				
LOAN	0.2234*	0.2994*	0.5364*	-0.5222*	0.2389*	1.0000			
OPE	0.4524*	0.2412*	0.0111	-0.1923	-0.2355*	0.1829*	1.0000		
INFLAT	0.1304*	-0.026	-0.2913*	0.1806*	-0.1910*	-0.2156*	0.1921*	1.0000	
GGDP	0.0017	0.1763*	0.2434*	-0.1132	0.2608*	0.3434*	-0.1386*	-0.8226*	1.0000

Note: ROA: the ratio of earnings after interest and tax to total assets; ROE: the ratio of earnings after interest and tax to total equity; DEP: the ratio of customer deposits to total assets; NONDEP: the ratio of Non-deposit liabilities to total assets; SIZE: Natural logarithm of total assets; LOAN: the ratio of bank loans to total assets; OPE: the ratio of operating costs to total assets; INFLAT: Annual inflation rate; GGDP: Annual GDP growth rate. * indicate significance at the 10% level.

examined the effects respectively of DEP and NONDEP on return on equity (ROE). There are five control variables: bank size (SIZE), bank loans (LOAN), operating costs (OPE), inflation (INFLAT)), and GDP growth (GGDP).

As shown in Table 4, customer deposit ratios are negatively associated with bank profitability because the coefficients estimators for the customer deposits ratios are significantly negative at the 1% level. While Non-deposit liabilities ratios are positively associated with bank profitability because the coefficients estimators for the customer deposits ratios are significantly negative at the 1% level. Specifically, the coefficient customer deposits ratios in columns 1 and 3 are -0.0129 and -0.1445 , which denotes that an increase of 1% in customer deposits ratios will lead to a decrease of approximately 0.1% in ROA and ROE, holding all other variables constant. However, the coefficients of Non-deposit liabilities ratios in columns 2 and 4 are less than 0.2, suggesting that when Non-deposit liabilities ratios rise 1%, the ROA and ROE will increase less than 0.2%, all else held equal. Another significant point is that overall F-tests with all p-values below 1% report good fitness of the models. In addition, most adjusted R-squared values are moderate, from 0.3192 to 0.4719. Especially in ROE regressions, the values of adjusted R-squared are around 0.46, reflecting that the models can explain 46% of the change in ROE. However, as discussed in the methodology chapter, regression using the OLS method cannot control for unobserved individual effects, which commonly appear in most research using cross-sectional data. Therefore, FE and RE modeling were conducted alongside pooled OLS for unobserved individual effects.

$$BP_{i,t} = \mu_0 + \mu_1 CS_{i,t} + \mu_2 Z_{i,t} + \alpha_i + \varepsilon_{i,t}$$

4.4. Fixed and random effect models

Table 5 reports the results of examining the relationships between capital structure and bank profitability, which were estimated by fixed and random effect models. Statistics are based on annual data for the years 2012–2018. The capital structure is measured by customer deposits to total assets (DEP) and Non-deposit liabilities to total assets (NONDEP) and bank profitability is measured by ROA and ROE. Statistics were based on annual data for the years 2012–2018. There are five control variables: bank size (SIZE), bank loans (LOAN), operating costs (OPE), inflation (INFLAT)), and GDP growth (GGDP).

To select the appropriate model between FE and RE, the Hausman test was performed. The results of chi-square statistics are all insignificant at the 10% level, favoring the RE model over the FE model. The Wald test also shows that the FE model is better than pooled OLS. Hence, the RE estimator was used to investigate the effect of leverage on bank profitability.

The results of the LM tests (Breusch and pagan Lagrangian Multiplier) show that $\text{Prob} > \chi^2_2 > 0.05$, showing that the models do not have heteroscedasticity. Wooldridge tests result show that $\text{Prob} > F = 0.0000 < 0.05$, so it is concluded that autocorrelation occurs in all models. To control this problem, the FGLS method (Feasible Generalized Least Square) was applied.

4.5. Feasible generalized least square method

Overall, all results remain similar with the RE model reconfirming the negative relationship between deposits ratio and bank profitability; the positive relationship between non-deposit liabilities ratio and bank profitability in Vietnamese commercial banks.

4.6. SGMM method

Using the FGLS method (as in Table 6) can help to control unobserved effects as well as heteroskedasticity; however, the endogenous issue, which leads to biased and inconsistent estimators, may still exist. This is caused by the inability to ascertain if a simultaneous reverse relation link exists between capital structure and bank profitability. In addition, the capital structure can be considered simply an indicator of unobserved features that influence profitability. To strengthen

Table 4. The effect of capital structure on bank profitability—Pooled OLS regression

	Dependent ROA		Dependent ROE	
	(1)	(2)	(3)	(4)
DEP	−0.0129*		−0.1445*	
	(0.0032)		(0.0343)	
NONDEP		0.0081*		0.1405*
		−0.0033		−0.0343
SIZE	0.0014*	0.0012*	0.0310*	0.0280*
	(0.0002)	(0.0002)	(0.0029)	(0.0029)
LOAN	0.0086	0.0066*	0.1019*	0.1046*
	(0.0031)	(0.0032)	(0.0326)	(0.0333)
OPE	0.4566*	0.4767*	3.7399*	4.0567*
	(0.0581)	(0.0598)	(0.608)	(0.6127)
INFLAT	0.0294	0.0375**	0.2761	0.2804
	(0.0208)	(0.0213)	(0.2182)	(0.2189)
GGDP	0.0786	0.0923	1.4236***	1.2671
	(0.0818)	(0.0847)	(0.8554)	(0.8669)
Constant	−0.0519*	−0.0553*	−1.0531*	−1.0840*
	(0.0101)	(0.0102)	(0.1049)	(0.1045)
Observations	206	2056	2056	2056
Adj R-squared	0.3692	0.3192	0.4719	0.4685
F-test	19.41	17.02	29.64	29.35
Prob > F	0.000	0.000	0.000	0.000

Standard error in parentheses; *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

the research outcomes, a system two-step GMM was applied to cope with the endogenous problem.

The outcomes of the system GMM are reported in [Table 7](#). It once again confirms the result between capital structure and bank profitability. Sargan-Hansen test shows suitable instrument variables, while AR(2) test shows no second-order autocorrelation. These results confirm the appropriateness of the model.

4.7. Result discussion

4.7.1. Customer deposit

To discuss the research results, SGMM regression models are used because the SGMM method overcomes the limitations of the Pooled OLS, FE, RE, and FGLS methods. Research results from all regression models show that customer deposits hurt ROA and ROE. As customer deposits increase, the bank's asset management efficiency and capital efficiency decrease. This result can be explained when the bank receives more deposits, which means that the bank's assets and financial leverage increase, and the bank is under pressure to effectively use the mobilized money, which leads to inefficient investment in projects or credit and reduces ROA and ROE. Therefore, while profits may increase, it does not offset the increase in shoddy assets. This result is consistent with the study of D. E and R (2007), but contrary to the work of Berger and Bonaccorsi Di Patti (2006), research hypothesis, and agency theory.

Table 5. The effect of capital structure on bank profitability –RE and FE models

	Dependent variable: ROA			Dependent variable: ROE		
	(1)	(2)	(3)	(4)	(5)	(6)
	RE	RE	FE	FE	RE	FE
DEP	-0.0166* (0.0036)		-0.0194* (0.0041)		-0.1445* (0.0343)	-0.1578* (0.0394)
NONDEP		0.0100* (0.0037)		0.0116** (0.0044)		
SIZE	0.0015* (0.0004)	0.0012* (0.0004)	0.0012 (0.0012)	0.001 (0.0014)	0.0310* (0.0029)	0.0280* (0.0029)
LOAN	0.0098 (0.0039)	0.0067** (0.004)	0.0115** (0.0049)	0.0072 (0.0052)	0.1019* (0.0326)	0.1046* (0.0333)
OPE	0.3838* (0.0753)	0.4332* (0.0776)	0.2997* (0.1002)	0.3831* (0.1018)	3.7399* (0.608)	4.0567* (0.6127)
INFLAT	0.0281 (0.0176)	0.0382** (0.0183)	0.0286 (0.0188)	0.0395** (0.0194)	0.2761 (0.2182)	0.2804 (0.2189)
GGDP	0.0746 (0.0744)	0.0951 (0.0776)	0.0795 (0.1045)	0.1021 (0.1087)	1.4236*** (0.8554)	1.2671 (0.8669)
Constant	-0.0498* (0.0121)	-0.0555* (0.0148)	-0.0401 (0.0381)	-0.0503 (0.0409)	-1.0531* (0.1049)	-1.3499* (0.1045)
Observations	206	206	206	206	206	206
Adj R-squared	0.3228	0.3398	0.3597	0.3192	0.4125	0.4719
F-test	21.3576	19.0654	32.45	22.0621	27.1565	25.1576
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Standard error in parentheses; *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

Table 6. The effect of capital structure on bank profitability—FGLS method

	Dependent ROA		Dependent ROE	
	(1)	(2)	(3)	(4)
DEP	−0.0129*		−0.1445*	
	(0.0032)		(0.0337)	
NONDEP		0.0081*		0.1405*
		(0.0044)		(0.0337)
SIZE	0.0014*	0.0012*	0.0310*	0.0280*
	(0.0002)	(0.0002)	(0.0029)	(0.0029)
LOAN	0.0086*	0.0066**	0.1019*	0.1046**
	(0.0031)	(0.0052)	(0.0321)	(0.0327)
OPE	0.4566*	0.4467*	3.7399*	4.0567*
	(0.0571)	(0.0588)	(0.5975)	(0.6022)
INFLAT	0.0264	0.0375**	0.2761	0.2804
	(0.0205)	(0.021)	(0.2145)	(0.2151)
GGDP	0.0786	0.0923	1.4326***	1.2671
	(0.0804)	(0.0832)	(0.8407)	(0.8521)
Constant	−0.0519*	−0.0553	−1.0531*	−1.0840*
	(0.0098)	(0.01)	(0.1031)	(0.1027)
Observations	2056	2056	2056	2056
Prob > F	0.0000	0.0000	0.0000	0.0000

This table reports the results of examining the relationships between capital structure measured by customer deposits to total assets (DEP) and Non-deposit liabilities to total assets (NONDEP), and bank profitability measured by ROA, and ROE. Statistics were based on annual data for the years 2012–2018. Columns 1 and 2 examined the effects respectively of DEP and NONDEP on return on assets (ROA). Columns 3 and 4 examined the effects respectively of DEP and NONDEP on return on equity (ROE). There are five control variables: bank size (SIZE), bank loans (LOAN), operating costs (OPE), inflation (INFLAT)), and GDP growth (GGDP). Standard error in parentheses; *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

4.7.2. Non-deposit liabilities

Unlike customer deposits, non-deposit liabilities have a positive impact on ROA and ROE in all regression models. When commercial banks mobilize more with non-deposit liabilities, the bank's financial leverage also increases accordingly. Different from mobilizing capital from customer deposits, which often have many different terms or demands, Vietnamese commercial banks mobilize capital from non-deposit liabilities with higher interest rates and longer terms. The positive relationship between non-deposit liabilities shows that the use of capital from non-deposit liabilities is effective and increases ROA and ROE. Vietnamese commercial banks use non-deposit liabilities to finance projects or loan portfolios with long terms and high-interest rates, increasing the efficiency of assets and equity. This result is consistent with the agency theory, research hypothesis, and studies of Berger and Udell (2006) but different from the study of D. E and R (2007).

4.7.3. Control variables

Research results show that bank size (SIZE) has a positive impact on the ROA and ROE of Vietnamese commercial banks, supporting the view of the market power theory. This research result is consistent with the research hypothesis and studies of Sufian (2011), Alexiou and Vogiazas (2009), and Kosmidou et al. (2007). Large-scale banks have better access to customers, more diversified products, reputable brands, and a high level of trust among customers and investors, and can invest in more modern technologies and have a competitive advantage due to scale, favoring the concept of scale-efficiency. As a result, commercial banks with large scale achieve higher profitability.

Table 7. The effect of capital structure on bank profitability—System two-step GMM estimator

	Dependent ROA		Dependent ROE	
	(1)	(2)	(3)	(4)
DEP	−0.044*		−0.0536**	
	(0.0017)		(0.0696)	
NONDEP		0.001		0.7720*
		(0.0013)		(0.0287)
SIZE	0.0007*	0.0008*	0.0342*	0.0281*
	(0.0002)	(0.0003)	(0.0115)	(0.0122)
LOAN	0.0026	0.0004	0.0896*	0.1005*
	(0.0021)	(0.002)	(0.0291)	(0.0304)
OPE	0.4976*	0.5267*	2.8768*	3.0351*
	(0.0453)	(0.047)	(0.6593)	(0.6316)
INFLAT	0.0410*	0.0454*	0.2627*	0.2767*
	(0.0088)	(0.0089)	(0.1066)	(0.1032)
GGDP	0.2088*	0.2233*	0.749	0.8932
	(0.0453)	(0.0464)	(0.6471)	(0.6246)
Constant	−0.0428*	−0.0501*	−1.1974*	−1.0719*
	(0.0082)	(0.0092)	(0.345)	(0.3552)
Sargan-Hansen test	0.2042	0.2229	0.1149	0.1273
AR(2) p-value	0.4996	0.5325	0.5849	0.6494

This table reports the results of examining the relationships between capital structure measured by customer deposits to total assets (DEP) and Non-deposit liabilities to total assets (NONDEP), and bank profitability measured by ROA, ROE, which are estimated by the system GMM estimator. Statistics were based on annual data for the years 2012–2018. Columns 1 and 2 examined the effects respectively of DEP and NONDEP on return on assets (ROA). Columns 3 and 4 examined the effects respectively of DEP and NONDEP on return on equity (ROE). There are five control variables: bank size (SIZE), bank loans (LOAN), operating costs (OPE), inflation (INFLAT), and GDP growth (GGDP). Standard error in parentheses; *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level.

Bank loan has a positive impact on the profitability of Vietnamese commercial banks, consistent with the study of Sufian (2011), Le (2017), and Rahman et al. (2015). A bank with a high loan-to-asset ratio means that it strategically focuses on lending and holds more interest-bearing assets. In other words, the more banks expand their lending activities, the more financially efficient they will be. This is the main revenue and profit-generating activity for Vietnamese commercial banks, but the risks that banks face are also higher.

Operating costs (OPE) have a positive impact on profitability. Banks with high operating costs can increase the profitability of Vietnamese commercial banks. The period 2012–2018 is the period when Vietnamese commercial banks restructure and rearrange the banking system, and renovate the banking administration system towards modernity, in line with international practices and standards (The Prime Minister, 2012). At the same time, banks also restructured business activities towards safer and healthier. As a result, the management and administration activities of banks have become more professional, approaching modern banking governance standards, actively cooperating in technology transfer, and strategic cooperation with global banks. This result is consistent with the study of Molyneux and Thornton (1992) and the research hypothesis.

The results show that inflation has a positive impact on the ROA and ROE of Vietnamese commercial banks. High inflation can help banks to impose high lending rates, but there is a potential risk in the future because high loan interest rates will create a burden on the debt repayment budget. When interest rates rise, the difference between deposit rates and lending rates will increase, leading to an increase in the bank's profit.

When the economic growth is high, the borrower's ability to repay is also guaranteed and the loan quality is better. In addition, the good quality of economic growth has a positive impact on the investment portfolio, increasing the asset value, and cash flow of banks, resulting in higher profitability. The research result is similar to the studies of Kohlscheen et al. (2018), Athanasoglou et al. (2008), Trujillo-Ponce (2013), Athanasoglou et al. (2008), and Nguyen and Nguyen (2016), and Le (2017), and Tran (2014) and is consistent with the research hypothesis. Additional analysis on the use of Tier 1 capital to total assets as the dependent variable in the models are stated in the Appendix section (see Appendix Table 8–11).

5. Conclusion and policy implications

The study was conducted to evaluate the impact of capital structure on the profitability of Vietnamese commercial banks. Due to the difference between the capital structure of enterprises and commercial banks, the author uses customer deposits and non-deposit liabilities to represent the capital structure of Vietnamese commercial banks. Using the dataset of 30 Vietnamese commercial banks from 2012–2018, the research results show that customer deposit hurts bank profitability and non-deposit liabilities have a positive on bank profitability in all regressions. Besides, the factors of bank size, bank loan, operating costs, inflation, and GDP growth have positive impacts on the profitability of Vietnamese commercial banks. On that basis, the authors propose some solutions to the capital structure of Vietnamese commercial banks to be more reasonable to achieve better profitability, specifically as follows:

Firstly, it is necessary to use customer deposits more effectively. Vietnamese commercial banks need to make a more thorough and reasonable appraisal when lending to ensure the quality of assets as well as the quality of the bank's loans. When a bank's assets increase but its asset quality is worse, it will lead to long-term consequences, such as the inability to recover capital to meet customers' withdrawal needs, increasing liquidity risk, and default risk of banks.

Second, non-deposit liabilities are sources of long-term loans for banks. Banks often invest in projects or long-term loan portfolios with higher interest rates and longer terms. Although non-deposit liabilities increase the bank's profitability, it is necessary to carefully evaluate the use of this capital. Specifically, it is necessary to more thoroughly appraise investment projects as well as long-term loans, ensuring the quality of the bank's assets in the long term. Finally, commercial banks need to consider increasing capital to reduce financial leverage and balance harmoniously between the profit of shareholders and the risks of commercial banks.

The limitation of this study is that it only evaluates the impact of capital structure on the profitability of Vietnamese commercial banks. Meanwhile, the capital structure can affect both profitability and risk of a bank. Therefore, in the next studies, the author will evaluate the impact of capital structure on the risk of commercial banks in Vietnam and expand to Southeast Asian countries.

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Correction

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Appendix

Table 8. The effect of capital structure on bank profitability—pooled OLS regression

	Dependent ROA	Dependent ROE
CAP	0.0564*** (0.0109)	0.0391 (0.1227)
SIZE	0.0024*** (0.0003)	0.0298*** (0.0029)
LOAN	0.0006 (0.0026)	0.0316 (0.0326)
OPE	0.3348** (0.0619)	3.7848** (0.6915)
INFLAT	0.0524 (0.0196)	0.5222* (0.2194)
GGDP	0.2125 (0.0795)	2.1866* (0.8554)
_cons	−0.1012** (0.0138)	−1.1315*** (0.1458)
Observations	206	206
Adj R-squared	0.3829	0.4251
F-test	22.02	24.53
Prob > F	0.0000	0.0000

Table 8 reports the results of examining the relationships between capital structure and bank profitability, which were estimated by Pooled OLS models. Statistics are based on annual data for the years 2012–2018. The capital structure is measured by Tier 1 capital to total assets (CAP), and bank profitability is measured by ROA and ROE. Statistics were based on annual data for the years 2012–2018. There are five control variables: bank size (SIZE), bank loans (LOAN), operating costs (OPE), inflation (INFLAT)), and GDP growth (GGDP). Standard error in parentheses; *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

Table 9. The effect of capital structure on bank profitability—RE and FE models

	Dependent ROA		Dependent ROE	
	RE	FE	RE	FE
CAP	0.0764** (0.0117)	0.0193** (0.0136)	0.1898 (0.1253)	0.4094** (0.1449)
SIZE	0.0033*** (0.0005)	0.0087*** (0.0013)	0.0379*** (0.0065)	0.0754** (0.0147)
LOAN	0.0002 (0.0034)	0.0025 (0.0040)	0.0226 (0.0369)	0.0341 (0.0430)
OPE	0.2002** (0.0808)	0.0830 (0.0970)	2.3454** (0.8794)	1.5148 (1.0330)
INFLAT	0.0547** (0.0159)	0.0333* (0.0166)	0.5488** (0.1658)	0.4005** (0.1767)
GGDP	0.2148* (0.0704)	−0.0430 (0.0960)	2.1958*** (0.7491)	0.3873 (1.0226)
Constant	−0.1297* (0.0179)	−0.0519* (0.2868)	−1.3845* (0.2052)	−2.4575* (0.4398)
Observations	206	206	206	206
Adj R-squared	0.3702	0.4243	0.3053	0.3325
F-test	25.72	20.88	35.56	24.11
Prob > F	0.0000	0.0000	0.0000	0.0000

Table 9 reports the results of examining the relationships between capital structure and bank profitability, which were estimated by fixed and random effect models. Statistics are based on annual data for the years 2012–2018. The capital structure is measured by Tier 1 capital to total assets (CAP), and bank profitability is measured by ROA and ROE. Statistics were based on annual data for the years 2012–2018. There are five control variables: bank size (SIZE), bank loans (LOAN), operating costs (OPE), inflation (INFLAT)), and GDP growth (GGDP). Standard error in parentheses; *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

To select the appropriate model between FE and RE, the Hausman test was performed. The results of chi-square statistics are all insignificant at the 10% level, favoring the RE model over the FE model. The Wald test also shows that the FE model is better than pooled OLS. Hence, the RE estimator was used to investigate the effect of capital structure on bank profitability.

The results of the LM tests show that $\text{Prob} > \chi^2_2 > 0.05$, showing that the models do not have heteroscedasticity. Wooldridge tests result show that $\text{Prob} > F = 0.0000 < 0.05$, so it is concluded that autocorrelation occurs in all models. To control this problem, the FGLS method (Feasible Generalized Least Square) was applied.

Table 10. The effect of capital structure on bank profitability—FGLS method

	Dependent ROA	Dependent ROE
CAP	0.0546*** (0.0100)	0.0391 (0.1206)
SIZE	0.0024*** (0.0003)	0.0298*** (0.0039)
LOAN	0.0006 (0.0026)	0.0316 (0.0292)
OPE	0.3348* (0.0608)	3.7048** (0.6796)
INFLAT	0.0524* (0.0193)	0.5222** (0.8727)
GGDP	0.2125* (0.0781)	2.1866* (0.9727)
Constant	−0.1012** (0.0128)	−1.1357 (0.1433)
Observations	206	206
Prob > F	0.0000	0.0000

Table 10 report the results of examining the relationships between capital structure and bank profitability, which were estimated by FGLS models. Statistics are based on annual data for the years 2012–2018. The capital structure is measured by Tier 1 capital to total assets (CAP), and bank profitability is measured by ROA and ROE. Statistics were based on annual data for the years 2012–2018. There are five control variables: bank size (SIZE), bank loans (LOAN), operating costs (OPE), inflation (INFLAT), and GDP growth (GGDP). Standard error in parentheses; *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

Using the FGLS method can help to control unobserved effects as well as heteroskedasticity; however, the endogenous issue, which leads to biased and inconsistent estimators, may still exist. This is caused by the inability to ascertain if a simultaneous reverse relation link exists between capital structure and bank profitability. In addition, the capital structure can be considered simply an indicator of unobserved features that influence profitability. To strengthen the research outcomes, a system two-step GMM was applied to cope with the endogenous problem.

Table 11. The effect of capital structure on bank profitability—System two-step GMM estimator

	Dependent ROA	Dependent ROE
CAP	0.0384*** (0.0105)	0.5334*** (0.0718)
SIZE	0.0027*** (0.0005)	0.0061 (0.0091)
LOAN	0.0009 (0.0013)	0.0338 (0.0205)
OPE	0.3953** (0.0622)	4.3632** (0.6796)
INFLAT	0.0389** (0.0073)	0.4152** (0.1098)
GGDP	0.1974** (0.0363)	1.5940** (0.5348)
Constant	−0.1118** (0.0178)	−0.3355 (0.2248)
Sargan-Hansen test	0.2660	0.1609
AR(2) p-value	0.5811	0.6589

Table 11 report the results of examining the relationships between capital structure and bank profitability, which were estimated by SGMM models. Statistics are based on annual data for the years 2012–2018. The capital structure is measured by Tier 1 capital to total assets (CAP), and bank profitability is measured by ROA and ROE. Statistics were based on annual data for the years 2012–2018. There are five control variables: bank size (SIZE), bank loans (LOAN), operating costs (OPE), inflation (INFLAT), and GDP growth (GGDP). Standard error in parentheses; *significant at the 10% level; **significant at the 5% level; ***significant at the 1% level

Bank capital has a positive impact on the ROA and ROE of Vietnamese commercial banks. Bank capital represents the internal strength of the bank, is a financial safety cushion for the bank, and builds customers' confidence in the stability of operations. The higher the proportion of capital in the total capital, the more self-financed banks are and vice versa. In addition, banks with significant capital easily gain trust from customers, depositors, users of banking services, and borrowers, thereby diversifying revenue sources and positively impacting the profitability of Vietnamese commercial banks.



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