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Determinants of Bank Profitability in Vietnam:

The effects of bank-specific, industry-specific, financial and macroeconomics determinants between 2012 and 2020

Bachelor thesis: Financial economics

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ABSTRACT

The aim of this paper is to examine the effects of bank-specific, industry-specific, financial and macroeconomic determinants on Vietnamese bank profitability. The Fixed Effects models and the dynamic panel data models using Arellano-Bond estimators are applied to a panel data set of 23 listed domestic commercial banks over the period of 2012-2020. The empirical results indicate that as size increases, bank profitability increases but at a decreasing rate. Strong equity improves earnings while high credit risk reduces profits. Inflation positively impacts bank performance. However, not enough evidence is found for the relationships of other determinants. These findings provide several implications for governments, investors and bank managers regarding the optimal policies, evaluation and the assessment of bank performance.

Keywords: *Bank profitability, Emerging economies, Size, Equity, Credit risk, Inflation*

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1. Introduction

The role of banks is undeniably vital in economic growth and the financial system's stability (Barth, Caprio Jr & Levine, 2001). In developing countries, the banking sector has a significant duty of efficiently allocating investments, and incentivizing savings, investments and employment (Patrick, 1966). In the light of the COVID-19 pandemic, the global banking industry outperformed analysts' expectations of profitability and was healthier compared to previous economic crises (Dietz, Ferreira, Nadeau & Sengupta, 2021). This was driven by banks' diversification in business activities, low benchmark rates set by central banks, and massive stimulus and economic support from governments. A profitable and stable banking system has the ability to withstand negative shocks and protect the economy. Hence, bank profitability is an indication of financial system soundness and is a crucial predictor of financial crises (Demirgüc-Kunt & Detragiache, 1999). The global pandemic has driven the switch from cash to digital payments, driving the growth of banking sectors in emerging market economies (EMEs) as more than half of the population in those regions are still unbanked (Ward, 2021). This contrasts with the low credit growth in advanced economies due to the deleveraging of firms and households, thus, creating a favorable position and outlook for EMEs to extend their global footprint (Van Horen, 2012). Since 2017, digital transformation in Vietnam has been accelerating significantly as their adoption of digital banking has caught up with that of developed markets (Barquin, Buntoro, HV & Pricillia, 2021). In 2020, Vietnam was one of a few to report a positive economic growth of 2.9%, compared to a global average of -3.6%, thanks to its strict regulations and successful containment of COVID-19 (World Bank, 2022). This highlights Vietnam's blooming potential and opportunities, attracting both domestic and international investors. Although Vietnam's banking industry experienced strong growth and doubled profitability from 2015 to 2019, it remained low compared to ASEAN standards due to low capital buffers and high impaired loans (International Monetary Fund, 2021). These underlying vulnerabilities need to be addressed for stable and sustainable growth in the long run.

Most bank profitability studies focus on developed markets. Many researchers study banks in the United States (US) and the European Union (EU); some focus on developing and emerging markets, but very few examine Vietnamese banks. Though, all share common findings: there are internal and external determinants of bank profitability. Gul, Irshad & Zaman (2011) find significant and direct relationships between bank-specific internal features and

macroeconomics characteristics with Pakistani commercial banks' profitability. Size, loans, deposits, growth and inflation improve profitability as banks benefit from economies of scale, increased operating profits, and strong ability to push inflation costs onto customers. A study by Batten & Vo (2019), looking specifically into Vietnamese bank profitability, also suggests similar factors while including additional banking-specific measures such as credit risk, cost and productivity; all demonstrate significant impacts on profitability. Additionally, the industry factor of market concentration is examined in further studies, showing a negative effect on performance (Athanasoglou, Brissimis & Delis, 2008). As the market power increases, managers tend to engage in inefficient and risk-averse decisions, reducing earnings and performance. Financial factors such as interest rates, stock market capitalization and foreign exchange rate also improve bank profitability as they influence the activities and performance of financial institutions (Aburime, 2008; Borio, Gambacorta & Hofmann, 2017). However, a complete combination of these factors is not yet studied in the Vietnamese banking sector.

Considering the differences in the banking sector's structure and growth potentials between EMEs and well-researched countries, much research is needed to understand bank profitability in developing regions to sustain economic growth and development. Literature on bank profitability can aid bank managers, investors and governments in improving managerial efficiency, highlighting investment opportunities, predicting bank crises and maintaining a sound financial sector (Menicucci & Paolucci, 2016). This paper contributes to the academic literature by providing an up-to-date analysis of bank profitability in the emerging market of Vietnam with the following research question:

"What are the effects of bank-specific, industry-specific, financial and macroeconomic factors on bank profitability in Vietnam between 2012 and 2020?"

Due to limitations in data availability, the sample consists of 23 listed domestic commercial banks in Vietnam, including state-owned commercial banks and joint-stock commercial banks. The study period is from 2012 to 2020. Data are extracted from ORBIS Bank Focus for bank profitability proxy (return on assets) and bank-specific factors (size, equity, credit risk, loans, deposits, overhead expenses, current account savings account ratio and profit persistence). Available financial statements of individual banks are also examined for data cross-checking and calculating the current account savings account ratio. Data on the industry-specific factor (market concentration) is retrieved from The Global Economy. International Monetary Fund and

World Bank databases are used for financial (interest rate, foreign exchange rate, stock market capitalization) and macroeconomic (economic growth, inflation) factors. Our data is a panel data set with both cross-sectional and time series elements. Thus, the Fixed Effects (FE) and Random Effects (RE) models are most appropriate and will be used with the Hausman test to choose the best-fitting model (Brooks, 2014). Additionally, the dynamic panel data models with Arellano-Bond estimators will also be performed to account for the persistence of profitability in Vietnamese banks; Arellano-Bond tests for dynamic models and Wald tests for the goodness of fit of multiple models will be discussed.

Our results indicate that bank profitability increases as size increases but at a decreasing rate. Equity drives profitability as it absorbs loss and funds future opportunities while high credit risk reduces earnings due to increasing loan loss reserves and default risks. Lastly, inflation has a positive relationship with bank profitability. There is not enough evidence to support the Structure-Conduct-Performance hypothesis, which states that market power drives banks' monopolistic profits. Additionally, we find no statistically significant results at a 5% level for the other determinants of bank profitability in our sample and study period.

This paper is organized as follows. Section 2, Theoretical Framework, will give an overview of the history of the Vietnamese banking sector and discuss the relevant existing literature on bank profitability in different regions. Section 2 will also address each factor in the four groups of determinants, providing the expected signs and corresponding hypotheses. Section 3 will describe the data and methodology used in our research. Section 4 presents the results, divided into FE and dynamic model specifications. Lastly, section 5 provides the conclusion, discussion of the implications, limitations and suggestions for future research.

2. Theoretical framework

2.1. Vietnamese banking sector

The Vietnamese financial sector has changed significantly over the past 30 years. The banking system switched from a one-tier to a two-tier system during "Đổi mới" - the economic reform in the 1990s. The State Bank of Vietnam (SBV), which previously acted as both the central bank and a commercial bank, divided its activities into four specialized segments: agricultural, infrastructure, international trade and commercial lending. These functions were then transferred to four newly formed State-owned commercial banks (SOCBs). Besides these

initial four SOCBs, SBV continues to invest in underperforming commercial banks, having them as SOCBs until their fundamentals are stronger. SOCBs are defined as commercial banks with the state owning over half of their charter capital. There are many perks of being state-run: the reputation of the state guarantee, lower funding costs, negotiable credit growth cap and decreased state treasury deposits. In 2021, the initial four SOCBs still account for 45% of market deposits and outstanding loans. In the two-tier system after the reform, SBV's role includes implementing monetary policies, managing currency reserves and governing credit institutions while commercial banks focus on funds mobilization and financial resource allocation.

In 2007-2008, the banking industry was booming with new financial institutions. However, not all were deemed successful. The performance of many was poor, leading to a three-year restructuring plan in 2012, where state-owned and strong commercial banks would take over weaker ones through mergers and acquisitions unless the weak banks were successful in restructuring themselves. The reform program was launched with the hope that the SOCBs would keep their competitiveness and leading positions in the industry (Bland, 2012). In 2022, there are a total of 35 active domestic commercial banks. State-owned (SOCBs) and Joint-stock commercial banks (JSCBs) act as direct competitors as they both function as commercial banks. This is different from the dynamics of public versus private banks in developed countries. In the US, the only state-owned bank, Bank of North Dakota (BND), acts as a supporter of private financial institutes rather than a competitor (Hardmeyer, 2013). BND's loan portfolio includes home mortgages, business, farm and student loans. In the EU, promotional banks, municipality funding agencies and public commercial banks cater to financial intermediaries (banks, VC funds, financial institutions) and beneficiaries (SMEs, universities, governmental institutions) (European Association of Public Banks, n.d.). These public banks do not directly compete with private commercial banks as they serve a different customer base. Conversely, in Vietnam, SOCBs and JSCBs serve both individual and corporate customers. The customer base depends on the size of the banks. Medium-to-large banks have a larger segment of corporate customers while small banks focus on individuals. According to SBV's statistics, in 2020, individual customers account for 49% of market deposits and 44% of credits with financial institutions, a significant increase from 28% for retail credit in 2012. Thus, big players in the industry are putting more focus on retail banking to capture this opportunity.

2.2. Bank profitability and the main drivers

Vietnamese commercial banks (both SOCBs and JSCBs) earn profits from interest and fees (Gobat, n.d.). Banks charge depositors at a given interest rate and use those as funds to provide loans at a higher interest rate. They make a profit from the difference between deposit and lending rates, which is called the interest rate spread. In Vietnam, the SBV sets a base interest rate and commercial banks are allowed to have their own rates, however, there is an interest rate ceiling (Dao, 2013). Banks set their interest rates based on several factors. Firstly, the supply and demand of a given bank determine its deposit and lending rates. The demand for specific loans guides the corresponding rates. For example, to match the high demand for long-term loans, banks will require more long-term deposits and will adjust the long-term rates accordingly. Additionally, it's essential for banks to maintain a healthy liquidity ratio, loan-to-deposit ratio and capital adequacy ratio. If the liquidity ratio is low as there are more loans than deposits, banks will need to stabilize this ratio by regulating their lending and deposit interest rates. Along with interest income, banks also earn fees associated with the services provided. The most common types are account fees, ATM fees, interchange fees and brokerage fees. Banks' costs are categorized into interest expenses and non-interest expenses. Interest expenses are paid to depositors with the set interest rate. Non-interest expenses involve operating costs such as rent, services, marketing, wages and employee benefits. Profitability stems from the bank's ability to generate more revenues than expenses.

Previous literature examines bank profitability from either a cross-country or an individual-country perspective. The first few to analyze a cross-country dataset are Short (1979), Bourke (1989), Molyneux & Thornton (1992) and Demirgüç-Kunt & Huizinga (1999). Many subsequent studies also employ a cross-country sample to examine bank profitability (Demirgüç-Kunt & Levin, 2004; Le & Ngo, 2020). Staikouras & Wood (2004) study EU banks between 1994 and 1998 using OLS and FE models, finding a significant relationship between macroeconomic factors (interest rates & real GDP growth) and profitability (return on assets). The latter group performs analyses on a single country's financial system. Most research in this group studies bank profitability in the developed markets, especially the US. Regarding the bank-specific factors, they find that risk and market power are positively correlated to bank profitability while size shows a negative impact (Berger, 1995; Rhoades, 1985; Smirlock, 1985). Bank profitability also shows a pro-cyclical pattern and persists through time (Chronopoulos,

Liu, McMillan & Wilson, 2015). More recent studies focus on developing and emerging markets including China, Thailand, Malaysia, Pakistan and the Philippines as their banking sectors are growing significantly from globalization and opportunities in digital and retail banking. These regions have a large potential market for expanding services as a huge portion of their population remains unbanked while the demand for digital payments has increased (Ward, 2021). Chinese banking system shows signs of profit persistence and positive relationships with macroeconomic determinants such as inflation, economic growth and stock market development while bank size and market concentration negatively affect profitability (Sufian, 2009; Sufian & Habibullah, 2009; Tan, 2016; Tan & Floros, 2012). The Vietnamese banking sector is much smaller in size compared to that of China. However, similar to the reformed structure of Vietnamese banks, the Chinese banking system has also been dominated by the biggest four SOCBs ever since these state-owned banks were commercialized in 1995 (Tan, 2020). Guru, Staunton & Balashanmugam (2002) study banks in Malaysia from 1885 to 1998 using the FE model, suggesting the importance of improving cost efficiency, deposits and current account and savings account deposits as profit drivers while the interest rate negatively impacts bank profitability.

The research on Vietnamese bank profitability is sparse. Batten & Vo (2019) study the sample of 35 commercial banks for the period of 2006-2014 using the FE model. They find that size, risk, expenses, concentration and macroeconomic environment (economic growth, inflation) all impact profitability significantly. However, the significance and effect direction of these determinants are not uniform across different profitability proxies. In another study, Le (2017) examines the data of 40 banks from 2005 to 2009, finding significant persistence in bank profitability using return on assets as the main proxy. The results suggest that profitability is positively correlated to cost efficiency, economic growth and liquidity, and is negatively correlated to size and market concentration. Two other studies using the OLS and FE models with a sample of 10 banks for the periods of 2008-2018 and 2012-2016 find conflicting results with the prior studies (Dao & Nguyen, 2020; Phan, Hoang, Dinh & Hoang, 2020). The effects of market concentration and economic growth on bank profitability are positive and negative respectively. This can be explained by the difference in the sample sizes compared to Batten & Vo (2019) and Le (2017). They only study 10 banks, most are large banks that heavily focus on corporate customers. Firstly, a highly concentrated banking industry will benefit large banks due to market power and economies of scale. Thus, a positive effect of concentration in such a

sample is biased and not representative of the whole industry. Secondly, those banks mainly lend to firms. If businesses are not looking to expand through debt and banks do not raise retail lending proportionally, GDP growth can have a negative impact on the earnings of these banks (Dao & Nguyen, 2020). These studies in Vietnam commonly find positive effects of inflation and credit risk on earnings. However, the relationships of several determinants remain ambiguous.

The groups of determinants vary amongst studies. Most literature on bank profitability is based on the research of Demirgüç-Kunt & Huizinga (1999). They examine the determinants of bank profitability using bank-level data of 7900 commercial banks in 80 developed and developing countries from 1988 to 1995. Using regression analysis, they find a variety of determinants including "bank characteristics, macroeconomic conditions, explicit and implicit bank taxation, deposit insurance regulation, overall financial structure, and several underlying legal and institutional indicators". Although the variable selection varies from study to study, most research on bank profitability splits determinants into two groups, internal and external factors. Internal determinants, also referred to as bank-specific or micro factors, are those that can be altered by managerial decisions or objectives. These can be seen in individual banks' financial statements. External factors reflect the economic and financial environment that can influence the performance of banks. Athanasoglou et al. (2008) study the profitability of Greek banks during the period of 1985- 2001 using the FE model. They further divide external factors into industry-specific determinants: market concentration, industry size and ownership status, and macroeconomics determinants: inflation, interest rates and cyclical output. In addition, the foreign exchange rate is a variable of interest in Davydenko's (2010) study on Ukrainian bank profitability with an unbalanced panel for the period of 2005-2009 using the FE and RE models, finding a positive effect of exchange rate depreciation on income.

Thus, the following section groups the common factors found in previous academic literature into four categories: bank-specific, industry-specific, financial and macroeconomic factors. The relationships between these determinants on bank profitability found in the previous academic literature are described in detail. Then, the respective hypotheses are formulated based on the findings and their application to the Vietnamese banking sector.

2.3. Determinants of bank profitability and hypotheses

2.3.1. Bank-specific factors

Bank size. Many studies find a positive relationship between size and profitability (Bikker & Hu, 2002; Smirklock, 1985). Larger banks have advantages such as greater loans, accessibility to asset markets, lower unit cost and higher diversification, which reduce earnings volatility and improve profitability (De Haan & Poghosyan, 2012). However, smaller banks that are increasing in size can gain more from economies of scale than larger banks that have exhausted their benefits (Goddard, Molyneux & Wilson, 2004). Batten & Vo (2019) find a negative relationship between size and profitability in Vietnamese banks. This is due to inefficiency and low management quality from over-branching. When large banks expand their geographical coverage for customer convenience, it increases costs, especially with expanded office sizes (Berger, Hanweck & Humphrey, 1987). Thus, the expected sign is ambiguous.

Equity. Bank capital reflects the ability to adhere to regulations and the funds available for loans and other activities (Gul et al., 2011). Having larger equity reduces funding costs and the expected cost of financial distress including bankruptcy (Berger, 1995). A high bank capital-to-asset ratio from an increased capital adequacy requirement can also reduce risk. This allows the asset portfolio to have riskier loans with higher returns (Guru et al., 2002). Banks with high equity also have lower leverage and risk, thus, a lower borrowing cost (Sufian & Habibullah, 2009). We expect a positive relationship with profitability.

Credit risk. Credit risk refers to any risks associated with an event regarding credits: changes in credit ratings or quality, variations in credit spreads, and defaults (Bielecki & Rutkowski, 2013). Some studies find a negative impact of credit risk on profit (Miller & Noulas, 1997). Increased exposure to risk leads to higher loan loss provisions and reserves, hindering profit-maximization. An accumulation of unpaid loans and loan losses also reduces returns. However, taking on high-risk loans can improve interest margin due to high returns (Naceur & Omran, 2011; Saona, 2016). Studies in Vietnam find no significant impact of this determinant on profitability (Batten & Vo, 2019; Phan et al., 2020). Hence, we do not have a fixed expectation.

Loans. Loans have higher returns than other assets and securities, but they are also riskier (Demirgüç-Kunt & Huizinga, 1999; Gul et al., 2011). As banks increase loans, they experience higher funding requirements and increased operational costs for service and monitoring (Staikouras & Wood, 2004). In Vietnam, traditional loans are the primary source of profit as they

generate interest revenue. All else equal, if more deposits can be converted into loans, banks will observe higher income and interest margin (Sufian & Habibullah, 2009; Tan & Floros, 2012). A positive impact of loans is found in several studies on Vietnamese banks due to the low-risk, low-volatility and realizable activities observed in commercial banks (Le, 2017; Phan et al., 2020). This relationship is also in-line with findings in international studies (Bashir, 2001; Saona, 2016). Thus, we expect a positive relationship between loans and profitability.

Deposits. Deposits are considered a liability on the financial statements of banks. It is the main source of funds and can be transformed into loans for interest income. A positive relationship between deposits and profitability is seen in previous research (Alkassim, 2005; Gul et al., 2011). Thus, we predict a positive sign.

Current Account Savings Account (CASA) ratio. The CASA ratio is the ratio of the deposits in the current account savings account to total deposits. This ratio is an important driver of bank profitability in Southeast Asian countries (The Economic Times, n.d.). CASA is an account that has features of both savings and checking accounts, allowing customers to keep money in the bank as non-term deposits without a set maturity or expiration date. The bank pays low to no interest for the current account feature and receives high returns for the savings. Thus, the CASA feature earns more than a normal deposit, driving profitability. These deposits are considered low-cost funds available for loans at a higher interest rate, boosting interest margin. As Vietnam is transitioning towards a cashless society, more individuals are opening bank accounts for everyday mobile and internet banking transactions. Prior studies on Malaysian, Indian and Indonesian banks propose that banks should focus on increasing CASA deposits as it contributes to higher earnings (Artha & Mulyana, 2018; Guru et al., 2002; Rasiah, 2010). In 2021, Vietnamese banks show an increase in CASA ratio from 17% to 19.4%. However, the government is proposing to reduce the use of short-term capital to fund medium-to-long termed loans (Ministry of Finance, 2022). Thus, a study on the relationship between the CASA ratio and bank profitability is needed, so that the SBV and commercial banks can regulate this ratio effectively. For this determinant, we expect a positive impact on bank profitability.

Overhead Expenses. Low costs derived from managerial efficiency and new technologies can improve profitability. This negative relationship is supported by prior studies (Bourke, 1989; Sufian & Habibullah, 2009). Nevertheless, a positive relationship found in EU banks suggests that higher salary expenses come with increased productivity, boosting earnings (Molyneux &

Thornton, 1992). A similar direction of effects is also observed in Malaysia and Tunisia as banks are able to pass costs to customers by adjusting deposit and lending rates (Guru et al., 2002; Naceur, 2003). Banks that attempt to raise earnings through adjusted rates can lose customers to those with more attractive rates. Although the switching costs remain low in Vietnam, the process is complicated and can hurt corporate customers, thus, there is a low tendency to switch banks (MarketLine, 2022). Therefore, we predict a positive relationship.

Persistence of Profitability. Prior studies find evidence of banks' profit persistence - the tendency to remain in the same profit distribution (Berger, Bonime, Covitz & Hancock, 2000; García-Herrero, Gavilá & Santabárbara, 2009). The presence of performance persistence is associated with existing entry barriers and low competition, suggesting market power (Berger et al., 2000). According to Chronopoulos et al. (2015), there is short-run profit persistence in US banks as the competitive landscape reduces positions of abnormal profitability. Additionally, profitability persists strongly after the recent financial crisis as interventions prioritize stability over competition. Compared to developed countries, developing countries in Asia exhibit weaker persistence due to low cost of entry, fast economic growth and highly competitive domestic market (Goddard, Liu, Molyneux & Wilson, 2011). Le (2017) finds significant profit persistence in Vietnamese banks between 2005 and 2015. The results suggest low competition and a high degree of government intervention in bank capital and asset quality, making it difficult to change business models.

Based on the aforementioned, the majority of bank-specific factors have a positive effect on banks' profitability. The hypothesis regarding the first group of determinants is as follows:

H1: Bank-specific factors positively influence bank profitability in Vietnam

2.3.2. Industry-specific factor

Market concentration. International studies on bank performance frequently refer to the Structure-Conduct-Performance (SCP) paradigm regarding market power and profitability. SCP hypothesis suggests that as the banking industry deviates from a competitive market structure, market power generates monopolistic profits through low deposit rates and high loan interests (Hannan, 1991). Prior studies supporting this hypothesis find a positive relationship between concentration and profitability (Smirklock, 1985; Staikouras & Wood, 2004). However, this can only increase profitability for banks with large market shares and high product diversification

(Berger, 1995). Many studies find a negative impact of concentration on performance (Naceur, 2003; Tan, 2016). As managers in a concentrated market are more likely to make high-cost decisions and take on less risky assets, it reduces returns (Heggestad, 1977). Studies on Vietnamese banks also find evidence of a negative relationship. As the biggest banks are mainly SOCBs, when their market shares increase, they need to set aside more loan loss provisions and reserves, reducing profitability (Le, 2017). Furthermore, state ownership has a significant negative impact on profitability as SOCBs are usually given more advantages even though they are less efficient (Phan et al., 2020). Therefore, market concentration in the Vietnamese banking industry is expected to reduce profitability. Regarding this, we have the following hypothesis:

H2: Market concentration has a negative impact on bank profitability in Vietnam

2.3.3. Financial factors

Interest rate. There are two ways interest rates can affect bank profitability. Firstly, an increase in interest rate has a direct effect on net interest income as it raises interest margin and returns. It is important to note that an increase in the base interest rate can influence both deposit and lending rates, but banks can still earn profit from the interest spread. Secondly, a positive change in interest rate drives loan loss provisions to account for the higher default risks, reducing profitability. The net impact of interest rate on profitability depends on these two factors. Borio et al. (2017) study 109 international banks for the period of 1995-2012 and find a positive relationship, suggesting that the positive effect on net interest income offsets the negative impact on loan loss provision. In Vietnam, banks must adhere to strict regulations and policies from the SBV regarding asset quality and loan loss reserves to protect them from financial distress. The required reserves are set regardless of the interest rate. Thus, in a period of rising interest rates, if banks have been maintaining a healthy loan loss provision ratio, we expect a net positive effect of interest rate on profitability.

Foreign exchange rate depreciation. The exchange rate regime in Vietnam is a managed floating system, where the currency fluctuates daily but is regulated by the SBV to maintain a range against a basket of currencies. A study on Ukrainian bank profitability shows a positive effect of exchange rate depreciation on income (Davydenko, 2010). Banks' ability to predict fluctuations results in gains on foreign exchange (forex) transactions. In developing countries like Vietnam and Ukraine, one can gain profits from the lack of transparency in transaction

pricing. Vietnamese banks report an increasing portion of foreign assets on their balance sheets. Forex trading as a portion of Vietnamese banks' profit has grown significantly in 2020 with the greatest earner, Commercial Bank for Foreign Trade of Vietnam (VCB), experiencing a 17% increase from 2019 (Ministry of Finance, 2020). This is due to an increase in exports and imports as Vietnam contained the pandemic well in 2020. Commercial banks also benefited from large foreign currency transactions performed by the SBV to increase the US dollar reserve and keep the Vietnamese Dong low. We predict a positive impact of forex rate depreciation on profits.

Stock market capitalization. Studies find higher bank profitability in countries with well-developed stock markets as banks have more profitable opportunities (Bashir, 2000; Demirgüç-Kunt & Huizinga, 1999). Firms with access to the stock market have options to increase capital through equity, reducing their loan default risks. An increase in equity can also lead to firms borrowing more money from the banks to further expand their businesses and maintain a constant leverage ratio. Additionally, the stock markets reduce information asymmetry, increasing transparency in the evaluation and monitoring process that banks perform on corporate customers. Thus, stock market development leads to an increase in banks' business volume while reducing risk and boosting profitability.

The third hypothesis considers the applicability of prior studies on financial factors to Vietnamese banks and is as follows:

H3: Financial factors have a positive relationship with bank profitability in Vietnam

2.3.4. Macroeconomic factors

Economic growth. Prior studies find a positive effect of economic growth on profitability (Demirgüç-Kunt & Huizinga, 1999; Dietrich, Hess & Wanzenried, 2014). Staikouras & Wood (2004) suggest two possible reasons for the observed relationship. Firstly, economic growth enlarges the market size for bank operations with higher demand for financial products and services. Secondly, during an expansion of the business cycle, asset quality can improve, reducing default risks. This can lower loan loss provisions and reserves, increasing profitability. Studies in Vietnam also report a positive relationship, which aligns with our expectations in this paper (Batten & Vo, 2019; Le, 2017).

Inflation. A positive inflation rate implies a decrease in the value of a given currency over time. Inflation can lower the ability of borrowers to pay interest and repay debt. This increases

loan losses and default risks, negatively affecting profitability. However, inflation can lead to high lending rates for higher interest earnings. The effect of inflation on bank profitability relies on the extent to which it is anticipated (Perry, 1992). If inflation is anticipated, bank managers can adjust their rates accordingly to ensure revenues would increase faster than costs (Molyneux & Thornton, 1992). Conversely, for unexpected inflation, costs can increase faster than revenues if banks cannot adjust their rates promptly. Studies in Vietnam find evidence of a positive relationship between inflation and performance (Batten & Vo, 2019; Phan et al., 2020). This implies a timely adjustment of rates as a reaction to inflation and the ability to pass the costs of inflation onto customers. We predict a positive effect of inflation on earnings.

Thus, we have our hypothesis for the last group of determinants as follows:

H4: Macroeconomic factors have a positive effect on bank profitability in Vietnam

3. Data & methodology

3.1. Data collection

The sample of our study consists of 23 listed domestic commercial banks in Vietnam including both SOCBs and JSCBs. Considering representativeness, banks are selected with a few criteria: they must be active, listed, based in Vietnam from 2012, more than half of equity is domestically owned and have the total assets exceeding 1 billion USD in at least one year during the research period. Then, only banks with no missing data are selected for a balanced panel data set with 207 observations. The data is collected for the period of 2012-2020. The restructuring plan shaping the banking industry was brought into effect in 2012 and 2020 is the last available year of data for most banks. Raw data on bank-specific information and bank profitability proxy are obtained from ORBIS Bank Focus by Bureau van Dijk. The (annual) values of the following variables are extracted from the database: Company name, Consolidation code, Total assets, Gross loans, Loan loss provision, Equity/Total assets, Deposits & short-term funding, Overheads, ROA using P/L before tax. The data is presented in percentages for ratios and in thousands of US dollars for total assets values. The raw data is further transformed with the formulas mentioned in the next section to arrive at the final ratios used for bank-specific factors. Individual banks' annual financial statements are examined to calculate the CASA ratio. All financial statements were audited by the big four accounting firms (EY, PwC, KPMG & Deloitte) and aligned with the Vietnamese accounting standards. The market concentration ratios

are collected from The Global Economy database. Data on the foreign exchange rate is retrieved from the IMF database. Data on the lending interest rate, stock market capitalization, economic growth and inflation are retrieved from the WorldBank database.

3.2. Variables

Based on the mentioned studies in the previous chapter, we will define and describe the calculation of the dependent and independent variables in the following section.

Dependent variable

Recent literature selects Net Interest Margin (NIM), Return on Assets (ROA) and Return on Equity (ROE) as proxies for profitability. NIM is typically associated with banks, measuring the income from interest activities (Naceur & Goaied, 2001). More commonly used ratios for corporate performance are ROA and ROE. ROA shows the net income relative to the bank's total assets, measuring profit earned per dollar of assets while ROE measures net income per dollar of capital invested by shareholders. Prior studies use ROA as it examines management efficiency - how well the bank uses its investments to generate income (Petria, Capraru & Ihnatov, 2015). A limitation of ROA is that it does not recognize off-balance-sheet assets, which can account for a large portion of the profit. Thus, Goddard et al. (2004) argue that the use of ROE is preferred. However, in Vietnam, bank equity is abnormally low, and leverage is influenced by the government's regulations and policies so the usage of ROE as a profitability proxy is not suitable (Le, 2017). Thus, using ROA as a proxy for profitability is more appropriate as it takes into account the risk of financial leverage. ROA is calculated as follows:

$$\text{ROA} = \frac{Net\ profits\ before\ taxes}{Total\ Assets}$$

Independent variables

Bank-specific factors

Bank size (Size and Size^2): Previous study measure size with the natural log of Total Assets (Staikouras & Wood, 2004; Tan & Floros, 2012). Total Assets include earning assets, fixed assets, goodwill, intangibles, cash and other assets. Additionally, to test the non-linear relationship of size, we are also adding the square of total assets (logarithm) (Athanasoglous et al., 2008). On the database, the variable is presented in thousands of US dollars.

Equity: The leverage structure of a bank can be measured by the equity-to-asset ratio (Berger, 1995; Gul et al., 2011). This ratio captures the funds available for business and for absorbing losses. This ratio is calculated as follows:

$$\text{Equity-to-asset} = \frac{Total\ Equity}{Total\ Assets}$$

Credit risk: Similar to previous studies, we use loan-loss-provision to total loans ratio as a proxy for credit risk (Le, 2017; Sufian & Habibullah, 2009). Loan-loss-provision (LLP) is an expense on the income statement showing the designated reserve to cover expected loan defaults and problem loans. This ratio assesses the financial health of the bank and its credit risk.

$$\text{LLP-to-loan} = \frac{Loan-loss-provision}{Total\ Loans}$$

Loans: The loan-to-asset ratio is used to measure the portion of the outstanding loans in total assets (Staikouras & Wood, 2004). A large loan book means banks would need to take on more risks and potentially higher funding costs to maintain a high loan-to-asset ratio. The calculation of this ratio is as follows:

$$\text{Loan-to-asset} = \frac{Gross\ Loans}{Total\ Assets}$$

Deposits: Deposits are the main source of funds for banks and are considered liabilities. The ratio of deposit-to-asset is used as a proxy for the liquidity of the bank and its available funds (Gul et al, 2011).

$$\text{Deposit-to-asset} = \frac{Total\ Deposits}{Total\ Assets}$$

CASA ratio: As defined in the previous section, the CASA ratio is the current account savings account deposits to total deposits and measures the portion of non-term deposits. The CASA deposits are presented in the footnotes of the annually reported balance sheets. The ratio is calculated as follows:

$$\text{CASA ratio} = \frac{Current\ Accounting\ Deposits + Savings\ Account\ Deposits}{Total\ Deposits}$$

Overhead Expenses (Overhead Exp.): As defined in the new database of financial indicators, the overhead expense to total assets ratio is used to measure the efficiency of commercial banks (Beck, Demirgüç-Kunt & Levine 1999). Overhead cost is an item on the income statement, accounting for the ongoing business expenses including but not limited to administrative costs, rent, salaries and employee benefits.

$$\text{Overhead-to-asset} = \frac{Overhead\ Expenses}{Total\ Assets}$$

Persistence of Profitability (ROA_{t-1}): Prior research papers study the persistence of profitability by adding a one-year lagged profitability variable to the regression (Le, 2017).

Industry-specific factors

Market concentration (Concentration): A structural measurement of market concentration is three-firm-concentration ratio, in which the sum of assets of the three largest banks are divided by the total assets of the banking industry. This ratio measures the extent of competition in the industry. A lower value means a more competitive market. This ratio is commonly used in bank profitability research along with the Herfindahl–Hirschman index (Athanasoglous et al., 2008; Hannan & McDowell, 1984). Due to data unavailability, we only have the three-firm-concentration ratio in Vietnam. From 2012 to 2020, three SOCBs (CTG, BID & AGRIBANK) have remained the three banks with the largest total assets in the industry.

Financial factors

Interest rate: Vietnamese commercial banks are allowed to set their own interest rates depending on supply-demand and their internal ratios. Thus, using the base rate or the ceiling rate will not be appropriate as they do not reflect the true interest rate in the industry. Individual banks' interest rates are not fully published during the sample period. Therefore, we will use the annual average lending rates estimated by World Bank to measure this variable.

Foreign exchange rate (Forex rate): In Vietnam, the US dollar is the most used and reserved foreign currency. The exchange rate of USD to VND shows the value of the Vietnamese dong (VND) per US dollar. An increase in value is an appreciation; a decrease is a depreciation. We will use the IMF's annual average forex rates. The smallest denomination of Vietnamese currency is the 100 VND banknote (The State Bank of Vietnam, n.d.). Thus, we transform this variable, dividing it by 100, to obtain meaningful estimates and interpretations.

Stock market capitalization: The development of the stock market is measured by the total market capitalization of listed domestic companies as a percentage of GDP. This serves as an indicator of the size and valuation of the stock market. This ratio is used in previous studies to measure the development of the domestic stock market (Demirgüç-Kunt & Huizinga, 2000)

Macroeconomic factors

Economic growth: An increase in the domestic production of goods and services over a period of time is considered economic growth. Thus, it can be measured by the annual percentage change in the gross domestic product (GDP).

Inflation: A positive inflation rate indicates an increase in prices, leading to a decreased purchasing power of the domestic currency over time. This is measured by the change in Consumer Price Index (CPI) reported by IMF. CPI is the weighted average of consumer prices based on a basket of goods and services.

3.3. Descriptive statistics

Table 3.1: Descriptive statistics for dependent and key explanatory variables

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
ROA (%)	207	0.948	0.767	0.004	3.594
Size	207	15.888	1.074	13.456	18.032
Equity (%)	207	8.355	3.595	2.621	23.838
Credit Risk (%)	207	0.935	0.820	-0.992	4.295
Loans (%)	207	56.883	12.048	21.621	78.806
Deposits (%)	207	85.040	5.873	60.693	93.152
CASA ratio (%)	207	16.044	8.803	2.142	46.262
Overhead Exp. (%)	207	1.766	0.534	0.679	3.340
ROA_{t-1} (%)	184	0.889	0.719	0.015	3.346
Concentration (%)	207	41.564	12.214	28.710	66.250
Interest Rate (%)	207	8.487	2.038	6.960	13.472
Forex Rate	207	219.748	8.446	208.280	232.084
Stock Market Cap. (%)	207	42.225	15.785	23.556	68.598
Economic Growth (%)	207	5.928	1.241	2.906	7.076
Inflation (%)	207	4.016	2.322	0.631	9.095

Table 3.1 shows the summary statistics of the profitability proxy ROA and the determinants in the sample of 23 listed commercial banks in Vietnam. There are 207 observations for all variables except for the persistence of profitability since it is calculated as the one-year lagged variable of ROA. ROA is on average 0.948% with a minimum value of 0.004% and a maximum value of 3.594%, showing that all banks are profitable during the study period. GDP growth has a mean of 5.928%, a minimum of 2.906% and a maximum of 7.076%. Therefore, during our study period, Vietnam has consistent economic growth and did not experience any negative growth or recession. The banks in the sample are mixed in terms of their bank-specific characteristics: size, equity, credit risk, loans, deposits, CASA ratio and expenses. There is a large standard deviation in the loan-to-asset ratio of 12.048%. Some new and small banks rely heavily on loans to run business activities while others have a mix of cash and other interest-earning assets (stocks, bonds, derivatives) and non-earning assets (buildings, branches,

technology). Market concentration has a mean of 41.564% with a standard deviation of 12.214%. This highlights the market power and the expansions of the three biggest banks (BID, CTG & AGRIBANK) during the years. Similarly, stock market capitalization averages at 42.225% of annual GDP with a standard deviation of 15.785%. This shows growth and development in the stock market from 2012 to 2020 as it becomes a crucial channel for mobilizing capital.

3.4. Correlation matrix and multicollinearity

We use a correlation matrix and variance inflation factor (VIF) to detect multicollinearity, where regressors in a model are highly correlated. In cases of moderate multicollinearity (correlation <0.8), there is no need for remedies (Shrestha, 2020). In cases where the variables of interest are highly correlated to each other, one variable can be dropped and it will be chosen by assessing previous literature, comparing the VIFs of models when dropping the variables, and the effects on the dependent variable. In this section, we will briefly discuss the correlation matrix, the VIF table (see Appendix A) and the multicollinearity detected, justifying any variable drop with previous studies. Then, in section 4 of the results, the models and their mean VIFs will be presented.

The variable of Size and its squared value, $Size^2$, are expected to be highly correlated. $Size^2$ is added to determine the non-linear relationship between size and profitability. Economic growth and the banking industry's market concentration have a high negative correlation of -0.912. In a highly concentrated market, banks with market power will set high lending rates and lower the quantity of available funds, reducing credit access to younger firms and depressing economic growth (Cetorelli & Gambera, 2001). Considering extensive literature on the effects of both variables on profitability, dropping either of these variables can lead to omitted variable bias. Thus, these variables will be included in the model (Le, 2017; Tan & Floros, 2012).

Inflation and interest rate also have a high correlation of 0.937. As the interest rate is the average lending interest rate reported annually, it suggests that banks hike their rates during periods of inflation to offset the rise in prices and expenses (Perry, 1992). Amongst the previous studies discussed in section 2.2, the majority included inflation in their models (Athanasoglou et al., 2008; Batten & Vo, 2019). Whilst, interest rate, though has many studies of its own effect on profitability, is rarely included in papers researching both internal and external factors. In appendix A table A.2, the variable interest rate also has a larger VIF of 24.68, indicating high

multicollinearity while the VIF of inflation is only 8.97, which suggests low multicollinearity (Gujarati, Porter & Gunasekar, 2012). Thus, interest rate will be dropped from the model.

Stock market capitalization and foreign exchange rate have a high correlation of 0.960. As the stock market develops, the foreign capital inflow and foreign investments can increase, resulting in an appreciation of the domestic currency (Hoque & Yakob, 2017). In appendix A table A.2, stock market concentration shows a higher VIF of 43.66 than that of the foreign exchange rate at 33.53. Thus, the variable of stock market capitalization is dropped.

3.5. Fixed Effects and Random Effects models

Our panel data contains observations of the same cross-sectional units across time. The advantages of the panel data set are that it allows for heterogeneity across entities and solves the issues of time-invariant omitted variables (Brooks, 2014). However, it cannot address time-variant omitted variables. There are two types of panel data models: homogenous (pooled ordinary least squares) and heterogeneous (FE and RE) (Wooldridge, 2010). Firstly, pooled ordinary least squares model (pooled OLS) stacks all the data, treats it as a purely cross-sectional data set and assumes common coefficients for all observations. This creates problems as part of the correlation remains in the errors. Thus, academic research prefers heterogeneous models such as the FE model, which allows constants to vary across entities, but the coefficients are constant across all units and time. FE with least squares dummy variables (LSDV) estimation includes individual-specific effects by using dummy variables for entities. RE assumes that the variation across entities is part of a stochastic error term. RE does not use dummy variables like in LSDV but uses generalized least squares (GLS) to incorporate between-entity and within-entity errors in the model. Thus, we will use FE and RE models with robust standard errors using STATA for this study. To determine whether FE or RE is appropriate for the data, the Hausman test is performed to find the correlation between the regressors and the unique errors. The significance of the coefficients is determined by t-test statistics and the joint significance by F-test.

The Fixed Effects model is of the following form (Eq.1):

$$Y_{i,t} = \alpha_i + \sum_{j=1}^{J} \beta_j X_{i,t}^{J} + \sum_{k=1}^{K} \beta_k X_{i,t}^{K} + \sum_{l=1}^{L} \beta_l X_{i,t}^{L} + \sum_{m=1}^{M} \beta_m X_{i,t}^{M} + \nu_{i,t}$$

where $Y_{i,t}$ is the profitability of bank i at time t. $i = 1, \ldots, N$, represents cross-sectional units and $t = 1, \ldots, T$ represents time periods. α_i are entity-specific intercepts capturing the heterogeneity

across units measured with dummy variables and $u_{i,t}$ is the error term. $X_{i,t}$ are the explanatory variables, grouped into bank-specific $X_{i,t}^{J}$, industry-specific $X_{i,t}^{K}$, financial $X_{i,t}^{L}$ and macroeconomics factors $X_{i,t}^{M}$. β_j , β_k , β_l and β_m are their subsequent coefficients. In the FE least squares dummy variables model, N-1 dummy variables are added to account for cross-sectional entities and avoid perfect multicollinearity.

The Random Effects model is of the following form (Eq.2):

$$Y_{i,t} = \alpha + \sum_{j=1}^{J} \beta_j X_{i,t}^{J} + \sum_{k=1}^{K} \beta_k X_{i,t}^{K} + \sum_{l=1}^{L} \beta_l X_{i,t}^{L} + \sum_{m=1}^{M} \beta_m X_{i,t}^{M} + \omega_{i,t}$$

$$\omega_{i,t} = \epsilon_i + \nu_{i,t}$$

where $Y_{i,t}$, $X_{i,t}$ and β are defined similarly to the FE model (Eq.1). There are no dummy variables capturing the heterogeneity. α is the common intercept and the error term ϵ_i measures the variation across entities from α. The individual observation error term is $\nu_{i,t}$.

The use of FE or RE on a panel data set leads to the assumptions of homoskedasticity and non-correlated errors being preferable but not necessary. The multicollinearity problem is addressed in section 3.4. The main concern is endogeneity, which results in biased and inconsistent parameters. As an attempt to address this problem, we include relevant independent variables (instrumental variables), take extra caution and perform cross-checking while measuring and analyzing independent variables to limit omitted variable bias, attenuation bias and simultaneity bias.

As bank profitability has the tendency to persist over time, it is important to address the possible autocorrelation in the panel data by adding a one-period lagged dependent variable. However, we cannot perform an OLS model for profit persistence. Adding a lagged dependent variable to the FE or RE model means that both $Y_{i,t}$ and its one-period lagged variable $Y_{i,t-1}$ are functions of the time-invariant error term (Maeshiro, 1996). In OLS models, the correlation between lagged variable (regressor) with the error term leads to biased inconsistent estimates and unreliable hypothesis testing (Keele & Kelly, 2006). Thus, we will also transform our model into a dynamic panel data model with the Arellano-Bond estimator to address the endogeneity problem (Arellano & Bond, 1991). We will perform a dynamic model for bank profitability proposed by Athanasoglou et al. (2008). The dynamic specification of their model includes the lagged profitability with the remaining regressors and has the following form (Eq.3):

$$Y_{i,t} = \alpha_i + \delta Y_{i,t-1} + \sum_{j=1}^{J} \beta_j X_{i,t}^{J} + \sum_{k=1}^{K} \beta_k X_{i,t}^{K} + \sum_{l=1}^{L} \beta_l X_{i,t}^{L} + \sum_{m=1}^{M} \beta_m X_{i,t}^{M} + \nu_{i,t}$$

where $Y_{i,t}$, $X_{i,t}$, β, α_i and $\nu_{i,t}$ are defined similarly to the FE model (Eq.1). $Y_{i,t-1}$ is the one-period lagged bank profitability and δ is the adjustment speed to the equilibrium. δ with the value between 0 and 1 implies that there is profit persistence but bank's profit will return to the normal (average) level. A value close to 0 implies a competitive structure with high adjustment speed while a value close to 1 implies a less competitive industry with slow adjustment. Taking the first difference of Eq.3 to eliminate the individual effect, we have the following equation for the Arellano-Bond estimator (Eq.4):

$$\Delta Y_{i,t} = Y_{i,t} - Y_{i,t-1} = \delta \Delta Y_{i,t-1} + \sum_{j=1}^{J} \beta_j \Delta X_{i,t}^{J} + \sum_{k=1}^{K} \beta_k \Delta X_{i,t}^{K} + \sum_{l=1}^{L} \beta_l \Delta X_{i,t}^{L} + \sum_{m=1}^{M} \beta_m \Delta X_{i,t}^{M} + \Delta \nu_{i,t}$$

4. Results

Firstly, the Hausman test is performed on STATA to choose between the FE and RE models (see appendix B). The p-value of 0.005 (< p-value of 5%) rejects the null hypothesis that the difference in coefficients between FE and RE is non-systematic. Thus, the use of FE models is appropriate and favored. Based on the models previously described, the first subsection will discuss the FE models with clustered standard errors at bank level. Then, we will include the lagged dependent variable in the linear dynamic panel-data models with robust Arellano–Bond estimators. Lastly, the subsection of alternative specifications will address the dropped variables due to severe multicollinearity. It is important to note that the interpretation of the constant is only valid when the values of all independent variables are 0. In our case, this is not plausible. For example, the value of Size measured by the natural logarithm of total assets cannot be 0. Thus, the constants will not be interpreted. Statistical significance of a variable is reported either at the level of 10%, 5% or 1%. If a variable is not significant, its effect is statistically negligible; we do not have enough evidence to reject the null hypothesis that the true unknown value of β is 0 (Brooks, 2014). For statistically significant variables, the coefficients can be meaningfully interpreted. In applied statistics research, the commonly adopted significance criterion or p-value is 5% (Singh & Masuku, 2014). A table summarizing our expectations versus the results of the

FE and dynamic panel data regressions (discussed in 4.1 and 4.2) and the tests of corresponding hypotheses is shown in Appendix D.

4.1. Fixed Effects regressions

First, we will discuss the results of the FE regressions and test our hypotheses. In table 4.1, models 1, 2, 3 and 4 each focus on a specific group of factors: bank-specific, industry-specific (market concentration), financial (forex rate) and macroeconomic factors respectively. Model 5 includes all variables of interest except the lagged ROA.

Table 4.1: FE regressions results for the relationship between the groups of determinants and bank profitability

Variables	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROA
Size	6.873***				7.363***
	(1.592)				(1.743)
$Size^2$	-0.185***				-0.195***
	(0.051)				(0.057)
Equity (%)	0.169***				0.178***
	(0.028)				(0.028)
Credit Risk (%)	-0.132*				-0.149**
	(0.065)				(0.064)
Loans (%)	-0.004				0.005
	(0.008)				(0.009)
Deposits (%)	-0.028***				-0.016
	(0.010)				(0.009)
CASA ratio (%)	0.010*				0.012*
	(0.006)				(0.006)
Overhead Exp. (%)	0.019				-0.050
	(0.136)				(0.162)
Concentration (%)		0.009***			0.004
		(0.002)			(0.009)
Forex Rate			0.026**		0.001
			(0.010)		(0.009)
Economic Growth (%)				-0.078***	0.066
				(0.016)	(0.063)
Inflation (%)				-0.006	0.068***
				(0.025)	(0.020)
Constant	-60.127***	0.575***	-4.794**	1.435***	-67.811***
	(13.189)	(0.084)	(2.159)	(0.170)	(14.451)
Observations	207	207	207	207	207
R^2	0.637	0.041	0.166	0.030	0.681
Adjusted R^2	0.622	0.036	0.161	0.020	0.662

Notes: Models 1, 2, 3 and 4 each focus on bank-specific, industry-specific, financial and macroeconomic factors respectively. Variables presented in percentages are labeled. Model 5 considers all groups of determinants. Standard errors in parentheses are heteroskedasticity robust and clustered at bank level. Significance levels are * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

All models cluster standard errors at bank level. We also perform FE models without clustering the standard errors and the results are presented in appendix C, table C.1. The coefficients are the same but the standard errors and subsequent significant levels differ from table 4.1 In table 4.1 column 2, considering the adjusted R^2 of model 1, bank-specific factors explain 62% of the variation in ROA. This group of bank-specific determinants has eight variables, more than other groups with either one or two variables. As more variables are added, the explanatory power naturally increases. Thus, adjusted R^2 is used to address this problem as it only increases if additional regressors improve the explanatory power of the model. Comparing the adjusted R^2 of model 1 and model 5, as shown in columns 2 and 6, adding market concentration, forex rate and macro factors only increases the explanatory power of the model by 4%. Thus, bank-specific determinants account for most of the variation in bank profitability compared to the other groups. The adjusted R^2 of the most extensive model, model 5, is 0.66, meaning that 66% of the variation in bank profitability can be explained by all the determinants. This explanatory power is appropriate and satisfactory compared to previous studies. Batten & Vo (2019) report an adjusted R^2 of 0.69 when studying 35 Vietnamese banks in the period 2006-2014 using a FE model. Staikouras & Wood's (2004) FE regression on 685 EU banks from 1994 to 1998 attains an explanatory power of 0.68. As model 5 contains all determinants from all groups, the F-statistics of 83.18, p-value <0.05, indicate that all variables are jointly significant, justifying the inclusion of these independent variables. Next, we will discuss the effect of each group of determinants on profitability proxied by ROA in the most extensive FE model, model 5.

Firstly, we will discuss the group of bank-specific determinants and the corresponding hypothesis (*H1)*. The coefficients of size and size-squared variables are respectively 7.363% and -0.195%, both statistically significant at a 1% significance level. A 1 unit increase in bank size (measured by the natural logarithm of total assets) raises ROA by 7.363% minus 0.195% times twice the initial size of the bank, all else equal. This indicates that the increase in size also increases ROA but at a decreasing rate. Compared to growing small banks, larger banks that are expanding would benefit less from economies of scale and can make cost-inefficient decisions. The positive relationship between size and profitability is in line with the findings of Gul et al. (2011) as larger banks have lower earnings volatility and higher diversification. However, Dao & Nguyen (2020) find a negative effect of size on ROA in Vietnam. This is due to the small sample size of 10 banks in their paper. As those banks are amongst the biggest and oldest banks in the

industry, they can experience lower earnings when expanding due to over-branching and inefficient managerial decisions (Le, 2017). The diminishing rate of the positive effect found in our study is in line with Staikouras & Wood's (2004) findings. In Vietnam, this non-linear relationship has not yet been studied.

Next, the coefficient of equity (measured by equity-to-asset ratio) is 0.178% and statistically significant at a 1% significance level. The positive relationship between equity and profitability is consistent with Berger (1995) and Sufian & Habibullah (2009). Banks with strong capital structures can withstand financial crises and undesirable economic conditions. In Vietnam, the SBV encourages banks to raise equity to absorb losses and to expand operations for stable long-term profits as high levels of capital ensure that banks can pursue profitable opportunities and absorb unexpected losses efficiently. Credit risk is the only variable with a negative coefficient (-0.149%) that is statistically significant at a 5% level. As credit risk increases by 1%, ROA decreases by 0.149%, ceteris paribus. This is in line with the findings in EU banks by Petria et al. (2013) and Chinese banks by Tan & Floros (2012). As banks have riskier loans, the reserves for loan losses and accumulate unpaid loans would increase, hence reducing returns. This suggests that Vietnamese banks should improve policies regarding the screening and monitoring process of risky loans to ensure a low non-performing loan ratio and higher returns. The CASA ratio has a coefficient of 0.012%, statistically significant at a 10% significance level. The positive effects of these variables are in line with the findings of Guru et al. (2002) but overall, the effect is very small. In other studies, the effect of CASA ratio on bank profitability is larger than our results but remains below 0.1% (Andhikatama, 2020). The results suggest that banks should work on increasing the current account and savings account deposits in their portfolio. The remaining bank-specific factors of loans, deposits and overhead expenses are insignificant. For hypothesis 1 (*H1: Bank-specific factors positively influence bank profitability in Vietnam)*, we use an F-test to test if the sum of the coefficients for bank-specific factors is greater than 0. The null hypothesis is that the sum of the coefficients for bank-specific factors is smaller than or equal to 0. The p-value is reported at 0.0002, thus, we can reject the null hypothesis, and hypothesis 1 can be accepted at a 1% significance level.

Market concentration and forex rate have no statistically significant effect on ROA. We will first discuss the results of the statistical test for hypothesis 2 (*H2: Market concentration has a negative impact on bank profitability in Vietnam)*. The null hypothesis is that the coefficient for

market concentration is greater than or equals 0. The p-value of 0.655 is larger than the critical p-values at 10%, 5% and 1% significance levels. Thus, there is not enough evidence to reject the null hypothesis and we can reject hypothesis 2. However, in the dynamic models, we find a significant positive relationship, which is expected and will be discussed in the next subsection. Similarly, we have the test for hypothesis 3 (*H3: Financial factors have a positive relationship with bank profitability in Vietnam)* and the null hypothesis is that the coefficient for forex rate is smaller than or equals 0. The p-value of the one-sided test is reported at 0.486. Thus, there is also not enough evidence to reject the null hypothesis and we reject hypothesis 3.

The last group of determinants is the macroeconomic factors. The coefficient for inflation is 0.068%, statistically significant at a 5% level. The results are consistent with the findings of Athanasoglou et al. (2008). This indicates that Vietnamese banks can partially anticipate inflation and adjust their interest rates to offset the rising costs and remain profitable (Perry, 1992). In a 2019 study, Batten & Vo also find a positive relationship between Vietnamese bank profitability and inflation, suggesting that banks pass inflation costs onto customers. Economic growth shows a positive effect on ROA though insignificant. During a period of economic growth, the market size of bank activities and the quality of loans would be improved, driving profits. We perform an F-test to test our fourth hypothesis *(H4: Macroeconomic factors have a positive effect on bank profitability in Vietnam).* The null hypothesis is that the sum of the coefficients for the group of macroeconomic factors is smaller or equal to 0. The p-value is reported as 0.007, thus, we reject the null hypothesis and accept hypothesis 4 at a 1% significance level. Answering the research question using the FE models, bank-specific and macroeconomic determinants have positive effects on Vietnamese bank profitability with bank-specific factors being the most important determinants. There is not enough evidence for the effect of the industry-specific factor (market concentration) and the financial factor (forex rate) on bank performance in Vietnam.

4.2. Arellano-Bond dynamic estimation

As mentioned in section 3, the LSDV estimator of the FE model is biased and inconsistent when a lagged dependent variable is among the regressors. Thus, we adopt dynamic panel data models using Arellano-Bond estimators with robust standard errors, adding a one-period lagged dependent variable. In table 4.2, models 1, 2, 3 and 4 each focus on a specific

group of factors: bank-specific, industry-specific (market concentration), financial (forex rate) and macroeconomic factors respectively including the lagged dependent variable. Model 5 accounts for all groups of determinants with the addition of the one-period lagged ROA.

Table 4.2: Arellano-Bond dynamic panel data regressions results for the relationship between the groups of determinants and bank profitability

	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROA
ROA_{t-1} (%)	0.320***	0.755***	0.562***	0.760***	0.243*
	(0.102)	(0.102)	(0.074)	(0.098)	(0.127)
Size	2.895				4.687**
	(2.398)				(2.250)
$Size^2$	-0.073				-0.135*
	(0.074)				(0.070)
Equity (%)	0.070*				0.087**
	(0.037)				(0.036)
Credit Risk (%)	-0.026				-0.031
	(0.045)				(0.045)
Loans (%)	0.011**				0.013*
	(0.005)				(0.007)
Deposits (%)	-0.008				0.000
	(0.007)				(0.006)
CASA ratio (%)	0.009*				0.010*
	(0.005)				(0.005)
Overhead Exp. (%)	0.262*				0.180
	(0.149)				(0.112)
Concentration (%)		-0.003			0.014**
		(0.002)			(0.007)
Forex Rate			0.025***		0.017
			(0.005)		(0.014)
Economic Growth (%)				0.019	0.131**
				(0.021)	(0.053)
Inflation (%)				-0.024	0.017
				(0.020)	(0.019)
Constant	-28.108	0.387***	-5.066***	0.230	-46.589**
	(19.663)	(0.079)	(0.929)	(0.212)	(18.619)
Observations	161	161	161	161	161
Number of instruments	37	30	30	31	41
Wald Test (p-value)	0.000	0.000	0.000	0.000	0.000
AB test AR(1) (p-value)	0.148	0.182	0.229	0.193	0.245
AB test AR(2) (p-value)	0.092	0.619	0.416	0.549	0.125

Notes: Due to the inclusion of lagged dependent variable, the dynamic panel data models consist of only 161 observations. Models 1, 2, 3 and 4 each focus on bank-specific, industry-specific, financial and macroeconomic factors respectively. Model 5 considers all groups of determinants. Standard errors in parentheses are auto-correlation and heteroskedasticity robust. Significance levels are * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The p-values of the Wald test and the Arellano-Bond tests for first- and second-order autocorrelation are shown.

In table 4.2, the coefficients for the lagged profitability (ROA_{t-1}) are statistically significant at a 1% level for models 1 to 4 and significant at a 10% level for the extensive model 5. In model 5, the coefficient for the one-period lagged dependent variable is 0.243, indicating a small degree of profit persistence. As there is a high adjustment speed to the normal level of profit, the Vietnamese banking industry's departure from a perfectly competitive market structure is small. This contradicts the findings by Le (2017) when studying 40 Vietnamese banks for the period 2005-2009. Their results show a higher degree of profit persistence of 0.41, suggesting barriers to competition. Our paper examines Vietnamese banks in a different study period of 2012-2020, where SOCBs are less protected and JSCBs increase their efficiencies with more competitive advantages. Thus, the Vietnamese banking sector is seen as more competitive in recent years with fewer barriers and government protection to promote efficiency.

Comparing the FE and the Arellano-Bond estimates, the effect directions of statistically significant variables are similar, indicating the robustness of our results (see appendix D). The statistical significances of the Arellano-Bond estimates for a few variables differ from those reported in the FE model. In the dynamic model, the positive coefficients for market concentration and economic growth are significant at a 5% level while the coefficients for credit risk and inflation are insignificant. Market concentration is positively correlated with ROA with the coefficient of 0.014%, statistically significant at a 5% significance level. The coefficient is very low, hence, the overall market concentration has a small impact on profitability. However, the results still support the SCP hypothesis of increasing profitability through market power. As the Vietnamese banking sector is more concentrated, bank profitability increases. This is inconsistent with the findings of Le (2017) when studying 40 Vietnamese banks. Our sample only contains 23 listed active domestic commercial banks out of 35 listed and private active domestic commercial banks. Listed banks tend to have more information transparency and published data than private banks. There are also more data on larger, older and more established banks. Therefore, our sample can be biased and only include renowned banks with certain levels of market power. With the dynamic panel data regression, hypothesis 2 (*H2: Market concentration has a negative impact on bank profitability in Vietnam)* can be accepted as we can reject the null hypothesis at a 5% significance level. With the dynamic models, we can answer the research question as follows. Bank-specific, industry-specific (market concentration) and macroeconomic determinants all have positive effects on Vietnamese bank profitability. Similar

to FE models, there are not enough evidence for the impact of the financial factor, forex rate, on banks' profits in Vietnam.

In all dynamic models, the Arellano-Bond estimators show evidence of profit persistence. High Wald test statistics with low p-values <0.000 indicate fine goodness of fit and that the overall model is significant at a 1% level of significance. The absence of the second-order autocorrelation indicates that the estimators are consistent (Arellano & Bond, 1991). However, a there is not enough evidence to reject the null hypothesis that there is no autocorrelation of the first-order. As the Arellano-Bond tests are used to determine whether the idiosyncratic error term has serial correlation, high p-values of the Arellano-Bond tests for AR(1) suggest that the error term in levels are highly serially correlated. In extreme cases, this implies a random walk, thus the first-differenced errors are serially uncorrelated. A possible explanation for our AR(1) p-value is that our number of observed banks (N=23) is small compared to the number of instruments used in the dynamic models (>30), therefore, it is insufficient to perform the dynamic model (Labra & Torrecillas, 2018). Thus, the results of our dynamic models are invalid and can possibly be alleviated by adding more banks with available data to the sample.

4.3. Alternative specifications

Previously in section 3.4, the problem of severe multicollinearity is addressed by dropping the variables of interest rate and stock market capitalization based on previous literature and the comparison of VIFs. In this section, we will briefly discuss the models when we include these dropped variables. First, we will run the FE regression with all the independent variables mentioned in the Theoretical Framework except for the lagged dependent variable. Then, the two pairs of models that include the swapped variables that are highly correlated with each other are compared to justify the final model that is chosen to be presented in 4.1. The results are shown in table 4.3 below.

Model 1, which includes all independent variables, has a mean VIF of 11.52. A detailed table of the VIF for each variable can be found in Appendix A table A.2. The results obtained by models with different combinations of regressors are similar in terms of effect direction for most of the variables, indicating that our results are robust across different specifications. The changes in the coefficients are minor for the statistically significant variables. The adjusted R^2 is reduced from 67% in model 1 to 66% in model 6 after dropping two variables. However, the mean VIF is

significantly reduced from 11.52 to 3.23. As a VIF above 10 indicates a severe collinearity problem, dropping interest rate and stock market capitalization as regressors relieves the problem of multicollinearity (Menard, 2001). Next, we will investigate two pairs of models in detail.

Table 4.3: FE regressions results when omitting variables with multicollinearity

Variables	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROA	(6) ROA
Size	7.391***	7.393***	7.348***	7.384***	7.410***	7.363***
	(1.798)	(1.790)	(1.758)	(1.789)	(1.800)	(1.743)
$Size^2$	-0.194***	-0.194***	-0.194***	-0.194***	-0.195***	-0.195***
	(0.058)	(0.058)	(0.057)	(0.058)	(0.058)	(0.057)
Equity (%)	0.177***	0.177***	0.177***	0.177***	0.177***	0.178***
	(0.027)	(0.027)	(0.028)	(0.027)	(0.027)	(0.028)
Credit Risk (%)	-0.153**	-0.153**	-0.149**	-0.153**	-0.153**	-0.149**
	(0.063)	(0.063)	(0.063)	(0.063)	(0.063)	(0.064)
Loans (%)	0.007	0.007	0.005	0.007	0.007	0.005
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Deposits (%)	-0.013	-0.013	-0.014	-0.012	-0.012	-0.016
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
CASA ratio (%)	0.013**	0.013**	0.012*	0.013**	0.013**	0.012*
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Overhead Exp. (%)	-0.072	-0.072	-0.052	-0.071	-0.070	-0.050
	(0.167)	(0.167)	(0.163)	(0.166)	(0.165)	(0.162)
Concentration (%)	0.004	0.004	0.006	0.004	0.004	0.004
	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)
Interest Rate (%)	0.103	**0.101**		0.093	0.097	
	(0.040)	(0.027)		(0.042)	(0.043)	
Forex Rate	-0.004	-0.003	0.016	**0.002**		0.001
	(0.012)	(0.014)	(0.014)	(0.008)		(0.009)
Stock Market Cap. (%)	0.003	0.003	-0.008		**0.001**	
	(0.005)	(0.006)	(0.006)		(0.003)	
Economic Growth (%)	0.081	0.081	0.076	0.083	0.082	0.066
	(0.067)	(0.064)	(0.066)	(0.065)	(0.066)	(0.063)
Inflation (%)	-0.002		**0.077*** **	0.008	0.004	0.068***
	(0.024)		(0.021)	(0.029)	(0.030)	(0.020)
Constant	-68.953***	-69.040***	-71.297***	-69.933***	-69.754***	-67.811***
	(14.505)	(14.373)	(14.213)	(14.692)	(14.601)	(14.451)
Observations	207	207	207	207	207	207
R^2	0.691	0.691	0.684	0.691	0.691	0.681
Adjusted R^2	0.669	0.670	0.663	0.670	0.670	0.662
Mean VIF	11.52	7.59	7.46	4.54	4.86	3.23

Notes: Model 1 contains all the independent variables in the data collection. Model 2, 3, 4 and 5 each drop one variable and the coefficient of the included variable is presented in bold. Model 2 and 3 compares dropping inflation vs. interest rate. Models 4 and 5 show the results of dropping stock market capitalization and forex rate respectively. Model 6 is the final model after dropping interest rate and stock market capitalization. Standard errors in parentheses are heteroskedasticity robust and clustered at bank level. Significance levels are * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The mean VIF is calculated without the correlation between Size and $Size^2$ as one is a squared value of another.

First, we will discuss models 2 and 3 as they address the correlation between interest rate and inflation. Looking at the correlation matrix and VIF table in appendix A, inflation and interest rate have a high correlation of 0.937. As mentioned before, interest rate has a larger VIF of 24.68, indicating high multicollinearity while VIF of inflation is only 8.97 for low multicollinearity (Gujarati et al., 2012). In table 4.3, the mean VIF is slightly improved from 7.59 to 7.46 when dropping the variable of interest rate compared to dropping inflation. In the final model in column 7, inflation has a positive effect on ROA at a 1% significance level. Similarly, we will compare models 4 and 5 regarding the high collinearity correlation of 0.960 between stock market capitalization and foreign exchange rate. In appendix A table A.2, stock market concentration shows a higher VIF at 43.66 than that of foreign exchange rate at 33.53. All FE regressions in table 4.3 exhibit relatively low coefficients for both variables, showing that changes in these variables have small effect on the dependent variable. Removing the forex rate also reduces the mean VIF (4.54) more, compared to the mean VIF (4.86) after removing forex rate. Thus, the exclusion of the interest rate and stock market capitalization variables can be justified to fix the severe multicollinearity problem in the model.

5. Conclusion & discussion

In this paper, we aim to investigate the effects of bank-specific, industry-specific, financial and macroeconomic determinants on bank profitability in Vietnam between 2012 and 2020. As emerging economies are growing rapidly and present potential opportunities, we perform up-to-date research with a representative sample of domestic listed commercial banks. Our paper incorporates a variety of bank profitability determinants and applies the appropriate methodology for the panel data set. Our sample includes 23 active listed domestic Vietnamese commercial banks with data available on ORBIS Bank Focus. The study period is from 2012, when the major reformation of the banking sector started, to 2020, the last data availability date for many banks. Data on industry-specific, financial and macroeconomic factors are retrieved from The Global Economy, IMF and WorldBank databases. We performed the FE models and dynamic panel data models using Arellano-Bond estimators to find a well-fitting model. Additionally, the Hausman test, Arellano-Bond tests, statistical t-tests and F-tests are also reported in our analysis.

Sustainable profitability in the banking sector is crucial as it boosts economic growth and maintains a sound and stable financial system (Demirgüc-Kunt & Detragiache, 1999). As the Vietnamese banking sector is rapidly growing and dynamically changing, our results are relevant and important to bank managers, investors and the government for optimal policies, mergers & acquisitions valuation and the assessment of individual banks' performance. We find that bank-specific and macroeconomic factors both have a positive relationship with ROA. Additionally, bank-specific determinants are the most important in explaining the variation in bank profitability in Vietnam. As the size of a bank increases, profitability also increases but at a decreasing rate, consistent with the findings of Staikouras & Wood (2004). Growing banks can benefit from economies of scale but larger banks wishing to expand must evaluate the efficiency of managerial decisions so that there are no over-branching or unnecessary costs that can reduce earnings. Equity can act as a buffer to absorb loss and fund future business opportunities, driving profitability. As Vietnamese banks still have low capital compared to their neighbors, publicly listed banks should focus on raising equity while private banks should consider going public. The Vietnamese government and the SBV should aid local banks in terms of regulations to be listed on the stock market. This would also improve the transparency of information in the banking system, creating more data for future research. Another finding is that high credit risk can reduce profitability. Individual banks should improve the screening and monitoring of loan quality and diversify their revenue sources to hedge against risks and improve earnings. Credit risk should be regulated internally by bank managers and externally by the SBV. Especially in challenging times, the accumulation of loan losses and increased default risks can hurt banks significantly. Lastly, the macroeconomic variable of inflation positively correlated with profitability, similar to findings in Vietnamese banks by Le (2017). This signals the ability to anticipate inflation by banks and to pass inflation costs onto customers. However, the SBV should work closely with banks and supervise the lending and deposit rates to protect customers as banks can take advantage of their power.

Our research paper has several limitations. Firstly, we collect data from the annual financial reports available on ORBIS Bank Focus, hence, there is a limitation in data availability. Since only public banks post their annual financial reports, we could not find data for private banks. This affects our external validity as the results might be strictly applicable to publicly listed commercial banks in Vietnam. Thus, including private banks in the sample will increase

our observations and their representativeness, and improve our estimations for the dynamic models. Secondly, we use the annual average lending rate as the interest rate. However, as banks are allowed to set their own lending and deposit rates, the individual banks' rates and subsequent interest spreads are more appropriate to be included in the research. As banks develop a better online presence through their websites, these rates might be more available in future research. Similarly, due to data unavailability, we used the three-firm-concentration ratio to measure market concentration. However, the Herfindahl–Hirschman index can also be used in future studies as it is a more accepted and more commonly used as a measure of concentration. To measure this index, the market shares of individual banks are needed throughout the sample period, which was not available for our study. Additionally, we collect data from 2012 to 2020, when there was only positive economic growth reported in Vietnam. Future studies can investigate a longer time horizon that can potentially include economic crises and recessions to study the effect of the business cycle on bank profitability and improve the validity of the findings. Lastly, considering the internal validity of the research, there are threats of omitted variable bias. Banks can drive profits with competitive advantages from intangible assets and characteristics that are non-quantifiable such as reputation, bank image and customer relationship, which are not included in our paper.

Besides fixing our limitations, we have a few suggestions for future research. This study mainly focuses on domestic commercial banks. Future studies can extend their scope to include foreign banks in Vietnam and compare the results to domestic banks. Taking a step further, a cross-country analysis can be performed on emerging markets, comparing them to developed markets. However, it should be noted that extensive research on the regulations, accounting standards and Basel standards should be carried out for such comparative analysis. Additionally, research on monetary policies and bank profitability is also relevant and important, especially in the context of developing economies.

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Appendices

Appendix A: Multicollinearity detection through correlation matrix and VIF

Table A.1: Correlation matrix of independent variables and dependent variable

	Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1)	ROA	1.000															
(2)	ROA_{t-1}	0.879	1.000														
(3)	Size	0.196	0.190	1.000													
(4)	$Size^2$	0.192	0.188	0.999	1.000												
(5)	Equity	0.306	0.402	-0.601	-0.585	1.000											
(6)	Credit Risk	0.216	0.230	-0.029	-0.023	0.319	1.000										
(7)	Loans	0.243	0.235	0.481	0.496	-0.105	-0.000	1.000									
(8)	Deposits	-0.529	-0.555	0.200	0.197	-0.555	-0.384	-0.067	1.000								
(9)	CASA ratio	-0.034	-0.086	-0.207	-0.210	0.074	0.053	-0.203	-0.087	1.000							
(10)	Overhead Exp.	0.441	0.441	-0.155	-0.155	0.460	0.427	0.156	-0.530	0.011	1.000						
(11)	Concentration	0.143	0.268	-0.020	-0.017	0.154	0.096	-0.080	-0.200	0.032	0.013	1.000					
(12)	Interest Rate	-0.015	0.096	-0.234	-0.230	0.266	0.137	-0.295	-0.162	-0.042	0.145	0.473	1.000				
(13)	Forex Rate	0.288	0.205	0.314	0.314	-0.204	-0.095	0.395	-0.145	0.045	-0.063	-0.074	-0.682	1.000			
(14)	Stock Market Cap.	0.306	0.224	0.304	0.304	-0.183	-0.073	0.371	-0.173	0.046	-0.055	0.085	-0.576	**0.960**	1.000		
(15)	Economic Growth	-0.121	-0.229	-0.019	-0.021	-0.105	-0.071	0.020	0.160	-0.055	0.017	**-0.912**	-0.293	-0.047	-0.162	1.000	
(16)	Inflation	0.019	0.085	-0.196	-0.194	0.229	0.129	-0.253	-0.174	-0.035	0.136	0.501	**0.937**	-0.590	-0.425	-0.294	1.000

Notes: Correlation >0.8 is considered severe multicollinearity and is highlighted in bold.

Table A.2: VIF of all independent variables to detect multicollinearity

Independent Variable	VIF
Size	958.08
$Size^2$	941.71
Concentration	49.15
Stock Market Cap.	43.66
Forex Rate	33.53
Economic Growth	25.18
Interest Rate	24.68
Inflation	8.97
Equity	3.84
Deposits	2.64
ROA_{t-1}	2.36
Loans	2.03
Overhead Exp.	1.93
Credit Risk	1.47
CASA ratio	1.14
Mean VIF	140.02

Appendix B: Hausman test for FE and RE models without lagged dependent variable

Table B.1: The regressions results of FE and RE models for the relationship between determinants and bank profitability in Vietnam and the corresponding Hausman test result

Variables	FE	RE	Difference	Std. Error
Size	7.363	7.595	-0.231	0.564
$Size^2$	-0.195	-0.219	0.024	0.019
Equity (%)	0.178	0.167	0.011	0.006
Credit Risk (%)	-0.149	-0.120	-0.028	0.011
Loans (%)	0.005	0.0004	0.004	0.003
Deposits (%)	-0.016	-0.017	0.002	0.002
CASA ratio (%)	0.012	0.007	0.005	0.004
Overhead Exp. (%)	-0.050	0.020	-0.070	0.044
Concentration (%)	0.004	0.005	-0.001	0.0005
Forex Rate	0.001	0.001	-0.0002	0.000
Economic Growth (%)	0.066	0.066	-0.0004	0.003
Inflation (%)	0.068	0.057	0.011	0.003
Hausman test	X^2 (8) = 22.00, P-value = 0.0049			

Appendix C: FE results without clustering standard errors at bank level

Table C.1: FE regressions results for the relationship between the groups of determinants and bank profitability in Vietnam for period 2012-2020 without clustering standard errors at bank level

Variables	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROA
Size	6.873***				7.363***
	(1.261)				(1.237)
$Size^2$	-0.185***				-0.195***
	(0.039)				(0.039)
Equity (%)	0.169***				0.178***
	(0.019)				(0.019)
Credit Risk (%)	-0.132***				-0.149***
	(0.044)				(0.043)
Loans (%)	-0.004				0.005
	(0.005)				(0.005)
Deposits (%)	-0.028***				-0.016*
	(0.008)				(0.008)
CASA ratio (%)	0.010				0.012*
	(0.007)				(0.007)
Overhead Exp. (%)	0.019				-0.050
	(0.112)				(0.110)
Concentration (%)		0.009***			0.004
		(0.003)			(0.006)
Forex Rate			0.026***		0.001
			(0.004)		(0.008)
Economic Growth (%)				-0.078**	0.066
				(0.033)	(0.052)
Inflation (%)				-0.006	0.068***
				(0.018)	(0.018)
Constant	-60.127***	0.575***	-4.794***	1.435***	-67.811***
	(10.410)	(0.139)	(0.954)	(0.233)	(10.472)
Observations	207	207	207	207	207
R^2	0.637	0.041	0.166	0.030	0.681
Adjusted R^2	0.575	-0.080	0.061	-0.098	0.619

Notes: Models 1, 2, 3 and 4 each focus solely on bank-specific, industry-specific, financial and macroeconomic factors respectively. Variables presented in percentages are labeled. Model 5 considers all groups of determinants. Standard errors in parentheses are heteroskedasticity robust and clustered at bank level.
Significance levels are * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix D: Summary of the FE and dynamic models' results compared to expectations of signs and the corresponding hypotheses

Table D.1: The regression results versus the expected signs with relevant tested hypotheses of the relationship between determinants and bank profitability in Vietnam

Group of determinants	Variable	Expected	FE models	Dynamic models with Arellano-Bond estimators	Hypothesis
Bank-specific	ROA_{t-1}	+		+*	*H1: Bank-specific factors positively influence bank profitability in Vietnam (Accepted)*
	Size	+/-	+***	+**	
	$Size^2$	-	-***	-*	
	Equity	+	+***	+**	
	Credit Risk	+/-	-**	-	
	Loans	+	+	+*	
	Deposits	+	-	+	
	CASA ratio	+	+*	+*	
	Overhead Exp.	+	-	+	
Industry-specific	Concentration	-	+	+**	*H2: Market concentration has a negative impact on bank profitability in Vietnam (Rejected with FE model, Accepted with dynamic model)*
Financial	Interest Rate	+			*H3: Financial factors have a positive relationship with bank profitability in Vietnam (Rejected)*
	Forex Rate	+	+	+	
	Stock Market Cap.	+			
Macroeconomic	Economic Growth	+	+	+**	*H4: Macroeconomic factors have a positive effect on bank profitability in Vietnam (Accepted)*
	Inflation	+	+***	+	