

Determinants of Bank Profitability in Thailand by Generalized Method of Moments Estimation

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Received: December 6, 2022 Revised: February 17, 2023 Accepted: July 6, 2023

Abstract

This research aimed to estimate the determinants of bank profitability of banks registered in Thailand using the System GMM Estimator method. Bank-level data from 2010-2020. Profitability is measured by three ratios: Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margin (NIM). The determinants of a bank's profitability are bank-specific. Banking Industry Specific Factors and Economic Factors. The results showed that increasing asset size results in lower profitability for banks, asset quality, and operating costs negatively affect profitability. On the other hand, capital adequacy, inflation, and gross domestic product helped boost profits for banks.

Keywords: Bank profitability, Generalized method of moments, Determinants of bank profitability

Introduction

Thailand's economy is primarily funded by commercial banks due to limited access to alternative funding sources for individuals and businesses (Subhanij, 2016). As a result, banks play an important role in driving the economy. Banks' operations effect their revenue, financial stability and the national economy. Profitability of banks, which also influences bank financial stability, should be encouraged (Pessarossi et al., 2020). In order to guide policy formulation and ensure banks' financial stability, bank executives must understand profitability and profitability drivers (Xu et al., 2019).

The profitability of the bank is of interest in academic circles, and it is widely researched in developed countries (Djalilov & Piesse, 2016; Le & Ngo, 2020; Elekdag et al., 2020; Kumar et al., 2021; Fenandes et al., 2021), developing and emerging market countries

(Jiraporn et al., 2019; Islam et al., 2017; Kanga et al., 2020), and Thailand (Thiangtong et al., 2018; Kirakul et al., 2019; Chantapong, 2005; Tran & Vo, 2018; Malini, 2020; Leon, 2020).

Profitability determinants have been a popular theme in previous research, and variables have been continuously developed (Le & Ngo, 2020; Kanga et al., 2020; Tan, 2020; Lerskullawat, 2021). Currently, the factors determining profitability can be divided into three groups: bank-specific, specific to the banking industry, and macroeconomic factors. Designing comprehensive and important variables can reduce endogeneity problems caused by misspecification. Defining the comprehensive and important variables can reduce endogeneity problems caused by misspecification problems, especially those caused by omitting important explanatory variables in the model (Kraipornsak, 2016). This problem leads to biased estimation results (Fernandes et al., 2021; Kumar et al., 2021). The study of bank profitability determinants in Thailand is limited, variables are defined differently, and key variables need to be covered, leading to endogeneity problems and biased results.

The endogeneity problem results in inconsistent and biased results for the Ordinary Least Square (OLS) estimator. The Fixed Effect Model (FEM) and Random Effect Model (REM) methods do not address the above problems, while the general interval estimator (GMM) using the appropriate instrument variable can eliminate this problem (Nguyen, 2021; Tan, 2020). This approach is most typically used to investigate bank profitability aspects and is thought to be suited to the dynamic nature of relationships (Dietrich & Wanzenried, 2011; Flannery & Hankins, 2013; Liu & Wilson, 2009; Tan, 2020; Lerskullawat, 2021). In Thailand, general period estimation (GMM) has yet to be employed to analyze the profitability determinants of banks.

This research aimed to estimate Thai banks' profitability determinants by the System GMM Estimator method. This research eliminates the endogeneity problem caused by neglecting the critical variable by defining the key independent variable in the model consisting of Bank specific factors, factors specific to the banking industry, and macroeconomic factors. In order to illustrate bank profitability across several dimensions, the dependent variables in this study are ROA, ROE, and NIM. The findings of this research are useful to regulators and bank executives as a guideline for formulating monetary policy to maintain the bank's financial stability and the country's economic growth appropriately.

Literature review

Bank profitability

Bank profitability indicates a bank's capacity to create operational profits and demonstrates how efficiently it uses its assets to earn money. Profitability is the consequence of business and governmental decisions (Mardiyati et al., 2012) and has the same effect as a

bank's financial soundness (Pessarossi et al., 2020). Since bank profitability impacts economic growth (Klein & Weill, 2022), bank executives may use it as a policy guideline to ensure the financial stability of banks, if they understand the source of profitability. (Xu et al., 2019).

Researchers utilized different bank profitability measurements depending on their objectives. Those who want to demonstrate a bank's total asset management capability to generate profits investigate different nations. For example, Tran and Vo (2018) investigated Thai banks. Jiraporn et al. (2019); Leon (2020); Daq and Nguy (2020); Malini (2020) studied ASEAN countries. On the other hand, Djalilov and Piesse (2016); Gilces et al. (2020), Le and Ngo (2020); Tan (2020); Elekdag et al. (2020); Kanga et al. (2020); Kumar et al. (2021); Fernandes et al. (2021) studied foreign banks both separately and collectively. A high return on assets shows a bank's capacity to manage assets properly, whereas a low return on assets suggests that a bank needs stronger asset management, and is not worthwhile. To demonstrate profitability to the shareholders, researchers use the net interest income margin as the profitability measure. Thiangtong et al. (2018); Ratanavararak and Ananchotikul (2018) examined banking in Thailand. Jiraporn et al. (2019); Leon (2020); Daq and Nguy (2020) investigated banking in ASEAN. Elekdag et al. (2020); Kumar et al. (2021), Fernandes et al. (2021); Kanga et al. (2020) studied banking internationally. A high return on equity implies that a bank can manage its revenues and costs to make profits and that it bank is efficient and cost-effective for shareholders' investments. However, a low rate of return on equity indicates that a could be more efficient in managing income and costs to create profits for shareholders. and it is not worthwhile. Furthermore, if researchers wish to demonstrate a bank's ability to earn interest on investments in a bank's earning assests, the net interest margin is utilized to calculate profitability. Kirakul et al. (2019) investigated Thai banks, whereas Le and Ngo (2020); Tan (2020); Kanga et al. (2020) investigated international banks. A sizeable net interest margin demonstrates that a bank can effectively generate interest on its investments in profitable assets. However, a low net interest income margin implies inefficiency, thus unworthiness, in generating interest.

Determinants of a bank's profitability

Each country's economic environment is distinctive. Researchers have utilized many indicators of a bank's profitability, classified into three categories: bank-specific characteristics, macroeconomic factors, and microeconomic factors. Banking details on industry-specific and macroeconomic aspects are also provided below.

Bank-specific factors

Banks provide financial services, like deposits, credits, and other financial products. A bank's most significant source of revenue is interest income from loans, followed by fees and service income. Good credit enables a bank to generate a reasonable amount of revenue. Non-performing loans diminish bank revenue. Non-performing debt causes a bank to lose credit earning possibilities and, as a result, bank profits (Chantapong, 2005; Kirakul et al., 2019; Jiraporn et al., 2019; Leon, 2020; Malini, 2020; Kumar et al., 2021). Such relationships are absent in some banks, particularly those that embrace a higher risk of embracing decreasing asset quality and establishing borrowing rates. The bigger the risk offset is, the higher the bank's profits (Daq & Nguy, 2020; Fernandes et al., 2021). In contrast, Kanga et al. (2020) discovered that asset quality has a statistically negligible influence on profitability. Furthermore, banks with more assets have a financial advantage, and their branch network influences prospect earnings and consumer reach. Djalilov and Piesse (2016) discovered that asset size positively affects profitability. The larger size of banks may not have a favorable influence on performance. This is owing to the high cost of labor, premises, and higher administration, all of which result in reduced profitability (Kirakul et al., 2019; Jiraporn et al., 2019; Daq & Nguy, 2020; Fernandes et al., 2021; Tan, 2020). Thiangtong et al., (2018), Kumar et al., (2021); Kanga et al., (2020) discovered that asset size was not statistically significant to profitability. A bank's financial stability is critical to its creditworthiness and borrowing costs and is defined by its capital sufficiency. The ability to pay future losses from hazardous assets is indicated by capital adequacy. A bank's performance will improve with sufficient capital (Kirakul et al., 2019; Kumar et al., 2021). On the other hand, banks with excellent financial stability, may not necessarily encourage good operation because they may miss an opportunity to gain money from extending loans, given that they must keep some of their capital in reserve to maintain attraction. Studies like Daq and Nguy (2020); Le and Ngo (2020); Tan (2020) discovered that capital sufficiency was inversely connected to profitability. These expenses are operational costs in terms of employee expenses, building expenses, and administrative charges. Banks with effective cost management have minimal operating costs, resulting in higher profits (Kirakul et al., 2019; Tan, 2020), while banks with ineffective cost management gain less profits (Daq & Nguy, 2020; Elekdag et al., 2020; Kumar et al., 2021).

Banking Industry-specific factors

Bank competition is a significant factor that influences a bank's performance. The concentration of large banks reduces competition and leads to a conspiracy to control interest rates that benefit the banks and boost their profits (Ratanavararak & Ananchotikul, 2018; Djalilov & Piesse, 2016; Lerskullawat, 2021). However, the study by Le and Ngo (2020) found

that fierce competition has reduced bank profitability, while the study of Kanga et al. (2020) detected no statistical significance.

Macroeconomic factors

The three important economic indicators are inflation, gross domestic product, and policy interest. Inflation measures economic circumstances that indicate price stability for goods and services. Higher inflation reduces bank operational profits (Kirakul et al., 2019). In contrast, Tan (2020); Leon (2020); Kumar et al. (2021) discovered that inflation had a beneficial effect on bank profitability. Le and Ngo (2020) did not find a statistically significant relationship between inflation and bank profitability. The gross domestic product (GDP) is an economic metric that indicates the overall economic value created inside a country. Previous literature shows mixed findings. Studies demonstrate that economic growth has either no significant impact (Tan, 2020), a negative impact (Kirakul et al., 2019), or a positive impact on bank profitability (Elekdag et al., 2020; Kumar et al., 2021). Central banks use the policy interest rate to influence economic activity, and changes in the policy interest rate affect bank interest rates. The policy interest rate is the rate of interest that represents the actual costs of banks and influences the cost of doing business. A high policy interest rate increases bank financing costs and reduces bank profits. On the contrary, if the policy interest rate falls, the bank's costs will fall, and its performance will be improved. However, previous research has revealed no statistically significant relationship between policy interest and bank profitability (Elekdag et al., 2020; Kanga et al., 2020; Kumar et al., 2021).

Research method

Data

The population consists of 30 commercial banks which operate in Thailand, categorized into 4 types: 1) 14 banks registered in Thailand, 2) 1 retail bank, 3) 4 subsidiary banks of foreign banks, and 4) 11 branches of foreign banks. This study mainly selected banks registered in Thailand. This is because they play a key role in economic growth and have high deposit and lending values relative to the total value of deposits and loans of the entire banking system (Bank of Thailand, 2022).

The research uses cross-sectional and time-series data, known as panel data, consisting of bank-specific and bank-industry-specific factors –obtained from the Bank's Annual Report by Auditors (BARA)– along with economic factors information –obtained from the Bank of Thailand (BOT), the Ministry of Commerce (MOC), and the Office of the National Economic and Social Development Council (NESDC)–. The period on which this study focuses is from 2010 to 2020. Data were balance panel data, totaling 154 data sets.

Table 1 Variables, measurements and data sources

Variables	Measurements	Data sources
Return on asset	Net operating profit to total assets	BARA
Return on equity	Net operating profit to equity	BARA
Net interest margin	Total interest income minus total interest expense and divided by average interest-earning assets	BARA
Asset quality	Non-performing loans to total loans	BARA
Capital adequacy	Capital adequacy to total risk assets	BARA
Asset size	Asset logarithm	BARA
Operating costs	Operating expenses to total revenues	BARA
Competitiveness	Big five banks' total assets to total bank system total assets	BOT
Gross domestic product	Gross domestic product growth	MOC, NESDC
Inflation	Change in the consumer price index	MOC, NESDC
Policy interest	The bilateral 1-day repurchase rate	BOT

Measures

This research defines the profitability of banks as return on assets (ROA), return on equity (ROE), and net interest margin (NIM). The independent variables are the determinants of bank profitability. They are divided into three categories: 1) bank-specific factors, which are asset quality (AQ), capital adequacy (CAR), asset size (SIZE), and operating costs (OC); 2) the banking-industry-specific factor, which is competition between banks (Com); and 3) economic factors, which are gross domestic product (GDP), inflation (Inf) and policy interest (PI). Details of variables are as follows:

- Return on assets (ROA) is measured by comparing net operating profit to total assets (Djalilov & Piesse, 2016; Le & Ngo, 2020; Elekdag et al., 2020; Kanga et al., 2020; Kumar et al., 2021; Fernandes et al., 2021; Tan, 2020). This indicator reflects a bank's total earning ability. Total earning consists of income from loans which is considered to be the bank's main income, service fee income, investment interest income, dividend income, and share of capital gains compared to the bank's total assets. A high return on assets shows that a bank efficiently and cost-effectively manages its assets to generate profits.

- Return on equity (ROE) is measured by comparing net operating profit to equity (Islam et al., 2017; Elekdag et al., 2020; Kanga et al., 2020; Kumar et al., 2021; Fernandes et al., 2021). This metric reflects the same gross earning capacity as ROA but differs in that it compares

earnings to the bank's equity. A high return on equity means that a bank can efficiently and cost-effectively generate income and profits for its shareholders.

- Net interest margin (NIM) is total interest income minus total interest expense divided by average interest-earning assets (Le & Ngo, 2020; Kanga et al., 2020; Tan, 2020). This measure reflects a bank's ability to earn income from the difference between interest income and interest expense, considering both credit and deposits, loans and loans between financial institutions, and investments, mostly mortgage bonds. A high-interest margin means that a bank can efficiently and worthly earn from the interest margin.

- Asset quality (AQ) is measured by calculating the ratio of the non-performing loans to total loans, that is, the NPL ratio (Islam et al., 2017; Tran & Vo, 2018; Le & Ngo, 2020; Elekdag et al., 2020; Malini, 2020; Daq & Nguy, 2020). A bank with low credit quality shows that it has a high amount of non-performing debt compared to its consolidated loans. Poor asset quality leads to higher bank provisions, and the bank consequently loses its opportunities for credit expansion. Furthermore, deterioration in asset quality means a loss of interest income from loans, and the bank's profitability will decrease accordingly.

- Capital adequacy (CAR) is measured by calculating the ratio of capital adequacy to total risk assets, that is, the capital adequacy ratio (Le & Ngo, 2020; Kanga et al., 2020; Kumar et al., 2021; Tan, 2020; Thiangtong et al., 2018; Kirakul et al., 2019; Malini, 2020; Daq & Nguy, 2020). Good capital adequacy indicates that a bank has good financial stability, and its low cost of financing results in its profitability.

- Asset size (AS) is measured by calculating the asset logarithm (Djalilov & Piesse, 2016; Islam et al., 2017; Thiangtong et al., 2018; Tran & Vo, 2018; Kirakul et al., 2019; Elekdag et al., 2020. Kanga et al., 2020; Kumar et al., 2021; Fernandes et al., 2021). Large banks have a branch network and a capital advantage, enabling them to support credit expansion to increase interest income. In addition, large banks have good financial standing, economies of scale, and an ability to operate under reduced costs, all of which increase their profitability.

- Operating costs (OC) are measured by calculating the ratio of operating expenses to total revenue (Kumar et al., 2021; Daq & Nguy, 2020; Elekdag et al., 2020). If efficiency in managing the bank's expenses is reduced, there will be a decrease in the bank's profitability.

- Competitiveness (Com) is measured by calculating the ratio of the big five banks' total assets to total bank system total assets (Le & Ngo, 2020; Lerskullawat, 2018; Laowattanabhongse & Sukcharoensin, 2018). This metric measures a bank's competitiveness through its market structure. An increase in the ratio reflects that banks are highly concentrated because it demonstrates that the market consists of a large proportion of big banks. This indicates that the bank market structure is monopolistic and less competitive (Lerskullawat,

2021). The present study examines banks in Thailand with low levels of competition. Since the banks' assets are concentrated among the top 5 big banks, demonstrating the market power of the big banks (Leenabanchong, 2012), a low level of competition and a higher asset ratio increase bank profitability.

- Gross domestic product (GDP) is measured by calculating the rate of gross domestic product growth (Le & Ngo, 2020; Kanga et al., 2020; Kumar et al., 2021; Tan, 2020). When economic growth is boosted, the economy is expanding, and the investment is increasing, the bank's credit will expand; and thus banks will gain more income and profits. On the other hand, an economic downturn, reflected by a lower gross domestic product growth rate, will result in a decline in economic activity. Borrowers may also have lower repayment capacity, leading to lower bank income and profitability.

- Inflation (Inf) is measured by calculating the rate of change in the consumer price index (Le & Ngo, 2020; Kumar et al., 2021; Tan, 2020). Mild inflation promotes economic expansion. Banks will expand loans and adjust interest rates to gain more income, thus increasing profits. However, suppose the inflation rate is severe and causes production costs and living costs to rise. In that case, the banks' debtors may not be able to comply with the conditions, resulting in more non-performing loans and a contraction in credit in the economy. Consequently, in this case bank profitability decreases.

- Policy interest (PI) is measured by calculating the bilateral 1-day repurchase rate (Elekdag et al., 2020; Kanga et al., 2020; Kumar et al., 2021). When the policy interest rate rises, banks will increase the interest on deposits and loans. If the difference between the interest on the loan and the deposit remains the same, banks' earnings will not be affected. However, if the difference between interest cannot sustain, bank's income will be impacted, resulting in either an increase or a decrease.

Method

This study uses the model of Tan (2020) to estimate the relationship between determinants of bank profitability and bank profitability in Thailand. The Model of Tan (2020) is based on Equation 1.

$$\Pi_{it} = C + \sum_{j=1}^j \beta_j X_{it}^j + \sum_{l=1}^l \beta_l X_{it}^l + \sum_{m=1}^m \beta_m X_{it}^m + v_{it} + \mu_{it} \quad (1)$$

Where i refers to the year and t refers to an individual bank. Π_{it} represents the profitability indicator for the specific bank in a specific year. C is the constant term. X_{it} are determinants of bank profitability. X_{it}^j represents bank-specific determinants, including asset quality, capital adequacy, asset size, and operating cost. X_{it}^l represents bank industry-specific

determinants, including competition in the banking sector. And X_{it}^m represents macroeconomic determinants, including inflation, GDP and policy interest. The unobserved bank-specific effect and the idiosyncratic error are represented by v_{it} and μ_{it} , respectively. β_j , β_l , and β_m are coefficients to be estimated. δ represents the speed of adjustment to equilibrium.

An unobserved bank-specific problem results in biased estimates. To tackle the problem, this research added a delay-dependent variable of bank profitability over a while ($\Pi_{i,t-1}$) to the model (Arellano and Bond, 1991; Fernandes et al., 2021; Tan, 2020; Kumar et al., 2021). The model for the analysis is as follows Equation 2.

$$\Pi_{it} = C + \delta \Pi_{i,t-1} + \sum_{j=1}^j \beta_j X_{it}^j + \sum_{l=1}^l \beta_l X_{it}^l + \sum_{m=1}^m \beta_m X_{it}^m + v_{it} + \mu_{it} \quad (2)$$

However, the System GMM estimation method may have too many instrument variables created, causing problems. Over-identification is where it is not possible to find the matrix of parameters that results in the smallest sum of squares (Roodman, 2008; Kumar et al., 2021). Therefore, we used the Hansen-J or overidentification test to verify the validity of the instruments used in the system GMM estimator (Roodman, 2009). The null hypothesis that the instruments were valid was not rejected as the p-value was greater than 0.05. This conclusion confirms that all the instruments employed in the model were appropriate (Kumar et al., 2021). To show the reliability of the estimated coefficients, this study tested for autocorrelation problems using Arellano-Bond tests for AR (1) and AR (2) and formulating the null hypothesis that the model did not have a problem (Le & Ngo, 2020; Tan, 2020). If the null hypothesis cannot be rejected when the p-value is greater than 0.05, no such problem has been encountered is confirmed (Harnphattananusorn, 2018).

Furthermore, this study analyzed the panel data to avoid unstable mean variance, and spurious regression (Granger & Newbold, 1974). Stationary data was therefore tested using the Levin, Lin, and Chu-test: LLC-Test method, given that this method was suitable for medium-sized data (Levin, et al., 2002). If the test results show that the data is not stable for non-stationary, long-term equilibrium relationships (cointegration) must be tested to avoid problems of biased analysis results. This research opted for the Johansen (1995) method as a test for multivariate cointegration and the Kao-ADF statistic. In addition, the test model designation must not contain multicollinearity. This study tested the problem by setting the Pearson correlation values of each pair of independent variables to be less than 0.8. It was concluded that no multicollinearity problem was found (Aonthong, 2007).

Results

Panel data analysis

The LLC-test showed that ROA, ROE, NIM, AQ, CAR, LOGSIZE, and OC were stationary at I (0), and GDP, INF, PI, and Cr5 were stationary at I (1). In addition, cointegration was tested in this study. The result shows that all variables of the ROA model, ROE model, and NIM model had a statistically significant cointegration at 1%, which allowed analysis without spurious regression. The multicollinearity test revealed that the PI variable had a correlation of 0.87 with the inf variable. The correlation with Cr5 was 0.90, considered a correlation greater than 0.80. The test results showed a problem with multicollinearity (Aonthong, 2007). Therefore, this study excluded PI variables from the analysis because it might cause spurious regression. It is also relevant to note that several studies have found no association between PI and bank profitability (Elekdag et al., 2020; Kanga et al., 2020; Fernandes et al., 2021; Kumar et al., 2021).

Bank profitability

The analysis of bank profitability showed that banks registered in Thailand had poor asset management to generate profits, with an average return on assets of 1.04%; a high potential to generate income for shareholders, with an average return on equity of 9.25%; and a decent earning from the interest margin, with an average net interest margin of 2.97%. The analysis determinants of bank profitability showed that banks registered in Thailand had good credit management, with an average asset quality of 2.99%; good capital adequacy, with an average capital adequacy ratio of 17.64%; and low efficiency in managing the bank's expenses, with an average operating cost of 48.70%. Also, the banking industry in Thailand was highly concentrated, and the level of competition was low, with an average ratio of the big five banks of 76.55%.

GMM estimated

The System GMM technique was used to estimate the determinants of bank profitability. The estimation results are displayed in the table below.

We utilized the Hansen-J test to verify instruments validity in the system GMM estimator. The testing found that the p-value was larger than 0.05, affirming that all the instruments in the model were suitable. The Arellano-Bond test result, used to test the autocorrelation problem, discovered that the null hypothesis could not be rejected as the p-value is larger than 0.05. This confirms that the problem was not present in the ROA, ROE, or NIM models.

The results of the ROA model estimation by the System GMM method showed that ROA_{t-1} resulted in a statistically significant reduction in ROA_t , with a coefficient of -0.3078.

Asset quality (AQ) and operating costs (OC) resulted in a statistically significant decrease in profitability (ROA), with coefficients of -0.1082 and -0.0451, respectively. Increased capital adequacy (CAR) resulted in a statistically significant increase in profitability, with a coefficient of 0.0665. However, it was found that bank size (INSIZE) had a statistically insignificant effect on bank profitability. For banking-industry-specific factors, concentration (Cr5) resulted in a statistically significant decrease in profitability, with a coefficient of -0.0870. Lastly, on economic factors, it was found that gross domestic product (GDP) and inflation (Inf) resulted in a statistically significant increase in profitability, with coefficients of 0.0182 and 0.0471, respectively.

Table 2 The impact of determinants of bank profitability on bank profitability

Variables	ROA	ROE	NIM
Profitability _{t-1}	-0.3078***	-0.2445**	0.0890
AQ	-0.1082**	-1.0693*	-0.0163
CAR	0.0665***	0.1491	0.0177
INSIZE	-0.0048	-0.0028	-0.0109***
OC	-0.0451***	-0.3674***	-0.0115
Cr5	-0.0870*	-0.8792*	0.1870***
GDP	0.0182**	0.1528**	-0.0175
Inf	0.0471*	0.5152**	0.1294
Hansen j-test	57.7942	49.0431	36.4533
Prob. p-value	0.0793	0.2779	0.7833
AR1 p-value	0.4398	0.5290	0.9303
AR2 p-value	0.8142	0.3087	0.8931

Note: *10% level; **5% level; ***1% level

The results of the ROE model estimation by the System GMM method revealed that ROE_{t-1} resulted in a statistically significant decrease in ROE_t, with a coefficient of -0.2445. For the bank-specific factors, asset quality (AQ) and operating costs (OC) resulted in a statistically significant decrease in profitability (ROE), with coefficients of -1.0693 and -0.3674, respectively. Capital adequacy (CAR) and asset size (INSIZE) had no statistically significant effect on profitability. The banking-industry-specific factors showed that concentration (Cr5) resulted in a statistically significant decrease in profitability, with a coefficient of -0.8792. Regarding economic factors, it was found that gross domestic product (GDP) and inflation (Inf)

resulted in a statistically significant increase in profitability, with coefficients of 0.1528 and 0.5152, respectively.

The NIM model estimation System GMM method revealed that NIM in the prior period had a statistically insignificant effect on current NIM. The bank-specific factor found that asset size (INSIZE) had a statistically significant decrease in profitability, with a coefficient of -0.0109. Asset quality (AQ), capital adequacy (CAR), and operating costs (OC) had a statistically insignificant effect on profitability (ROA). The banking industry-specific factors showed that concentration (Cr5) resulted in a statistically significant increase in profitability, with a coefficient of 0.1870. Lastly, regarding the economic factors, it was found that gross domestic product (GDP) and inflation (Inf) had a statistically insignificant effect on profitability.

Discussion

This study categorized profitability into 3 models; ROA, ROE, and NIM. The determinants of bank profitability consisted of bank-specific factors (AQ, CAR, INSIZE, OC), macroeconomic factors (GDP, Inf), and bank industry-specific factors (CR5). Different models yielded different results. Specifically, the NIM model had different results from the research hypothesis and the ROA and ROE models, which gave corresponding results.

The ROA and ROE models provided consistent results. The study found that bank profits were supported by inflation (Leon, 2020; Kumar et al., 2021) and gross domestic product (Elekdag et al., 2020; Kanga et al., 2020; Kumar et al., 2021). Economic growth has increased investment and capital demand, which drives credit expansion and bank profits. Capital strength improved bank profits in the ROA model (Kirakul et al., 2019) but was insignificant in the ROE model (Kumar et al., 2021). Extending credit is only sometimes good for banks. Declining bank profits are due to credit depreciation (Chantapong, 2005; Kirakul et al., 2019; Jiraporn, et al., 2019; Leon, 2020; Malini, 2020; Kumar, et al., 2021). High operating costs could be better for profits (Daq & Nguy, 2020; Elekdag et al., 2020; Kumar et al., 2021). High concentration and low competition result in lower profitability (Le & Ngo, 2020) because of lower service fees to maintain large banks' customer base and market share. In addition, the study found that asset size (INSIZE) was not statistically significant. The result of this study differs from that of Kirakul et al. (2019), which reported that asset size had a statistically significant effect on profitability in the opposite direction. Differences in the results of the two studies may be due to different data choices, given that this research used annual data while Kirakul et al. (2019) used quarterly data. In addition, it was also found that using different estimation methods resulted in different findings. Kumar et al. (2021) found that asset size had a statistically insignificant effect on profitability when using the GMM estimation method. In contrast, with

the OLS and FEM methods, the results showed that asset size had a statistically significant effect on profitability in the opposite direction.

The NIM model found no statistical significance between profitability and asset quality (Tan, 2020; Kanga et al., 2020), operating costs (Kirakul et al., 2019; Le & Ngo, 2020), capital adequacy (Tan, 2020; Kanga et al., 2020), gross domestic product, and inflation (Le & Ngo (2020). Some studies found that increased asset size hinders bank profits (Kirakul et al., 2019; Tan, 2020). One potential reason for the results of this study is that larger banks have higher operating costs and higher credit volumes. This results in lower credit control, lower credit management efficiency and an increase in the cost of debt collection and provision for non-performing debt. It was also found that high concentration and lower competition resulted in increased profitability. This is consistent with the results of the Lerskullawat (2021). The results of this study may be attributed to a conspiracy to direct interest rates that benefit the banks. In addition, low competition means that consumers or customers have few options for services and need to accept high-interest rates and fees, thus increasing bank profitability.

Conclusion and limitations

This research aimed to estimate the determinants of bank profitability of banks registered in Thailand using the System GMM Estimator method. The results showed that the concentration of banks registered in Thailand was high. The low level of competition leads to decreased profitability. Increasing asset size results in lower profitability for banks. Likewise, asset quality and operating costs negatively affect profitability. On the other hand, capital adequacy, inflation, and gross domestic product helped boost profits for banks.

In terms of practical application, the study shows that high concentration and low competition lead to lower profitability. The Bank of Thailand should stimulate more competition in the market, for example, by promoting and supporting the development of financial technology for banks to ensure access to financial services and reduce the cost of financial transactions. According to the findings, the increased asset size results in lower profitability. To reduce credit costs, bank executives should aim to improve credit management efficiency, such as raising credit standards to bring high-quality credit into their portfolios, limiting the number of credits per credit employee to enable thorough credit monitoring, promptly keeping up with the current situation, and developing credit personnel's credit monitoring and management skills to ensure efficacy in solving credit problems.

In terms of theoretical application, the findings show that high concentration and low competition lead to lower profitability. The results show that banks registered in Thailand were concentrated among large banks. However, banks registered in Thailand did not use their market power to conspire and direct interest rates to generate profits. Instead, banks registered in Thailand competed for credit and deposit customers by using interest rates and fee rates to

motivate service users and maintain a customer base. This tactic negatively affected the profitability of banks.

One limitation of the study was that it needed to consider bank size, which might make the study yield different results. Likewise, the study did not include specialized banks, which could compromise the findings. Therefore, future research should study the Thai bank system and classify banks according to different asset sizes.

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