

# **Determinants of financial soundness of commercial banks: Evidence from Vietnam**

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## **Abstract**

This study aims to analyze the factors affecting financial soundness of commercial banks in Vietnam, in which the financial soundness of banks is estimated in the CAMELS model. The number of observations is employed in this study consists of 22 commercial banks over the 12 years from 2006 to 2017. The authors utilize the logistic regression model with the BMA approach for models selection. Results show that *Overhead*, *Deposit*, *Owner*, and *NIEAR* have a negative impact on the financial soundness, while *RSVs* has a positive correlation with the financial soundness. The results also show that *LER* is only statistically significant in the case of without including yearly effect, whereas *CRED*, *Z\_score*, and macroeconomic variables (*GDP* and *CPI*) are not statistically significant.

**JEL classification numbers:** G15, G21, G28

**Keywords:** Bayesian Model Averaging (BMA), CAMELS, commercial banks, financial soundness, Vietnam

## **1 Introduction**

The banking sector has long been identified as the backbone of the economy, affecting on all economic life of the countries, which plays a crucial role in meeting customers' demands continuously from depositors to lenders, as well as an important tool in stabilizing financial market and managing the economy (Ongore and Kusa, 2013). When a bank operates effectively and generates profits,

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in addition, to promote the development of its own, it also contributes to the stability of the financial system. In contrast, it also leads to systemic bankruptcy, crippling the economy. In the fully cutthroat market, the performance of the banking industry in all countries is increasingly fiercer. The fact that the Vietnamese banking system is no exception, facing many difficulties such as credit risk, liquidity risk, and interest risk, lack of competitiveness, small-scale and low governance capacity, resulting in lower its financial soundness and performance at the moment. The question is whether which factors affecting the financial soundness in general and the financial soundness of commercial banks in Vietnam in particular. Therefore, the determinants of the financial soundness has become a topic of interest to many researchers in recent years and several studies dedicated to the analysis of the financial soundness in the world. However, the empirical results show that there is no consensus in the literature as different studies have produced different results.

One more important thing to note is that most of the studies have mainly focused on using financial ratios, such as return on assets – ROA, return on equity – ROE, net interest margins – NIM, total deposits/total assets – LIQ (Short, 1979; Bourke, 1989; Sarita and Zandi, 2012; Sufian and Noor, 2012; Garoui et al., 2013; Ameer, 2015; and Nouaili et al., 2015), or economic value added (EVA) approach as a measure of the financial soundness (Heffernan and Fu, 2010; Owusu-Antwi et al., 2015).

To our knowledge, there is no study of the factors affecting the financial soundness of commercial banks in Vietnam, especially based on the CAMELS rating framework to measure the financial soundness. The authors, therefore, employ an approach which differs from previous studies in its technique. Our paper uses the CAMELS rating framework to assess the financial soundness and then, identify the determinants of the financial soundness of commercial banks. Rozzani and Rahman (2013) and Hadriche (2015) used the same methodology to measure the financial soundness and estimated factors affecting the financial soundness as well. However, Rozzani and Rahman (2013) only employed internal variables as independent variables and ownership as a control variable, did not consider any external variables impact on the financial soundness. Hadriche (2015) applied both internal and external variables into the regression models, the author, however, was not interested in observing the time evolution of the bank rating. Compared to other previous studies, our paper contributes to the literature in two new points. First, the authors add time dummies to control for the time evolution of the bank rating within a country. Second, the authors do not utilize the CAMELS composite rating as a proxy of the financial soundness, instead of using the binary variable to measure dependent variable so that the authors can highlight the changes of CAMELS rating between strong banks and weak ones. The rest of the paper is structured as follows. Section 2 provides a literature review on the determinants of the financial soundness of commercial banks. Section 3 describes the data sampling and methodology, respectively. Section 4 presents the empirical results. Finally, section 5 offers some conclusions.

## **2 Literature review**

According to Kumar et al. (2012), the financial soundness of a bank is synonymous refers to the efficiency, productivity, profitability, and even stability. In the world, the analysis of the financial soundness of the banking system is really popular, but due to the differences of the characteristics of the financial markets in countries and the differences in approaches as well, the existing empirical results are different.

The literature on the determinants of the financial soundness of commercial banks can be divided into two main streams, known as particular banking industries in different countries and within a country. Some authors, such as Short (1979), has studied the relationship between commercial bank profit rates and banking concentration in Canada, Western Europe, and Japan, while others, Bourke (1989) has studied determinants of banks profitability in twelve countries in Europe, North America, and Australia. They conclude that the discount rate, the interest rate on long-term government securities, concentration, capital ratios, liquidity ratios, and interest rates as being positively related to the financial soundness, whereas the government ownership of banks, the rate of growth of assets, and staff expenses are correlated inversely with the financial soundness. This relationship is also empirically examined by Gooddard et al. (2004), they verify that the higher the capital ratios, the greater the bank's financial soundness.

In contrast, Molyneux, and Thornton (1992) find that between 1986 and 1989, the financial soundness was negatively related to liquidity, whereas both concentration and nominal interest rates have a statistically significant effect on the European banks' financial soundness positively. In addition, the authors also find a statistically significant positive relationship between the financial soundness and government ownership. For this variable, however, compare to previous empirical study (Short, 1979; Bourke, 1989), the empirical result in this paper is conflicted, suggesting that government-owned banks generate higher returns on capital than their private sector counterparts, result in improving the financial soundness.

Demirguc-Kunt and Huizinga (2000) examine the impact of financial structure on bank performance covers all OECD countries as well as many developing countries, concluding that there is a positive relationship between the lagged equity variable and the financial soundness. The explanation for this relationship is that the banks with capitalization rate have less bankruptcy cost, thereby increasing their returns and financial soundness. In addition, the authors also find that inflation is significantly positive impact on the financial soundness, suggesting that banks tend to be more profitable and get higher financial soundness in inflationary environments, whereas bank's financial soundness is negatively affected by non-interest earning assets ratio.

In the second stream, some studies have sought to analyze the determinants of the financial soundness within a country. Despite a large number of studies on this issue, the results remain ambiguous, such as Sarita et al. (2012) examine the

determinants of performance in the Indonesian banking industry for the period of 1994-1999 and conclude that bank's financial soundness is negatively affected by debt-to-total assets and capital adequacy ratio. By contrast, Ongore and Kusa (2013) have studied the determinants of the financial soundness of commercial banks in Kenya. They find evidence that capital adequacy ratio and management capacity have a positive impact on the financial soundness, whereas, assets quality and inflation rate affect the financial soundness negatively.

In light of Ongore and Kusa (2013) contributions, Nouaili et al. (2015) find that the financial soundness of commercial banks in Tunisia is positively related to capitalization, privatization, and quotation, whereas, bank size, concentration index, and efficiency have a negative influence. Other studies, however, have found evidence that there is a positive relationship between bank size and the financial soundness of commercial banks (Ameer, 2015; Rozzani and Rahman, 2013).

In addition, Ameer (2015) investigates the Pakistan banking industry in the period 2010-2014, the author also suggests that there is an indirect link between the credit risk, expenses, inflation, and the financial soundness. Moreover, the author also points out that there is a significant positive relationship between the capital, deposit, loans, FDI and the financial soundness. Rozzani and Rahman (2013) have found evidence of factors effecting on the financial soundness of commercial banks in Malaysia, emphasizing that there is only a significantly negative relationship between the operational cost and the performance of conventional banks, whereas the credit risk is supposed to be favorable to the improvement of performance of Islamic banks. Hadriche (2015) concludes that the bank size and operating cost affect the financial soundness of both conventional and Islamic banks from GCC countries. The authors report a summary of the contributions to the literature on the financial soundness in Table 1:

Table 1: Summary of the contribution related to the financial soundness

Authors	Country	Period	Empirical findings
Short (1979)	Canada, Western Europe, and Japan	1972-1974	The discount rate, the interest rate on long-term government securities as being positively related to the financial soundness. Government ownership, the rate of growth of assets are correlated inversely with the financial soundness.
Bourke (1989)	12 countries in Europe, North America and Australia	1972-1981	Concentration, capital ratios, liquidity ratios, and interest rates are positively related to the financial soundness. Government ownership and staff expenses are negatively correlated with the financial soundness.
Gooddard et al. (2004)	European	1992-1998	The higher the capital ratios, the greater the bank's financial soundness.
Molyneux, and Thornton (1992)	European	1986-1989	The financial soundness was negatively related to liquidity ratios. The financial soundness was positively related to concentration ratio and nominal interest rates, and government ownership.
Demirguc-Kunt and Huizinga (2000)	OECD countries	1990-1997	The lagged equity and inflation positively impact on the financial soundness. Non-interest earning assets ratio negatively impacts on the financial soundness.
Sarita et al. (2012)	Indonesia	1994-1999	Bank's financial soundness is negatively affected by debt-to-total assets and capital adequacy ratio.
Ongore and Kusa (2013)	Kenya	2001-2010	Capital adequacy ratio and management capacity positively impact on the financial soundness. Assets quality and inflation affect the financial soundness negatively.
Nouaïli et al. (2015)	Tunisia	1997-2012	The financial soundness is positively related to capitalization, privatization, and quotation. Bank size, concentration index, and efficiency have a negative influence.
Ameer (2015)	Pakistan	2010-2014	There is a positive relationship between bank size, capital, deposit, loans, FDI and the financial soundness.
Rozzani and Rahman (2013)	Malaysia	2008-2011	Bank size and credit risk are supposed to be favorable to the financial soundness. Operating cost negatively impacts on the performance of conventional banks.
Hadriche (2015)	GCC countries	2005-2012	Bank size and operating cost affect the financial soundness of both conventional and Islamic banks.

### 3 Data sampling and methodology

#### 3.1 Data sampling

Data used in this study are mainly obtained from consolidated financial statements and annual reports of commercial banks from our sample. The study employed an unbalanced dataset of these banks covering the period 2006–2017. By the end of 2017, there are more than 36 commercial banks operating in Vietnam. Due to eliminating missing value in the database, therefore, the dimension of the dataset is composed of 22 commercial banks with 240 observations over 12 years. List of commercial banks included in the sample is shown in Table 2:

Table 2: List of commercial banks included in the sample

No	Banks name	Acronyms	Bank type
1	An Binh Commercial Joint Stock Bank	ABBank	P
2	Asia Commercial Joint Stock Bank	ACB	P
3	Housing Development Commercial Joint Stock Bank	HDB	P
4	HSBC Vietnam	HSBC	P
5	Joint Stock Commercial Bank for Foreign Trade of Vietnam	VCB	S
6	Joint Stock Commercial Bank for Investment and Development of Vietnam	BID	S
7	Kien Long Commercial Joint Stock Bank	KLB	P
8	Lien Viet Post Joint Stock Commercial Bank	LPB	P
9	Military Commercial Joint Stock Bank	MBB	P
10	Nam A Commercial Joint Stock Bank	NamABank	P
11	National Citizen Commercial Joint Stock Bank	NCB	P
12	Petrolimex Group Commercial Joint Stock Bank	PGBank	P
13	Sai Gon Joint Stock Commercial Bank	SCB	P
14	Sai Gon Thuong Tin Commercial Joint Stock Bank	STB	P
15	Saigon Bank for Industry and Trade	SGB	P
16	Saigon Hanoi Commercial Joint Stock Bank	SHB	P
17	Vietnam Export Import Commercial Joint Stock Bank	EIB	P
18	Vietnam Technological and Commercial Joint Stock Bank	TCB	P
19	Vietnam Bank for Agriculture and Rural Development	Agribank	S
20	Vietnam Joint Stock Commercial Bank for Industry and Trade	CTG	S
21	Vietnam International Commercial Joint Stock Bank	VIB	P
22	Vietnam Prosperity Joint Stock Commercial Bank	VPB	P

*Note: P denotes for the private bank and S denotes for the state-owned bank*

#### 3.2 Methodology

##### 3.2.1 The estimation of the financial soundness: CAMELS approach

CAMELS is an acronym which comprises six components (namely Capital adequacy, Assets quality, Management, Earnings, Liquidity, and Sensitivity to market risk). This framework was adopted for the first time in 1979 by the federal

regulators in the USA under the name of CAMEL derived from the five core considered dimensions of a bank. The sixth component “S” was added into this rating system since 1996 for the purpose was to focus on risk. According to many empirical studies (Gilbert et al., 2000; Kumar et al., 2012; Roman and Şargu, 2013), CAMELS approach is considered as one of the most widely used models of analysis and evaluation of the performance and financial soundness of commercial banks in different countries.

Based on previous empirical studies, it is effortless to recognize that there are two main research directions involved in CAMELS approach (1) using sub-parameters in each component to evaluate and compare the performance of the banking sector, and (2) using the weight for rating the banks from 1 (best) to 5 (worst).

In this paper, to estimate the financial soundness based on CAMELS rating framework, the authors use the second research direction and measure the financial soundness of commercial banks in Vietnam in three steps. The authors first calculate the ratio’s rating for six components in turn and afterward add the weight for each component to measure composite ranking, the first two steps are illustrated in Table A (Appendix). Finally, based on rating range, the authors get an overall rank for banks from rank 1 (best) to rank 5 (worst), explained and simplified in Table B (Appendix).

### 3.2.2 The determinants of the financial soundness of commercial banks in Vietnam

In this study, the authors construct a logistic regression model to estimate variables that affect the financial soundness of commercial banks in Vietnam. This model arises as follows:

$$Y_{it} = \beta_0 + \sum_{k=1}^n \beta_k X_{kit} + Dummies_t + \varepsilon_{it} \quad (1)$$

Where,  $Y_{it}$  is dependent variable reflecting the financial soundness of bank  $i$  at year  $t$  (measured by the components of CAMELS framework). Due to being the binary variable, in order to process the regression model, the authors must perform the classification of strong banks and weak banks. Based on rating analysis mentioned above, banks rated 1 and 2 are generally considered to be strong banks and are assigned the value one, and banks rated 3, 4, or 5 are considered weak ones and are assigned the value zero (Kambhamettu, 2012; Rozzani and Rahman, 2013). At the same time, the authors also add time dummies into the model to control for the time evolution within a country over the entire period.

$\beta_0$  is a constant.

$X_{kit}$  is a matrix of independent variables, explained in detail in Table 3:

In addition, to ignore the uncertainty in a model selection with over-confident inferences, the authors also employ Bayesian Model Averaging (BMA) for direct

model selection and combine estimation (Hoeting et al., 1999). Based on Bayes' theorem, the model weights from posterior model probabilities in our study are given by:

$$p(M_\gamma | y, X) = \frac{p(y|M_\gamma, X)p(M_\gamma)}{p(y|X)} = \frac{p(y|M_\gamma, X)p(M_\gamma)}{\sum_{s=1}^{2^K} p(y|M_s, X)p(M_s)} \quad (2)$$

Where,  $p(y|X)$  – the integrated likelihood – is constant over all models. To obtain combined parameter estimates from some class of models, BMA allows the model weighted posterior distribution for any statistic  $\theta$  is given by:

$$p(\theta|y, X) = \sum_{\gamma=1}^{2^K} p(\theta|M_\gamma, y, X)p(M_\gamma|X, y) \quad (3)$$

Table 3: Interpretation and expectation sign of the independent variables

Independent variables	Description	Expected signs
CRED	The natural logarithm of non-performing loans	+/-
RSVs	The natural logarithm of reserves	+/-
SIZE	The natural logarithm of total assets	+
Overhead	Operating cost/Total assets	-
Deposit	Deposit/Equity	+
Owner	Dummy variable, equals 1 if a bank is state-owned commercial bank, equals 0 if otherwise	+/-
Z_score	Possibility of default for the banks $Z - score = \frac{ROA + \left(\frac{E}{A}\right)}{\sigma(ROA)}$	+
NIEAR	Non-interest earning assets/Total assets	-
LER	The book value of equity (assets minus liabilities) divided by total assets lagged one period	+
GDP	GDP growth rate	+
CPI	Inflation rate	+/-

Although some points are not truly consistent with each other (due to time, object, and scope of study), empirical studies have shown that the financial soundness of commercial banks is affected by many factors, including macroeconomic and bank characteristic factors. Based on the results of these study, and the limitations of our dataset, the authors select the appropriate factors and apply in our research



model. Among such variables, credit risk (*CRED*), reserves (*RSVs*), bank size (*SIZE*), operational efficiency (*Overhead*), leverage (*Deposit*), bank ownership (*Owner*), bank's distance from insolvency (*Z\_score*), non-interest earning assets ratio (*NIEAR*), lagged equity ratio (*LER*), the growth of GDP (*GDP*) and inflation (*CPI*) were included in the model. The expectation of the correlation of these variables with dependent variables is explained as follows:

The first independent variable, *CRED*, represents credit risk. Credit risk is the loss that a bank may face from the failure to fulfill its customer's payment obligations. Most of the previous studies have defined credit risk by using the natural logarithm of non-performing loans. In this study, therefore, the authors also employ the natural logarithm of non-performing loans as a proxy. According to traditional financial theory, which supposes that credit risk reduces the value of a bank's assets, resulting in loss of capital and will affect the solvency and financial soundness of the bank, similar to the studies of Chen (2009), and Hadriche (2015). However, this finding is a contrast to the studies of Fuentes and Vergara (2003), Srairi (2009), Sufian (2009), Wasiuzzaman and Tarmizi (2010), and Rozzani and Rahman (2013). Therefore, the expectation of the correlation between credit risk and the financial soundness of commercial banks in Vietnam has not yet been determined.

The second independent variable, *RSVs*, represents the bank reserves requirement. This is a small fraction of the total deposits is held internally by the bank in cash vaults or deposited with the central bank and divided into required reserves and excess reserves. In this study, the authors measure this variable by taking the natural logarithm of reserves, similar to the studies of Hassan and Bashir (2003), and Rashid and Jabeen (2016). There are several studies on the impact of reserve requirement on bank profits, but the empirical results are disparate. According to Demircuc-Kunt and Huizinga (1999), they found that there is a negative relationship between reserves and profitability, suggesting that the greater a bank holds reserves, the greater it incurs an opportunity cost, resulting in lower profitability because reserves do not generate any returns to the bank. In contrast, Hassan and Bashir (2003), and Rashid and Jabeen (2016) state that reserves have a positive impact on the financial soundness, indicating that the increase in reserves reduces the interest rate margin, earning more profits. The authors, therefore, have not identified the relationship between reserves and the financial soundness of commercial banks in Vietnam.

The third independent variable, *SIZE*, represents the bank size. Similar to most of the previous studies, the present study also use the natural logarithm of total assets as a proxy. Related to the expected sign of this variable, the previous existing studies found evidence of both significantly positive (Smirlock, 1985; Srairi, 2009; and Hadriche, 2015) as well as negative (Kosmidou and Pasiouras, 2007; Sufian and Habibullah, 2009; Rozzani and Rahman, 2013; Nouaili et al., 2015; and Rashid and Jabeen, 2016) effect of bank size on the financial soundness. However, in theoretical supposes that the larger the bank size, the higher the financial

soundness. It means that a bank with a larger asset size leads to higher returns and performance improvement, subsequently, brings more profits and stimulates the financial soundness to the bank. In this study, therefore, it is expected that bank size affects the financial soundness of commercial banks in Vietnam positively.

The fourth independent variable, *Overhead*, represents bank operational efficiency. This ratio is defined by taking the operating cost to divide total assets. According to the previous studies, the lower the ratio, the higher the bank efficiency and financial soundness (Demirguc-Kunt and Huizinga, 1999; Hassan and Bashir, 2003; Sufian, 2009; and Rashid and Jabeen, 2016). Hence, it is expected that overhead ratio has a significantly negative effect on the financial soundness of commercial banks in Vietnam.

The fifth independent variable, *Deposit*, represents the bank's leverage ratio. This ratio is calculated as deposits divided by total equity. According to Alper and Anbar (2011), deposit ratio does not have any significant impact on the performance as well as the financial soundness of the bank. Numerous existing studies, nevertheless, also find that deposit ratio and the financial soundness have a significantly positive relationship (Riaz and Mehar, 2013; and Rashid and Jabeen, 2016). In this study, therefore, it is expected that the deposit to equity ratio has a significantly positive effect on the financial soundness of commercial banks in Vietnam.

The sixth independent variable, *Owner*, represents the ownership of the bank. It is a dummy variable, which is assigned value equals to 1 if a bank is the government-owned commercial bank (nationalized bank), equals to 0 if otherwise (private bank). According to the previous studies, only Molyneux et al. (1992) found evidence that the nationalized banks are more efficient than private banks, whereas most authors found the opposite results (Short, 1979; Bourke, 1989; Marriott and Molyneux, 1991; Barth et al., 2004; Iannota et al., 2007; and Wanzenried and Dietrich, 2011), suggesting that the nationalized banks are less efficient than private banks. Therefore, the expected correlation coefficient between the bank ownership and the financial soundness of commercial banks in Vietnam has not been determined to be positive or negative.

The seventh independent variable, *Z\_score*, represents a bank's distance from insolvency. It means that the higher the *Z\_score*, the less that banking institution is likely to go bankrupt (Li et al., 2017). It is, thus, expected that the *Z-score* also affects the financial soundness of commercial banks in Vietnam positively.

The eighth independent variable, *NIEAR*, represents non-interest earning assets ratio, measured by cash, fixed assets, and other non-interest earning assets over total assets. According to Demirguc-Kunt and Huizinga (1999), they found the relationship between profitability and non-interest earning assets ratio is negative, indicating that the greater proportion of non-interest earning assets over total assets, the lower profitability the banks obtain. The authors, therefore, expect the sign of this variable is also negative.

The ninth independent variable, *LER*, represents the capital ratio of the bank through debt lagged one period. According to Demircuc-Kunt and Huizinga (1999), taking lagged total assets by one period to determine the effect of profit on the equity of the bank, in the case of not paid out in dividends in the previous year. The empirical results show that there is a positive relationship between the book value of equity divided by total assets lagged one period and bank profitability (Berger, 1995; Demircuc-Kunt and Huizinga, 1999). Based on the earlier studies, the authors expect that the impact of lagged equity ratio on the financial soundness positively.

The tenth independent variable, *GDP*, represents the GDP growth rate. According to Kuznets (1934), GDP growth rate is the increase in the income of the economy in a period of time (often annually or quarterly), related to the growth of a country's economy. Hadriche (2015) found that *GDP* is positively correlated to the financial soundness, suggesting that when the GDP growth rate is high, it will improve the living standard of the people, creating favorable conditions for individuals and enterprises to expand their investments, resulting in increases in banks' profitability, thereby improving their financial soundness. The finding is similar to Hassan and Bashir (2003), Kosmidou and Pasiouras (2007), Kosmidou (2008), and Zeitun (2012). Thus, it is expected that there is a positive relationship between the GDP growth rate and the financial soundness of commercial banks in Vietnam.

The final independent variable, *CPI*, represents the inflation rate. According to the Fisher effect, the real interest rate equals the nominal interest rate minus the expected inflation rate. In reality, fear of high inflation, currency devaluation due to the real interest rate reduction, so customers tend to invest in safer instruments such as gold, foreign currencies or stocks, instead of deposit money into the bank as before, resulting in decrease bank's fund. In addition, in the context of high inflation, the Central bank implemented a series of monetary tightening measures such as raising the reserves requirement ratio, raising interest rates, issuing compulsory bonds, reducing profits of commercial banks. This argument is consistent with Ongore and Kusa (2013), and Zeitun (2012), inflation is negatively related with the performances of commercial banks, whereas is opposed to Demircuc-Kunt and Huizinga (2000), Athanasoglou et al. (2009), Sufian and Habibullah (2009), and Delis and Papanikolaou (2009), suggesting that the banks tend to earn more profits in inflationary environments. Therefore, the expectation of the correlation between these two variables has not been determined.

## **4 Empirical results**

### **4.1 Descriptive analysis**

In this section, the authors analyze in general factors such as total assets, outstanding loan, non-performing loan ratio, and return on total assets (ROA) of

commercial banks in Vietnam.

#### 4.1.1 Total assets

Total assets is one of the important indicators used to compare the size of banks including cash on hand, balances with the State Bank of Vietnam, placements with loans to other credit institutions, held-for-trading securities, derivatives and other financial assets, loans and advances to customers, investment securities, fixed assets, and other assets. The total assets of commercial banks in Vietnam in the period of 2006 - 2017 is shown in Table 4:

Table 4: Total assets of commercial banks in Vietnam (2006-2017)

*Unit: VND million*

Year	n	Min	Mean	Max	SD
2006	12	3,884,483	70,891,193	246,529,869	82,773,276
2007	16	4,681,255	79,311,379	326,896,862	93,615,598
2008	19	2,939,018	80,855,729	400,485,183	108,000,000
2009	19	7,478,452	106,000,000	480,937,045	128,000,000
2010	21	12,577,785	132,000,000	534,987,152	145,000,000
2011	21	15,365,115	156,000,000	556,269,883	162,000,000
2012	22	14,852,518	165,000,000	614,946,541	176,000,000
2013	22	14,684,739	185,000,000	697,140,946	199,000,000
2014	22	15,823,336	214,000,000	763,589,797	228,000,000
2015	22	17,748,745	250,000,000	874,807,327	278,000,000
2016	22	19,047,890	295,000,000	1,002,463,235	327,000,000
2017	22	21,319,355	352,000,000	1,152,904,140	390,000,000

*Source: The authors' calculation*

Table 4 shows that the average total assets of commercial banks in Vietnam in the period 2006-2017 tends to increase year by year. The scale of the banks also has a clear distinction. As a bank with 100% state capital, Agribank always leads the whole sector in terms of total assets (more than VND 1,000 trillion in the year 2017), followed by VCB, CTG, BID, which are stock commercial banks with state-owned more than 50%. These banks focus on investing in the nationwide network of branches and transaction offices and installing many automatic machines (ATMs) to meet the needs of customers. Table 4 also shows that although there are a few banks with total assets of high value, also many banks have total assets at low levels over the years such as SGB, PGBank, and KLB, respectively (below VND 40 trillion in the year 2017).

#### 4.1.2 Outstanding loan

Outstanding loan is an important outlet in the use of funds, which is considered

the main source of revenue for banks. Similar to other lucrative investments, however, the outstanding loan is also exposed to many risks expressed through the bank's non-performing loans, so controlling the outstanding loan is always a concern at commercial banks in Vietnam.

Table 5: Outstanding loan of the commercial banks in Vietnam (2006-2017)

*Unit: VND million*

Year	n	Min	Mean	Max	SD
2006	12	2,047,541	42,202,627	188,501,345	56,976,968
2007	16	1,917,569	48,205,278	251,710,182	67,293,693
2008	19	2,195,377	48,094,529	294,523,096	75,138,380
2009	19	4,874,377	65,407,357	368,096,590	93,557,570
2010	21	5,302,112	78,162,781	431,991,985	109,000,000
2011	21	6,245,179	88,551,698	440,895,421	119,000,000
2012	22	6,262,547	98,916,976	480,616,369	130,000,000
2013	22	10,669,968	113,000,000	536,788,478	145,000,000
2014	22	11,232,242	130,000,000	558,658,784	160,000,000
2015	22	11,612,018	160,000,000	630,478,892	194,000,000
2016	22	12,533,642	194,000,000	749,091,083	234,000,000
2017	22	14,105,444	232,000,000	880,396,143	276,000,000

*Source: The authors' calculation*

Table 5 shows that the average outstanding loan of commercial banks in Vietnam tends to increase steadily over the years (2006 - 2017), except for 2007 and 2008 due to the impact of the global financial crisis. However, due to fierce competition with other credit institutions (including domestic and international credit institutions), it can be seen that the average outstanding loan still remain at a low level. In addition, the outstanding loan over the years has a large difference between commercial banks. To be specific, in the year 2017, the highest outstanding loans of a bank was up to VND 880.40 trillion, while the lowest outstanding balance among other banks stood at only VND 14.11 trillion.

#### 4.1.3 Non-performing loan ratio

A non-performing loan is classified into group 3 (sub-standard), group 4 (doubtful) and group 5 (loan losses) as defined in Articles 6 and 7 of the Consolidated Documents No. 22 issued by the State Bank of Vietnam in 2014. When customers' loans are not repaid on time or when they are overdue, the debt collection volume will not be in line with the plan, leading to a shortage of funds to meet the bank's liquidity demand, causing the banks to suffer losses and bankruptcy. In business, however, the risk is inevitable, so banks often accept a non-performing loan ratio is considered as a safe limit. This limit in each country is different, especially in Vietnam now accept the rate of 3%. Non-performing loan ratio of commercial banks in Vietnam is reported in Table 6:

Table 6 shows that the average non-performing loan ratio of commercial banks in Vietnam during the study period was almost below the safe threshold, with only in the year 2012 and 2013, the average non-performing loan ratios were 3% higher, reached 3.51% and 3.17%, respectively.

Table 6: Non-performing loan ratio of commercial banks in Vietnam (2006-2017)  
Unit: %

Year	n	Min	Mean	Max	SD
2006	12	0.20	2.11	8.81	2.32
2007	16	0.06	1.32	3.60	1.18
2008	19	0.57	2.15	4.71	1.19
2009	19	0.41	1.67	2.79	0.74
2010	21	0.34	2.02	11.40	2.31
2011	21	0.58	2.84	11.36	2.31
2012	22	1.32	3.51	8.81	2.18
2013	22	1.00	3.17	7.63	1.70
2014	22	0.49	2.32	5.72	1.09
2015	22	0.34	1.86	5.80	1.08
2016	22	0.68	2.04	6.91	1.32
2017	22	0.45	1.89	4.67	1.07

Source: The authors' calculation

Table 6 also shows that although some banks had very low non-performing loan ratio of 0.06% in 2007, some banks still remain this ratio at the high level (over 11% in the year 2010 and in the year 2011). However, it can be seen that the average non-performing loan ratio of commercial banks in Vietnam has tended to decrease over the years in the period 2014-2017. Achieving this result is due to the fact that banks have stepped up restructuring (merger and acquisition) and non-performing loan handling through the Vietnam Asset Management Company (VAMC).

#### 4.1.4 Return on total assets

The profitability of commercial banks in Vietnam is the result of the year, which is determined by the difference between operating income and operating expenses. This is an item used to evaluate how the performance of these units. In addition, this is considered as one of the sources to increase the equity fund of commercial banks in Vietnam. In this section, to assess the effectiveness of profitability, the authors use return on total assets, and shown in Table 7:

In general, Table 7 shows that the average ROA tends to decrease over the period 2006-2017, especially since 2012, the average ROA was always less than 1%, explained by the fact that since 2012 the average profitability of commercial banks in Vietnam tends to decrease, whereas the size of banks continues to expand

because the average of total assets tends to increase over the years.

Table 7: Return on total assets of commercial banks in Vietnam (2006-2017)

Year	n	Min	Mean	Max	SD
2006	12	0.40	1.43	2.40	0.66
2007	16	0.58	1.58	3.13	0.67
2008	19	0.17	1.15	2.37	0.65
2009	19	0.42	1.39	2.24	0.57
2010	21	0.26	1.53	5.57	1.07
2011	21	0.13	1.35	2.63	0.67
2012	22	0.01	0.93	2.35	0.64
2013	22	0.03	0.69	1.58	0.50
2014	22	0.02	0.64	1.31	0.39
2015	22	0.02	0.55	1.34	0.39
2016	22	0.02	0.68	2.01	0.55
2017	22	0.03	0.86	2.55	0.72

Unit: %

Source: The authors' calculation

### 4.1.5 The difference in bank ownership

In this section, the authors assess the difference in bank ownership (state-owned banks and private banks) for four indicators, (a) Credit risk, (b) Bank size, (c) Overhead and (d) Bank leverage, and is illustrated in Figure 1:

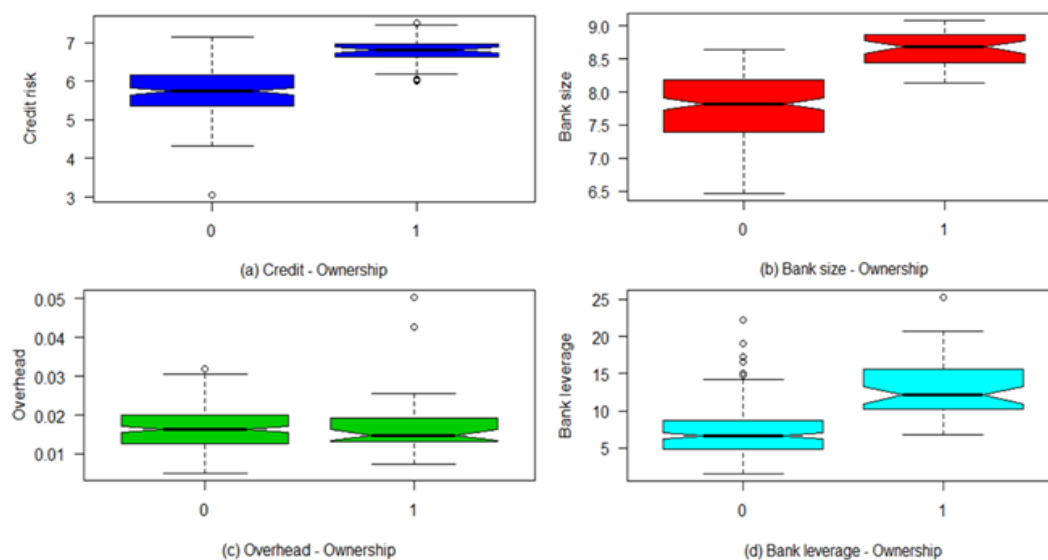


Figure 1: The difference in bank ownership for four indicators

The results show that only the mean of overhead in the two banking groups (state-owned banks and private banks) are similar (equal to 0.02), however, this difference was statistically insignificant ( $p$ -value = 0.87), while the mean of credit risk, bank size, and bank leverage are higher in the state-owned banks than in the private banks. And, the following t-test table shows that these differences were statistically significant ( $p$  = 0.00), suggesting that credit risk, bank size, and bank leverage difference between state-owned banks and private banks has occurred.

Table 8: The results of the t-test

Factors	Mean		t	p-value
	Government-owned banks	Private banks		
Credit risk	6.80	5.71	-16.04	0.00
Bank size	8.66	7.76	-17.60	0.00
Overhead	0.02	0.02	-0.16	0.87
Bank leverage	12.92	7.15	-9.39	0.00

*Source: The authors' calculation*

## 4.2 Baseline results

Prior to identifying and evaluating factors affecting the financial soundness of commercial banks in Vietnam, the authors analyze the correlation matrix of the independent variables included in the model, as shown in Table 9. Table 9 shows that only the SIZE variable has a high correlation with other independent variables (greater than 0.8), while other independent variables included in the regression model are correlated at the low level. Therefore, the authors continue to analyze the variance inflation factor (VIF), as shown in Table 10.

Table 10 show that the VIF of the SIZE variable is quite large ( $VIF > 10$ ), and the VIF of the other independent variables is relatively low. According to Hair et al. (1995), the tolerance value is 0.10 (a corresponding VIF of 10) has been used as a common cutoff threshold to indicate serious multicollinearity. In order to avoid the occurrence of multicollinearity, therefore, the authors eliminate the SIZE variable from the regression model.

Analysis of the factors affecting the financial soundness of commercial banks in Vietnam is estimated by the logistic regression model with the BMA method, shown in Table 12 (using a pooled regression without including year-fixed effect), and Table 13 (including time dummies to control the time evolution), respectively. Before interpreting the results in Table 12 and Table 13, the authors also conduct tests such as the Breusch-Pagan test for heteroscedasticity, Ramsey's RESET test for omitted variables in two cases (Model A-without including year-fixed effect, and Model B-including year-fixed effect), and the normal Q-Q plot for normality tests of residuals. The test results show that the variables included in the model do not violate the key assumptions of the regression model. To be specific, the models do not have heteroscedasticity, there is no variable omitted in the model



(Table 11), and the residuals of the model are estimated to have a normal distribution (Figure 2). Thus, the models are the best linear unbiased estimator (BLUE), satisfying the important assumptions of the estimation model.

Table 9: Correlation matrix

	CRED	RSVs	SIZE	Overhead	Deposit	Owner	Z_score	NIEAR	LER	GDP	INF
CRED	1.00	0.04	0.81	-0.40	-0.25	-0.33	0.33	-0.29	0.15	-0.15	-0.63
RSVs	0.04	1.00	0.06	-0.12	-0.14	-0.36	0.22	0.35	-0.04	0.01	0.05
SIZE	0.81	0.06	1.00	0.12	-0.34	-0.60	0.23	-0.27	0.48	-0.07	-0.80
Overhead	-0.40	-0.12	0.12	1.00	-0.02	-0.15	-0.06	0.33	0.24	-0.14	-0.09
Deposit	-0.25	-0.14	-0.34	-0.02	1.00	0.20	-0.06	0.40	-0.47	0.09	0.74
Owner	-0.33	-0.36	-0.60	-0.15	0.20	1.00	0.26	0.09	-0.36	-0.50	0.24
Z_score	0.33	0.22	0.23	-0.06	-0.06	0.26	1.00	0.28	0.01	-0.12	-0.28
NIEAR	-0.29	0.35	-0.27	0.33	0.40	0.09	0.28	1.00	-0.66	-0.10	0.48
LER	0.15	-0.04	0.48	0.24	-0.47	-0.36	0.01	-0.66	1.00	0.13	-0.59
GDP	-0.15	0.01	-0.07	-0.14	0.09	-0.50	-0.12	-0.10	0.13	1.00	0.25
INF	-0.63	0.05	-0.80	-0.09	0.74	0.24	-0.28	0.48	-0.59	0.25	1.00

*Source: The authors' calculation*

Table 10: The variance inflation factor (VIF) of the independent variables

Variables	VIF	1/VIF	Variables	VIF	1/VIF	Variables	VIF	1/VIF
CRED	5.66	0.18	Deposit	2.72	0.37	LER	2.99	0.33
RSVs	5.84	0.17	Owner	2.19	0.46	GDP	1.26	0.79
SIZE	10.33	0.10	Z_score	1.16	0.86	INF	1.40	0.71
Overhead	1.35	0.74	NIEAR	1.39	0.72			
Mean VIF	3.30							

*Source: The authors' calculation*

Table 11: The results of Breusch-Pagan and Ramsey’s RESET test

a. Breusch-Pagan test			
Model A		Model B	
BP = 40.22	p-value = 0.00	BP = 59.27	p-value = 0.00
b. Ramsey’s RESET test			
Model A		Model B	
RESET = 4.32	p-value = 0.01	RESET = 6.48	p-value = 0.00

Source: The authors’ calculation

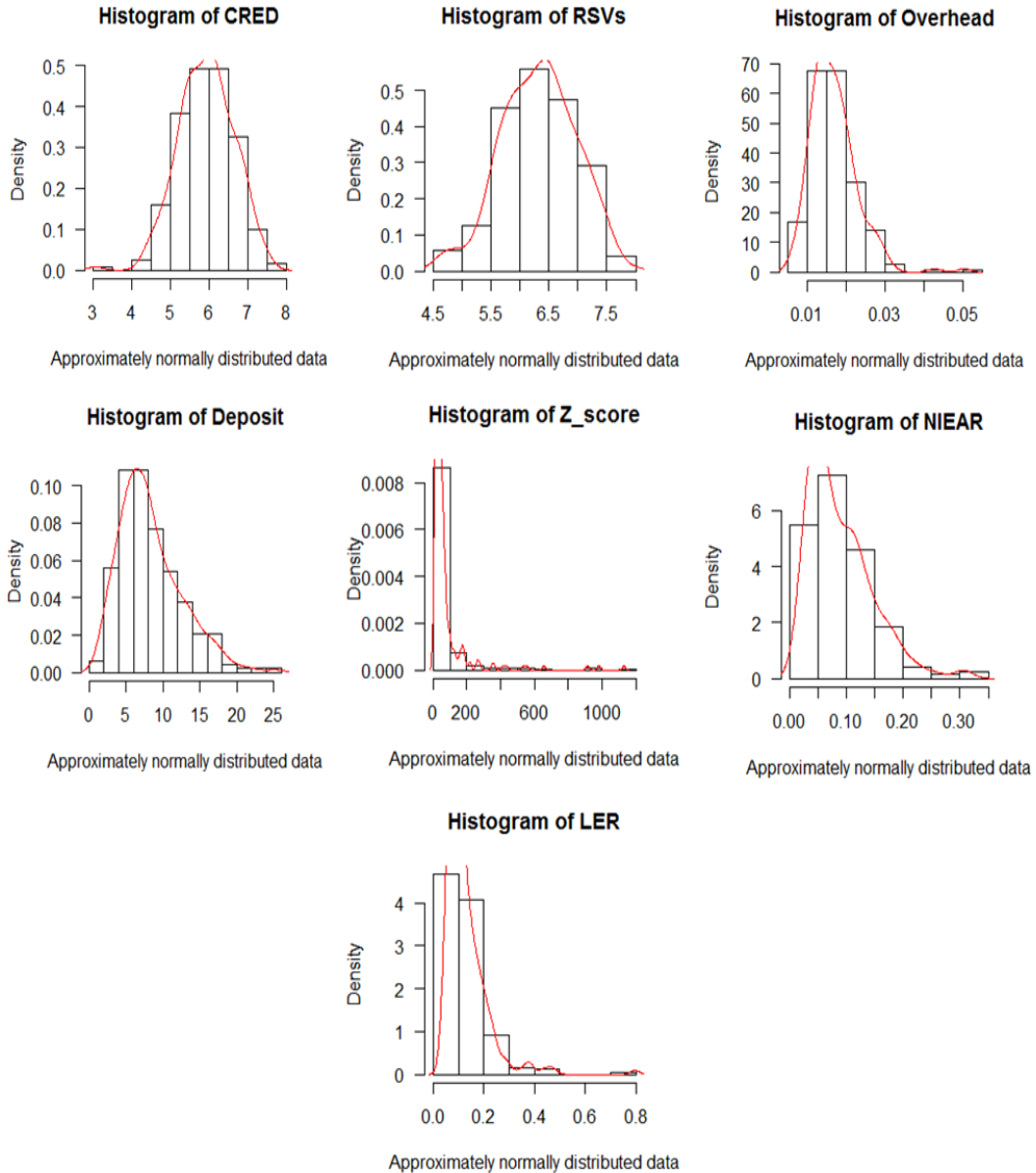


Figure 2: The normality tests of residuals

In Table 12, the authors perform logistic regression using the BMA approach with the regression equation as follows:

$$\text{Financial soundness} = \beta_0 + \beta_1 \text{CRED} + \beta_2 \text{RSVs} + \beta_3 \text{Overhead} + \beta_4 \text{Deposit} + \beta_5 \text{Owner} + \beta_6 \text{Z}_{\text{score}} + \beta_7 \text{NIEAR} + \beta_8 \text{Lagged equity ratio} + \beta_9 \text{GDP} + \beta_{10} \text{CPI} + \varepsilon \quad (4)$$

The results show that there are 5 models considered as optimal models in the 28 models selected, sorted in the order based on the posterior probability of each model.

Table 12: The results of BMA without including the year-fixed effect

Variables	p!=0	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	100.0	-10.4283	-3.6365	-1.8664	-5.2170	-8.1365
CRED	53.5	.	-1.2132	-1.5477	.	-0.9476
RSVs	100.0	2.2288	2.5298	2.2884	1.7803	2.7275
Overhead	100.0	-178.6268	-167.0945	-131.6375	-187.8330	-165.1266
Deposit	94.4	-0.2465	-0.3263	-0.3272	-0.3672	-0.2417
Owner	82.8	-2.7079	-2.0640	.	-2.4598	-2.3379
Z_score	1.9	.	.	.	.	.
NIEAR	65.4	-9.9311	-9.6237	.	-10.5869	-9.1326
LER	52.1	9.9893	.	.	.	7.8960
GDP	9.2	.	.	.	.	.
INF	12.4	.	.	.	.	.
nVar		6	6	4	5	7
BIC		-1074.7966	-1074.3008	-1073.7884	-1073.1147	-1072.9549
Post prob		0.160	0.125	0.097	0.069	0.064

Source: The authors' calculation

The results show that the probability for *RSVs* and *Overhead* associated with the financial soundness of commercial banks in Vietnam is 100%, whereas the probability for the *Z\_score* is only about 2%. More importantly, based on BIC value, the authors can choose the best model to interpret the empirical results (the lower the BIC value, the better the model). Look at Table 12, we can see that the optimal model is modeled with *RSVs*, *Overhead*, *Deposit*, *Owner*, *NIEAR*, and *LER*, and the probability for this model is 0.160 (BIC equal to -1074.7966). The second model includes *RSVs*, *Overhead*, *Deposit*, *Owner*, *CRED*, and *NIEAR* (BIC equal to -1074.3008), but the probability for this model is relatively lower (0.125). The other three models may also be good models for analyzing factors affecting the financial soundness of commercial banks in Vietnam. Obviously, through BMA analysis, we have more model choices and are able to evaluate the uncertainty of a statistical model. In order to obtain a more comprehensive overview of the models, we can look at Figure 3:

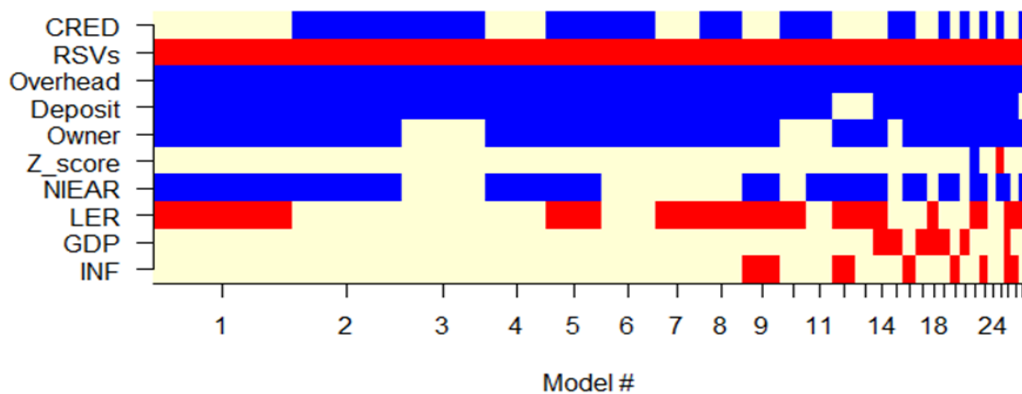


Figure 3: Models selected by BMA without including the year-fixed effect

Figure 3 shows the numerical results described in Table 12. On the horizontal axis, it reflects models were selected and scaled based on their posterior model probability. Moreover, this figure also shows coefficient signs between dependent and independent variables, where red color corresponds to a positive coefficient, blue to a negative coefficient, and white to a zero coefficient. Through this figure, we can see that there are 28 models were selected, and *RSVs* and *Overhead* are the factors that have the greatest impact on the financial soundness of commercial banks in Vietnam, however, the expected values of coefficients for two variables in all encountered were opposite. *Overhead* is certainly positive, whereas *RSVs* is virtually negative. Next important factors are *Deposit*, *Owner*, *NIEAR*, *CRED*, and *LER*, respectively. Factors such as *Z\_score*, *GDP*, and *INF*, although potentially affecting the financial soundness of the Vietnamese banking sector, are not as strong as these factors mentioned above.

In Table 13, the authors also conduct logistic regression using the BMA approach. However, the authors add time dummies to fix yearly effect, and regression equation is shown as follow:

$$\begin{aligned}
 \text{Financial soundness} = & \beta_0 + \beta_1 \text{CRED} + \beta_2 \text{RSVs} + \beta_3 \text{Overhead} + \beta_4 \text{Deposit} + \beta_5 \text{Owner} + \\
 & \beta_6 \text{Z\_score} + \beta_7 \text{NIEAR} + \beta_8 \text{Lagged equity ratio} + \beta_9 \text{dYear} + \varepsilon
 \end{aligned}
 \tag{5}$$

Table 13 shows that there are 5 best models from 16 selected models based on the BMA approach. Look at the table, we can see that the importance of the variables explaining the financial soundness is given in the second column ( $p \neq 0$ ) which represents posterior model probabilities. For instance, all of the posterior model mass rests on models that include *RSVs* and *Owner* (virtually 100%); *Deposit*, *Overhead*, *NIEAR*, *LER* have intermediate posterior model probabilities of 88.1%, 80.5%, 75.5%, and 75.1%, respectively. In contrast, *CRED*, and *Z\_score* do not seem to matter much. In addition, the results also show that the covariate *Overhead* has comparatively large coefficients and seem to be the most important variable.

Table 13: The results of BMA including the year-fixed effect

Variables	p!=0	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	100.0	-10.3846	-15.2107	-16.5209	-15.7273	-11.3892
CRED	3.3	.	.	.	.	.
RSVs	100.0	2.7171	3.1639	3.1651	2.8202	2.6833
Overhead	73.4	-113.1787	-111.4966	-93.6304	-90.0074	-95.0775
Deposit	82.1	-0.3269	-0.2258	-0.2277	.	-0.3323
Owner	100.0	-3.5154	-3.7956	-3.1204	-4.2235	-2.8086
Z_score	4.6	.	.	.	.	.
NIEAR	69.8	-10.3592	-9.8181	.	-10.1203	.
LER	60.4	.	8.8149	9.5130	13.8901	.
dYear	100.0	-0.3189	-0.3086	-0.3120	-0.3042	-0.3259
nVar		6	7	6	6	5
BIC		-1086.9267	-1086.7169	-1085.1684	-1084.3623	-1084.2100
Post prob		0.222	0.200	0.092	0.062	0.057

Source: The authors' calculation

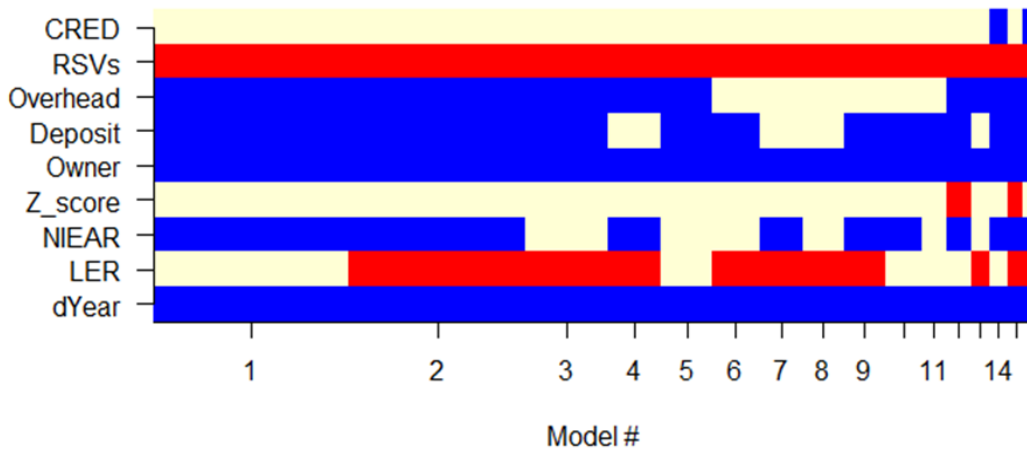


Figure 4: Models selected by BMA including the year-fixed effect

Similarly, Figure 4 shows that there are 16 models were selected, where *RSVs* and *Owner* are the factors that have the greatest impact on the financial soundness of commercial banks in Vietnam (100% of in the model). Similar to *RSVs* variable in Figure 3, this variable also has a negative relation to the financial soundness, whereas most *Owner* in all models impact on the financial soundness of commercial banks in Vietnam positively. Next important factors are *Deposit*, *Overhead*, *NIEAR*, and *LER*, respectively. For the *CRED* and the *Z\_score* variables, the models where these two variables are statistically significant and impact on the financial soundness are less than 5%.

Table 14 reports our baseline results based on two optimal models in both cases: (1) without including interactive year-fixed effect and independent variables (bank characteristic and macroeconomic variables), and (2) with the use of time dummy variables to control yearly effect.

Table 14: The baseline results

Variables	[1] Financial soundness	[2] Financial soundness
Intercept	-10.4283	-10.3846
CRED	-	-
RSVs	2.2288	2.7171
Overhead	-178.6268	-113.1787
Deposit	-0.2465	-0.3269
Owner	-2.7079	-3.5154
Z_score	-	-
NIEAR	-9.9311	-10.3592
LER	9.9893	-
GDP	-	-
INF	-	-
Year – Fixed effect	No	Yes
Number of observations	240	240
R <sup>2</sup>	40.3%	53.7%
Likelihood Ratio ( $\chi^2$ )	76.67	108.71

Source: The authors' calculation

In column (1), the results show that the financial soundness of commercial banks in Vietnam is affected by the following factors: *RSVs*, *Overhead*, *Deposit*, *Owner*, *NIEAR*, and *LER*, and these variables explain 40.3% of the variation in the financial soundness ( $R^2=40.3\%$ ). In column (2), the authors almost achieve the similar results, only the *LER* variable is not statistically significant, and  $R^2=53.7\%$ , suggesting that about 54% of the variation in the financial soundness is explained by these variables. In addition, we can see that the coefficient signs in both models are similar. The relationship between the independent variables and the dependent variable in both models is explained as follows:

The results show that a factor has the greatest impact on the financial soundness of commercial banks in Vietnam is *Overhead*. As was expected, the coefficient sign of this variable has an inverse correlation with the financial soundness, similar to the result of Bourke (1989), suggesting that holding other factors fixed, the higher the overhead, the lower the probability of a bank guaranteeing its financial soundness and vice versa. To be specific, with a 1% increase in overhead, the probability of a bank securing its financial soundness is decreased by 178.63% (in model 1) and by 113.18% (in model 2). This result is consistent with the context of commercial banks in Vietnam in recent years. Increasing overhead mean that staff expenses, management costs, as well as provision for credit losses on loans and advances to customers are increasing, which reduces bank profits, resulting in the reduction of probability that banks secure their financial soundness will be inevitable.

The second most important factor affecting the financial soundness of commercial banks in Vietnam is *NIEAR*. With a correlation coefficient of about -9.93% in

model 1, and -10.36% in model 2, the ratio of non-interest earning assets to total assets has a negative impact on the financial soundness of commercial banks, ie the ratio of non-interest earning assets to total assets increases 1%, the probability of the financial soundness decreases by about 10% in both models. This result is in line with the initial expectation and also in accordance with the research by Demirguc-Kunt and Huizinga (2000), suggesting that the non-interest earning assets account for the larger proportion of total assets, the lower the profitability of the bank, the more likely the financial soundness of commercial banks will be reduced.

For *Owner* variable, the authors find evidence that *Owner* has a significantly negative relation with the financial soundness, similar to those of Short (1979), Bourke (1989), Marriott and Molyneux (1991), Barth et al. (2004), Iannota et al. (2007), Million Cornett (2010), and Wanzenried and Dietrich (2011), and oppose to those of Molyneux, and Thornton (1992), suggesting that private banks generate returns higher than government counterparts, thereby increasing their financial soundness. The result shows that if a bank owned by the state, the probability of ensuring the financial soundness of about 3.5 times lower than the private banks. This result is relevant to the current situation of the Vietnamese banking system, most the state-owned banks operate ineffectively. Therefore, the Vietnamese banking system may accelerate the process of equitization of state-owned banks in the future. Realistically, the four state-owned commercial banks (Agribank, VCB, BID, CTG) are now multi-function commercial banks with similar functions, objectives and development strategies. As a result, the existence of all four state-owned banks has led to competing against each other, wasting resources and failing to establish a large-scale bank in the region. With the limited state resources, therefore it is necessary to shift the role from banks' owner to the regulator, supporting the development of the market economy.

In addition, contrary to the initial expectation and previous studies by Riaz and Mehar (2013), and Rashid and Jabeen (2016), the results show that *Deposit* in both models impacts on the financial soundness of commercial banks in Vietnam negatively. To be specific, holding other factors constant, with a 1% increase in the bank's leverage ratio, the probability of a bank meeting its financial soundness is decreased by 0.25% (in model 1) and by 0.33% (in model 2). This result is explained by the fact that when deposit from customers exceeds the amount of equity that the bank can use to ensure its ability to pay. This is effortless to lead to liquidity risk for banks in case of customers withdraw their money before maturity that the bank does not have enough resources to repay, reducing the financial soundness of commercial banks.

Among the variables included in the model, *RSVs* variable plays an important role in raising the financial soundness of commercial banks in Vietnam. The estimated coefficient of this variable is positive and statistically significant in both models (1) and (2), similar to the study of Hassan and Bashir (2003), and Rashid and Jabeen (2016). Estimated results show that with a 1% increase in requiring reserves, the probability of a bank securing its financial soundness increase by 2.23% (in model



1) and by 2.72% (in model 2), holding other factors fixed. The results also show that *LER* is only statistically significant in the case of using pooled regression, without including yearly effect, whereas *CRED*, *Z\_score*, and macroeconomic variables such as *GDP*, and *CPI* are not statistically significant.

## 5 Conclusions

Credit institutions in general as well as commercial banks in Vietnam in particular play a key role in the economy. These organizations are referred to as financial intermediaries, which mobilize deposits from customers and lend to other customers. However, the financial soundness of commercial banks in Vietnam in recent years still faces many difficulties, most of the banks are still not able to meet financial soundness in a fully competitive environment, and it is influenced by many factors, including the macroeconomic and the bank characteristic. Therefore, the purpose of this study is to identify factors affecting the financial soundness of commercial banks in Vietnam in the period 2006-2017.

This study employs a logistic regression model with a BMA approach for selecting optimal models for both cases, (1) without including yearly effect, and (2) including time dummies to control yearly effects, in which the financial soundness is estimated by the CAMELS model. Based on the regression results, the authors determine factors affecting the financial soundness of commercial banks in Vietnam such as *Overhead*, *Deposit*, *Owner*, *NIEAR*, *RSVs*, and *LER*, where only *RSVs* has a positive correlation with the financial soundness. The results also show that *LER* is only statistically significant in the case of without yearly effect, whereas *CRED*, *Z\_score*, and macroeconomic variables such as *GDP*, and *CPI* are not statistically significant.

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## Appendix

Table A: Evaluation under CAMELS rating system

Component	Financial Measurement	Weight	Ratio's Rating					
			1	2	3	4	5	
C	Capital adequacy	Capital adequacy ratio (CAR)	20%	>11%	8%-11%	4%-8%	1%-4%	<1%
A	Assets quality	Non-performing loans/Total loans	20%	<1.5%	1.5%-3.5%	3.5%-7%	7%-9.5%	>9.5%
M	Management	Operating expenses/Operating income	25%	≤25%	30%-26%	38%-31%	45%-39%	≥46%
E	Earnings (ROA)	Net profit after tax/Average assets	15%	>1.5%	1.25%-1.5%	1.01%-1.24%	0.75%-1%	<0.75%
	Earnings (ROE)	Net profit after tax/Average equity		≥22%	17%-21.99%	10%-16.99%	7%-9.99%	≤6.99%
L	Liquidity (L1)	Total loans/Total deposits	10%	<60%	60%-65%	65%-70%	70%-80%	>80%
	Liquidity (L2)	Current assets/Total assets		≥50%	45%-49.99%	38%-44.99%	33%-37.99%	≤32%
S	Sensitivity	Total securities/Total assets	10%	≤25%	30%-26%	37%-31%	42%-38%	≥43%

Source: Babar and Zeb (2011); Masood et al. (2016)

Table B: The CAMELS composite rating

Rating	Rating Range	Rating Analysis	Interpretation
1	1.0 – 1.49	Strong (or outstanding)	The bank is basically good in every aspect.
2	1.5 – 2.49	Satisfactory (or superior)	The bank is primarily good but has several identified weaknesses.
3	2.5 – 3.49	Fair (or average), with some categories to be watched	The bank has financial, operational, or compliance weaknesses that would give reasons for supervisory concern.
4	3.5 – 4.49	Marginal (or underperform), with some risk of failure	The bank has serious financial weaknesses that could damage future capability to ensure normal growth and development.
5	4.5 – 5.0	Unsatisfactory (or doubtful), with a high degree of failure	The bank has critical financial weaknesses that will give a probability of failure to be extremely high in the near future.

Source: Desta (2016), and Masood et al. (2016)