Financial soundness of Vietnamese commercial banks: A CAMELS approach

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Abstract

This study investigates the financial soundness of Vietnamese commercial banks between 2008 and 2013 using the combination of data envelopment analysis and CAMELS approach. These findings indicate that only one state-owned commercial bank is listed of the ten best-performing banks, suggesting that the implicit support from the government provides less incentive for these banks to improve their performance. In addition, the ten worst-performing banks are also indicated so that the State Bank of Vietnam should put more attention on supervising and monitoring them in order to strengthen the Vietnamese banking system.

Keywords: Vietnam, financial soundness, CAMELS approach, bootstrap-DEA

1. Introduction

Vietnam boasts one of the fastest-growing emerging economies in the world[2], with an average of approximately 6% Gross Domestic Product (GDP) growth per year in real terms. Due to the relatively underdeveloped capital market,[3] the Vietnamese banking system plays a critical role in the economy since it contributes approximately 16% to 18% to annual GDP (Stewart, Matousek & Nguyen 2016). However, the banking system has long remained undercapitalized and increased non-performing loans, especially during the global financial crisis. In response, the Decision No.254/QD-TT on restructuring the credit institutions system, officially released by the Prime Minister of Vietnam on 1 March 2012 (The Vietnamese Government 2012). One of its key terms of reference is to reassess the financial

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[1] The views expressed herein are the author's and do not necessarily reflect the views of the State Bank of Vietnam. Email address: tuldq@uel.edu.vn
[2] Just behind China within Asia (with an average of approximately 9% GDP growth per year over the same period)
[3] The stock market has been only serving a limited number of companies which are favored by the government.

health of credit institutions.[4] According to this program, the State Bank of Vietnam (SBV) does not propose the explicit criteria of the assessment on bank performance[5]. The motivations of this study are to (1) evaluate the soundness of Vietnamese commercial banks since entry into WTO in 2007 (2) indicate rankings of individual banks, thus helping the Vietnamese authorities to implement the appropriate policies in order to strengthen the banking system.

As suggested by IMF and World Bank (2005), the parameters of the CAMELS approach are considered as relevant indicators for assessing the financial soundness of banking system. Several studies suggest that the CAMELS approach is one of the effective tools for the regulatory authorities to monitor and supervise the banking system (Gilbert, Meyer & Vaughan 2000; Hays, De Lurgio & Gilbert 2009). In addition, the CAMELS approach is supposed to be one of the main models to assess the bank performance (Derviz & Podpiera 2008; Evans et al. 2000; Kumar et al. 2012). Therefore, this study adopts the CAMELS approach to assess the performance of Vietnamese banks.

This study contributes to the literature in several ways. The combination of data envelopment analysis and CAMELS approach is used in this study in order to assess the financial soundness of banks. More specifically, financial ratios are traditionally used to proxy for the indicator of management (M) (Kumar et al. 2012; Roman & Şargu 2013). These accounting ratios are single measures, therefore are unable to capture the full reality of banking operations in which multiple inputs-outputs are interacting and have trade-offs. These measures of the category (M) are unable to provide information of efficiency relative to that of best practice (Zhu 2003). In contrast, M category in this study is proxied by the efficiency scores of banks that are obtained from using bootstrap data envelopment analysis. Therefore, the combination of DEA into CAMELS approach would provide a better measure of financial soundness of banks. In addition, this study is the first attempt to examine the performance of the Vietnamese banking system over the period of 2008 to 2013 using the CAMELS framework. Therefore, our study has important implications for bank management and the policy-makers.

This study provides the overall ranking of 31 banks over the period of 2008 and 2013. It is surprising that only one state-owned commercial bank (SOCB) is listed in the 10 best-

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[4] It also includes scheduling the process of equitizing state-owned commercial banks, regulation of the financial system; competition and technological development; the promotion of mergers and acquisitions.
[5] The assessment on target banks may be confidential.

performing banks according to CAMELS approach. This suggests that the largest SOCBs have less incentive to improve their performance since they have received the implicit guarantee from the government. In addition, the list of the worst-performing banks is also determined, suggesting that SBV should put more attention on supervising and monitoring them in order to strengthen the banking system.

The remainder of this study is constructed as follows. Sector 2 provides a literature review. Section 3 presents the methodology. Section 4 describes the data used in this study. Section 5 discusses the empirical findings and section 6 concludes.

2. Literature review

Several studies have analyzed the performance of individual bank by using CAMELS approach. Roman and Şargu (2013) using Romanian data show that the largest banks may have strengths in some parameters of CAMELS approach but have weaknesses in others. In addition, several studies have investigated which parameters of CAMELS approach are used to predict bank failures. Gilbert, Meyer and Vaughan (2000) suggest the set of explanatory variables that include net worth, return on assets, size and securities roughly correspond to those verified in bank failures. Henebry (1997) demonstrates the ratios that involve capital to total assets, non-performing loans to total loans, and total loans to total assets are the only three-time stable predictors of bank failures. All in all, these findings suggest that some variables have less reliable predictive power compared with other variables and some degree of interchangeability is possible within a category of indicators (Derviz & Podpiera 2008).

In the literature, there is the increasing number of studies that have attempted to analyze the performance of Vietnamese banking system. Most studies use the economic frontier approach[6]. A study by Nguyen (2007) finds that bank cost inefficiency was mainly due to technical inefficiency rather than allocative inefficiency while Nahm and Vu (2013) suggest that the main source of low-profit efficiency was allocative inefficiency rather than technical inefficiency. Several studies further examine whether bank efficiency differs between large and small size. A study by Minh, Long and Hung (2013) indicates that large banks were not super-efficient than small counterparts. Their findings somewhat conflict with those of Stewart, Matousek and Nguyen (2016) who indicate that large and very large banks were more efficient than small and medium counterparts.

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[6] The advantages of the economic frontier approach over the financial ratios are discussed in Berger, Hunter and Timme (1993) and Nguyen, Roca and Sharma (2014).

In the Vietnamese banking system, there are two main players that include state-owned commercial banks (SOCBs) and privately owned commercial banks (POCBs). Nguyen, Roca and Sharma (2014) find that SOCBs were more cost and profit efficient than POCBs. These findings are in line with the findings of Vu and Turnell (2010) who found that there was a significant gap in allocative efficiency between SOCBs and other types of banks and POCBs were least profit efficient.

Recently, Le (2017b) analyses the efficiency effect of three merger cases in Vietnamese banking system. His results reveal that the efficiency improved in the majority of merger cases and was not related to acquiring bank's efficiency advantage over its targets. Small-and-medium POCBs should be promoted in future mergers and acquisitions as a means to enjoying efficiency gains. Similarly, Le (2017a) suggests that SOCBs are considered as the main drag for system's performance, thus the future bank M&As that include a SOCB should be approached with caution.

In contrast, this study is the first attempt to assess the soundness of the Vietnamese banking system by combining the economic frontier approach and CAMELS approach. This provides the overall rankings of selected banks in the sample, thus helping Vietnamese authorities to determine which Vietnamese banks need restructuring.

3. Methodology

3.1 Data envelopment analysis

The literature suggests two main approaches that are used to measure bank efficiency include: data envelopment analysis (DEA), a non-parametric approach and stochastic frontier analysis (SFA), a parametric approach (Berger & Humphrey 1997; Liu et al. 2013). In this study, DEA is selected to measure bank efficiency because it works well with small sample size (Evanoff & Israilevich 1991) and is less prone to specification error, thus is more flexible (Reinhard, Lovell & Thijssen 2000).

Given a bank with a set of input p and a set of output q, a production set Ψ can be defined in the Euclidean space R_+^{p+q} as $\Psi = \{(x,y) | x \in R_+^p, y \in R_+^q, (x,y) \ is \ \text{feasible}\}$ (1)

Assume that cost efficiency is the primary objective of Vietnam commercial banks. Following Farrell (1957) concept, the input-oriented efficiency score of a bank operating at the level (x, y) is estimated as $\theta(x_0, y_0) = \inf\{\theta|\theta x_0 \in C(y_0)\} = \inf\{\theta|(\theta x_0, y_0) \in \Psi\}$ (2)

Thereafter, the following DEA estimator under the variable returns to scale (VRS) assumption proposed by Banker, Charnes and Cooper (1984) is measured as:

$$\hat{\theta}_{DEA}(x_0, y_0) = \min \left\{ \begin{matrix} \theta|y_0 \leq \sum_{i=1}^n \gamma_i Y_i \, ; \theta x_0 \geq \sum_{i=1}^n \gamma_i X_i \, ; \, \theta > 0; \\ \sum_{i=1}^n \gamma_i = 1; \, \gamma_i \geq 0, i = 1, \ldots, n \end{matrix} \right\} \quad (3)$$

The value of $\hat{\theta}_{DEA}(x_0, y_0)$ will be bounded by 0 and 1. A bank that obtains a score of 1 is considered as technically efficient since it operates on the boundary of its production set.

However, DEA measure is often criticised as lacking a statistical basis (Assaf, Barros & Matousek 2011). Therefore, a bootstrap DEA is introduced to overcome this issue because this procedure can produce confidence limits on the efficiencies of the units to capture the true efficiency frontier within the specified interval (Dyson & Shale 2010). The procedure has been described in detail by Simar and Wilson (1998, 2000) and is not repeated here for want of space.

The bootstrap bias estimate for the original DEA estimator $\hat{\theta}_{DEA}(x_o, y_0)$ is computed as:

$$\widehat{BIAS}_B\left(\hat{\theta}_{DEA}(x_o, y_0)\right) = \frac{1}{B}\sum_{b=1}^B \hat{\theta}_{DEA,b}^*(x_0, y_0) - \hat{\theta}_{DEA}(x_0, y_0) \quad (4)$$

The bias-corrected estimator of $\theta(x_0, y_0)$ is estimated as:

$$\hat{\hat{\theta}}_{DEA}(x_0, y_0) = \hat{\theta}_{DEA}(x_0, y_0) - \widehat{BIAS}_B\left(\hat{\theta}_{DEA}(x_0, y_0)\right) = 2\,\hat{\theta}_{DEA}(x_0, y_0) - \frac{1}{B}\sum_{b=1}^B \hat{\theta}_{DEA,b}^*(x_0, y_0)$$

$\hat{\theta}_{DEA,b}^*(x_0, y_0)$ is a bootstrapped value; B is 2,000 replications   (5)

3.2 The CAMELS approach

The components of the CAMELS approach include capital adequacy, asset quality, management quality, earnings ability, liquidity and sensitive to market risk.

Capital adequacy (C) is used to assess the financial health of the banking system as it reflects the capacity of this sector to absorb the eventual losses caused by either internal or external factors or even both. Following prior studies such as Roman and Şargu (2013), C can be

proxied by the ratio of total equity to total assets (TETA) and the ratio of total equity to total debts (TETD)[7]. TETA represents the proportion of total assets that are financed by a bank's shareholder while TETD reflects the necessary internal sources that can be used to address default risk. Accordingly, the higher the ratio, the safer a bank is. Therefore, the highest rank is attributed to a bank that has registered the highest score for these indicators.

Asset quality (A) is used to assess the strength of a bank and is directly linked to capital adequacy because insolvency risk is accompanied by the deterioration of the bank's assets (IMF and World Bank 2005). Following prior studies, we use the ratio of loan loss provisions[8] to total loans (LLPTL), the ratio of loan loss provisions to net interest income (LLPII), and the ratio of total loans to total assets (TLTA)[9]. LLPTL represents the proportion of risky loans to total loans that were granted to the borrowers. LLPII indicates the ability of a bank to use the received interest income in order to cover the expenses caused by provisions for impaired loans. Accordingly, the lower value of LLPTL or LLPII, the better the quality of loans is. Also, a higher TLTA reflects the more sensitivity of assets structure to loan losses since loans represent the most important components of a bank's assets (Le 2018). Thus, the highest rank is attributed to a bank that has registered the lowest value of these indicators.

Management quality (M) reflects the ability of bank management to control operating costs. In contrast to the conventional CAMELS approach where M is proxied by financial ratios, M in this study is measured by bias-corrected efficiency scores (BCVRS) that can be obtained from the bootstrap DEA. The efficiency score lies in the range of 0 to 1. The higher efficiency score of a bank can obtain the better performing a bank has.

Earnings ability (E) can be measured by the following indicators return on assets (ROA), return on equity (ROE) and net interest margins (NIM). ROA, as measured by the ratio of profit before tax to total assets. ROE, as measured by the ratio of profit before tax to total equity reflects the profitability of a bank own capitals.[10] NIM, as measured by the ratio of net interest income to interest-bearing assets[11]. Accordingly, the higher value of the ratio the

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[7] It may be argued that total capital adequacy ratio is a better measure of capital adequacy since it reflects the ability of a bank to meet the time liabilities and other risks. Due to the unavailability of data, it is unable to calculate the capital adequacy ratio. Therefore, TETA and TETD are used instead.

[8] More-risky loans require a higher volume of loan loss provisions.

[9] It may be argued that the ratio of non-performing loans to total loans is a better measure of the quality of the loans. Unfortunately, there is a substantial missing amount of data on NPL. Therefore, LLP is used instead.

[10] This ratio should be interpreted with caution because a high level of profitability may be accompanied by a low level of capitalization and vice versa.

[11] Interest-bearing assets include cash and reserves, balance with the State Bank of Vietnam, dues from financial institutions, trading and available for sale securities and total loans.

better performance a bank has. Consequently, the highest rank is assigned to a bank that can obtain the highest the value of these indicators.

Liquidity (L) reflects the ability of a bank to withstand shocks to cash flows and unexpected withdrawals of depositors. Following prior studies, we use the ratio of liquid assets[12] to the short-term funding,[13] (LASTF) and the ratio of net loan to the short-term funding (NLSTF) as measures of bank liquidity. The higher LASTF the safer the bank is since banks hold more liquid assets that can be utilized to address the short-term debt. As a result, the highest rank is assigned to a bank that can acquire the greatest value of LASTF. However, the higher NLSTF the less stable the bank is since loans are generally considered illiquid assets. If the bank advances higher volume of loans, that bank may face liquidity problem to meet the unexpected withdrawals of depositors. The period of 2008 and 2010 witnessed a rapid growth in loans, especially in the booming real estate and stock markets rather than into productive investments. Consequently, this may affect the liquidity status of a bank. For that reason, the highest rank is assigned to a bank that has registered the lowest value of LASTF.

Sensitivity to market risks (S) reflects the way in which the market prices (the interest rates, the exchange rates, and the equity prices) impact the bank's earnings and capital negatively. S is measured by the ratio of the difference between rate-sensitive assets and rate-sensitive liabilities to total assets.[14] Rate-sensitive assets comprise dues from financial institutions and total loans whereas rate sensitive liabilities include interbank liabilities and other liabilities. Accordingly, the higher gap means that a bank becomes less exposed to the risk of losses arising from changes in market prices because the value of sensitive assets is still able to cover the value of sensitive abilities. As a consequence, the highest rank is assigned to a bank that can achieve the greatest value of the cumulative gap.

For each indicator of the above parameter, we compute its average value for each bank over the examined period. Thereafter, the resultant average values are used to rank the banks in the sample. Consequently, a bank with the higher rank is considered as better performing. In the case of two or more banks having the same ranking value, the respective banks are assigned to the average rank.

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[12] Liquid assets comprise cash and reserves, balances with the State Bank of Vietnam, dues from financial institutions, trading and available for sale securities.
[13] Short-term funding comprises total deposits and interbank liabilities.
[14] S can be measured by the ratio of total assets to total assets of the banking industry. One may argue that larger sized bank is less sensitive to the market risk, thus protecting itself from the failure.

4. Data

Foreign and joint-venture banks[15] are excluded from the sample as they are somewhat limited to operate in Vietnamese banking market. Because the data sample must be homogenous when using DEA, this exclusion ensures maximum feasible comparability among banks. The data used to estimate efficiency scores of banks using DEA were extracted from the balance sheets of individual banks between 2008 and 2013. Regarding the indicators of each category in the CAMELS approach, the data were mainly collected from a database constructed by Ngo and Le (2017). Therefore, a balanced panel data of 31 banks that includes four state-owned commercial banks[16] and 27 privately owned commercial banks[17] is obtained.

It is commonly acknowledged that the choice of variables significantly affects the results of DEA scores. Two approaches dominate the literature including the production approach (PA) and the intermediation approach (IA). PA[18] generally ignores the interest expenses incurred in the production outputs. This is inappropriate for the studies which examine the cost efficiency as interest expenses account for one-half to two-thirds of total costs (Berger & Humphrey 1997). Alternatively, this study adopts the intermediation approach in which banks are seen as an intermediary between savers and borrowers. This approach is consistent with the function of banks as written into law- Chapter 2, Article 1 of the Banking Act (SBV 2000). Following prior studies such as Nguyen and Simioni (2015), and Casu and Girardone (2005), the inputs include operating expenses, physical capital, and loanable funds. The outputs comprise total loans, other earning assets, and the nominal value of off-balance sheet (OBS) items[19]. Three measures of a bank's aggregate OBS include the total credit equivalent amount of OBS transactions according to Basle guidelines, an aggregate measure of asset

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[15] These banks can also receive the support the parent company as needed.

[16] State-owned commercial banks: Bank for Investment and Development (BID), Foreign Trade Bank (VCB), Bank of Industry and Trade (CTG), Housing Bank of Mekong Delta (MHB).

[17] Joint stock commercial banks: Asia Bank (ACB), An Binh Bank (ABB), Dong A Bank (DAB), Export-Import Bank (EIB), HCM Development Bank (HDB), Kienlong Bank (KLB), Lien Viet Post Bank (LVP), Maritime Bank (MSB), Mekong Development Bank (MDB), Military Bank (MB), Nam A Bank (NAB), National Citizen Bank (NCB), Ocean Bank (OCB), Orient Bank (OB), Petrolimex Group Bank (PGB), Saigon Thuong Tin Bank (STB), Saigon Bank for Industry and Trade (SGB), Saigon Commercial Bank (SCB), South-East Asia Bank (SEA), Saigon-Hanoi Bank (SHB), Southern Bank (PNB), Technological Bank (TCB), TienPhong Bank (TPB), Vietnam International Bank (VIB), Viet A Bank (VAB), VietCapital Bank (VCAPB), Bank for Private Enterprise (VPB).

[18] Such detailed transaction flow data is typically proprietary and not generally available to collect. Furthermore, the number of accounts and loans outstanding provide the appropriate measures of bank outputs and total costs involve all operating costs incurred in the production of outputs.

[19] The third output is used to reflect the fact that Vietnamese banks have diversified away from traditional financial intermediation business and into off-balance sheet and fee income-generating business.

equivalent, and the non-interest income (NII) (Clark & Siems 2002). However, these measures have disadvantages. The first measure may seriously underestimate the level of OBS (Boyd & Gertler 1994). The asset equivalent is a revenue-based measure that involves losses, thus potentially distorting measure of OBS. NII may overestimate the amount of OBS because fees and commissions are also drawn from on-balance sheet activities (Clark & Siems 2002). Given the sample of 31 banks, a 3x3 set has been used in this study which is consistent with DEA literature[20]. Table 1 provides descriptive statistics of variables used in this study.

Table 1 Descriptive statistics of inputs and outputs, pooled data 2008-2013

	Mean	SD	Min	Max
Inputs (VND million)				
Operating expenses	1433695	1946203	29452	9909654
Fixed assets	1087048	1346302	27905	7080388
Loanable funds	73084472	92559873	842382	445109121
Outputs (VND million)				
Loans	50040374	76790181	275493	391035051
Other earning assets	34348154	40066318	77957	184280837
Nominal value OBS	10751480	20219961	1939	84676027

5. Empirical results

5.1 Technical efficiency level of the Vietnamese banking system, 2008-2013

The VRS assumption in the bootstrap DEA was used to estimate bias-corrected efficiency scores of banks as indicated in the following figure.

Figure 1 The efficiency level of the Vietnamese banking system, 2008-2013

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[20] Dyson et al. (2001) and Nunamaker (1988) suggest that sample size should be at least three times larger than the sum of inputs and outputs to discriminate between the units.

As can be seen from Figure 1, the efficiency of Vietnamese banking system increased from 2008 to 2010 and started falling in the subsequent years. The reduction in bank efficiency suggests that it would take time for Vietnamese banking system to overcome the impact of GFC. It is important to note that the main focus of this study is to examine the soundness of Vietnamese banks as presented in the next section.

5.2 The analysis of CAMELS approach

5.2.1 Capital adequacy (C)

The results of two indicators of the category (C) are indicated in Appendix 1. As can be seen in Appendix 1, the ten best-performing banks include MDB, VCAPB, KLB, LVB, SGB, TPB, NAB, OB, ABB, and EIB. The ten worst-performing banks are determined as BID, MHB, OCB, ACB, MSB, CTG, VCB, PNB, SCB, and TCB. More interestingly, none of SOCBs are listed as the best-performing banks under this category.

5.2.2 Asset quality (A)

The results of three indicators of the category (A) are presented in Appendix 2. Accordingly, the ten best-performing banks involve TPB, LVB, VCAPB, NAB, VPB, ACB, MDB, KLB, EIB, and TCB. The ten worst-performing banks include BID, VCB, DAB, PNB, SCB, VAB, MHB, VIB, PGB, SGB, and ABB.

5.2.3 Management quality (M)

The results of BCVRS efficiency scores of banks[21] are indicated in Appendix 3. As can be seen in Appendix 3, the most efficient banks are EIB, OCB, SEA, CTG, MB, BID, VCB, MDB, TPB, and OB. The least efficient banks are MHB, SHB, ABB, NAB, HDB, STB,

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[21] Due to the space restrictions, the bias-corrected efficiency score, estimated bias, a standard deviation of the bias and the confidence intervals of the efficiency estimates cannot be presented but are available upon request.

KLB, VCAPB, NCB, and PNB. Most efficient banks are state-owned commercial banks (SOCBs). This can be explained as follows. First, SOCBs have benefited from government subsidies and the banking reforms mainly focused on SOCBs, resulting in better governance and better cost management. Second, since SOCBs have a much larger deposit base and loans volume, they have the advantage of economies of scale, which reduce the per unit cost (Nguyen, Roca & Sharma 2014). Third, SOCBs are protected by implicit government guarantees. Due to their government ownership, SOCBs are considered as safe banks in the Vietnamese banking system. Consequently, depositors are willing to accept lower deposit interest rates, thus reducing input costs for SOCBs.

5.2.4 Earnings ability (E)

The results of three indicators of the category (E) are shown in Appendix 4. As can be seen from Appendix 4, the ten best-performing banks include MB, SGB, LVP, CTG, MDB, KLB, TCB, STB, PGB, and DAB. The ten worst-performing banks comprise TPB, PNB, MHB, SCB, SEA, NAB, HDB, OCB, NCB, and VAB.

5.2.5 Liquidity (L)

The results of two indicators of the category (L) are presented in Appendix 5. As can been in Appendix 5, the ten best-performing banks are composed of TPB, SEA, LVB, MSB, OCB, TCB, MB, VIB, VPB, and HDB. The ten worst-performing banks include SGB, DAB, BID, OB, SCB, VAB, CTG, PNB, NCB, KLB, and PGB.

5.2.6 Sensitivity to market risk (S)

The results of the indicator of the category (S) are indicated in Appendix 6. As can be seen in Appendix 6, the ten best-performing banks comprise SGB, DAB, BID, VCB, KLB, STB, CTG, MB, OB, and PGB. The ten worst-performing banks include SEA, TPB, MSB, MHB, LVB, NAB, VCAPB, HDB, PNB, and VPB.

5.2.7. The CAMELS approach

Based on the analysis of each category of the CAMELS model, the overall ranking of banks is indicated in Table 2. The ten best-performing banks contain MDB, MB, LVB, EIB, KLB, SGB, TCB, TPB, CTG, and OB. The ten worst-performing banks are composed of MHB,

PNB, SCB, BID[22], NCB, HDB, VIB, VAB, SHB, and ABB. It is surprising that only one state-owned commercial bank, CTG is recorded as one of the ten best-performing banks. This suggests that the implicit guarantees from the government may provide less incentive for the largest SOCBs to improve their performance. In addition, the new-established banks such as LVB and TPB have better performance because they have applied advanced technology to their day-to-day operations and are able to adopt international standards quickly. Finally, these findings also suggest the SBV should put more attention on monitoring and supervising these following banks: MHB, PNB, SCB, NCB, HDB, VIB, VAB, SHB, and ABB.

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[22] BID may be an exceptional case although this bank is listed in the bottom ten banks according to the analysis of the CAMELS framework because this bank is strongly supported by the implicit government guarantee. For example, the lending activities of this bank in some areas may be controlled by the government.

Table 2 The overall rankings for Vietnamese banks, 2008-2013

	C	A	M	E	L	S	Average	Ranking
ACB	27	6	21	16	18	11	16.50	18
ABB	9	22	29	17	17	13	17.83	22.5
BID	31	31	6	18	28.5	3	19.58	28
DAB	17	29	16	10	30	2	17.33	20
EIB	10	9	1	11.5	12	19	10.42	4
HDB	16	11	27	25.5	10	24	18.92	26
KLB	3	8	25	6	21.5	5	11.42	5
LVB	5	2.5	19	3	3.5	27	10	3
MSB	27	14	12	19	3.5	29	17.42	21
MDB	1	7	8	5	19	12	8.67	1
MHB	30	24.5	31	28.5	14.5	28	26.08	31
MB	20	15	5	1	7	8	9.33	2
NAB	7	4	28	25.5	13	26	17.25	19
NCB	13	18	23	23	23.5	15	19.25	27
OCB	29	12	2	24	5	16	14.67	12
OB	8	19	10	13	28.5	9	14.58	10
PGB	11	22	18	9	21.5	10	15.25	15
STB	15	13	26	8	20	6	14.67	12
SGB	5	22	14	2	31	1	12.5	6.5
SCB	23	27	15	28.5	27	21	23.58	29
SEA	14	20	3	27	2	31	16.17	17
SHB	18	16	30	14	11	18	17.83	22.5
PNB	25	28	22	30	23.5	23	25.25	30
TCB	22	10	13	7	6	17	12.50	6.5
TPB	5	1	9	31	1	30	12.83	8
VIB	21	24.5	17	21	8.5	20	18.67	25
VAB	12	26	11	22	26	14	18.50	24
VCAPB	2	2.5	24	20	14.5	25	14.67	12
VCB	24	30	7	11.5	16	4	15.42	16
CTG	27	17	4	4	25	7	14.00	9
VPB	19	5	20	15	8.5	22	14.92	14

Notes: C, average rank of banks using the ratio of total equity to total assets, and the ratio of total equity to total debts; A, average rank of banks using the ratio of loan loss provision to total loans, the ratio of loan loss provisions to net interest income, and the ratio of total loans to total assets; M, rank of banks using the bias-corrected efficiency scores obtained from the bootstrap DEA; E, average rank of banks using return on average total assets, return on average total equity, and net interest margin; L, average rank of banks using the ratio of liquid assets to short term funding, and the ratio of net loan to short term funding, S, rank of banks using the ratio of difference between rate sensitive assets and rate sensitive liabilities to total assets.

6. Conclusion

Our study investigates the soundness of Vietnamese commercial banks between 2008 and 2013 by combining DEA into the CAMELS approach. This study provides the overall

ranking of individual banks, thus helping the Vietnamese authorities to assess the financial health of banks in Vietnam according to the international standards. These findings indicate that only one SOCB registers as one of the ten best-performing banks. This suggests that the government should speed up the reforms on the largest SOCBs in terms of equitizing these banks. In addition, the findings also identify nine worst-performing banks that include MHB, PNB, SCB, NCB, HDB, VIB, VAB, SHB, and ABB. The SBV should take appropriate measures to help them enhance their performance in respect of decision-making process about mergers and acquisitions.

This study examines one merging market and a limited period of study, it is suggested that the need for future research may use different indicators of each category to confirm the findings. In addition, the future research may incorporate the macro factors into CAMELS approach to investigate the soundness of Vietnamese commercial banks.

Appendix

Appendix 1 Capital adequacy indicators for Vietnamese banks, 2008 - 2013

	TETA		TETD		Group ranking	
	Average (%)	Rank	Average (%)	Rank	Average rank	Ranking
ACB	6.31	29	9.22	26	27.5	27.5
ABB	15.08	9	20.6	9	9	9
BID	5.32	31	7.48	31	31	31
DAB	9.22	18	12.45	17	17.5	17
EIB	14.02	11	20.35	10	10.5	10
HDB	10.3	15	14.24	16	15.5	16
KLB	21.71	3	31.53	3	3	3
LVP	18.67	6	29.85	4	5	5
MSB	7.03	27	8.76	28	27.5	27.5
MDB	39.55	1	86.05	1	1	1
MHB	6.22	30	7.97	29	29.5	30
MB	8.45	19	10.92	20	19.5	20
NAB	16.37	7	23.64	7	7	7
NCB	11.05	14	14.81	13	13.5	13
OCB	7.1	26	7.95	30	28	29
OB	15.14	8	20.63	8	8	8
PGB	14.1	10	17.07	12	11	11
STB	10.09	16	14.7	14	15	15
SGB	20.35	4	28.11	6	5	5
SCB	7.7	24	10.4	22	23	23
SEA	11.16	13	14.26	15	14	14
SHB	9.39	17	11.71	19	18	18
PNB	7.13	25	9.25	25	25	25
TCB	7.79	22	9.76	23	22.5	22
TPB	18.83	5	28.83	5	5	5
VIB	8.42	21	10.57	21	21	21
VAB	13.75	12	19.78	11	11.5	12
VCAPB	23.2	2	37.66	2	2	2
VCB	7.74	23	9.7	24	23.5	24
CTG	6.45	28	9.02	27	27.5	27.5
VPB	8.45	20	11.91	18	19	19

Notes: TETA, the ratio of total equity to total assets; TETD, the ratio of total equity to total

Appendix 2 Asset quality indicators for Vietnamese banks, 2008 -2013

	LLPTL		LLPII		TLTA			Group rank
	Average	Rank	Average	Rank	Average	Rank	Average rank	Ranking
	(%)		(%)		(%)			
ACB	1.02	6	19.27	8	45.35	11	8.33	6
ABB	1.66	27	26.86	21	46.51	12	20	22
BID	3.08	31	86.85	30	70.53	29	30	31
DAB	1.36	21	32.8	22	72.49	31	24.67	29
EIB	1.04	9	19.92	9	47.33	15	11	9
HDB	0.94	5	56.27	27	43.94	10	14	11
KLB	0.94	4	11.58	4	58.55	23	10.33	8
LVB	1.04	8	10.03	3	31.03	4	5	2.5
MSB	1.45	25	24.59	17	30.71	3	15	14
MDB	1.1	11	8.28	1	51.81	17	9.67	7
MHB	1.25	16	38.93	25	53.95	20	20.33	24.5
MB	1.7	28	22.04	15	42.74	7	16.67	15
NAB	0.76	1	16.89	7	43.63	9	5.67	4
NCB	1.17	14	26.01	20	53.46	19	17.67	18
OCB	1.34	20	25.15	18	36.35	5	14.33	12
OB	1.14	12	21.34	14	67.23	28	18	19
PGB	1.27	18	22.14	16	60.19	26	20	22
STB	1.05	10	20.33	10	58.57	24	14.67	13
SGB	1.27	17	21.13	13	71.73	30	20	22
SCB	1.42	23	57.82	28	54.46	21	24	27
SEA	1.86	29	33.46	24	28.37	2	18.33	20
SHB	1.25	15	33.31	23	46.86	13	17	16
PNB	1.44	24	94.63	31	52.81	18	24.33	28
TCB	1.39	22	20.7	11	40.43	6	13	10
TPB	1.03	7	9.61	2	26.38	1	3.33	1
VIB	1.48	26	25.47	19	48.76	16	20.33	24.5
VAB	1.32	19	40.61	26	58.82	25	23.33	26
VCAPB	0.88	2	14.82	5	43.29	8	5	2.5
VCB	2.87	30	67.2	29	56.25	22	27	30
CTG	1.15	13	20.92	12	64.7	27	17.33	17
VPB	0.94	3	15.51	6	47.31	14	7.67	5

Notes: LLPTL, the ratio of loan loss provision to total loans; LLPII, the ratio of loan loss provisions to net interest income; TLTA, the ratio of total loans to total assets.

Appendix 3 Management quality indicator for Vietnamese banks, 2008 -2013

	Average score[a]	Ranking
ACB	0.90	21
ABB	0.88	29
BID	0.95	6
DAB	0.92	16
EIB	0.96	1
HDB	0.88	27
KLB	0.90	25
LVB	0.91	19
MSB	0.94	12
MDB	0.94	8
MHB	0.82	31
MB	0.95	5
NAB	0.88	28
NCB	0.90	23
OCB	0.95	2
OB	0.94	10
PGB	0.91	18
STB	0.89	26
SGB	0.93	14
SCB	0.93	15
SEA	0.95	3
SHB	0.84	30
PNB	0.90	22
TCB	0.93	13
TPB	0.94	9
VIB	0.92	17
VAB	0.94	11
VCAPB	0.90	24
VCB	0.95	7
CTG	0.95	4
VPB	0.91	20

Note: [a] Average bias-corrected efficiency scores of banks over the period of 2008-2013 using bootstrap DEA under VRS assumption as suggested by Simar and Wilson (1998, 2000).

Appendix 4 Earnings ability indicators for Vietnamese banks, 2008 -2013

	ROAA Average (%)	Rank	ROAE Average (%)	Rank	NIM Average (%)	Rank	Group ranking Average rank	Ranking
ACB	1.04	23	16.74	10	3.49	11	14.67	16
ABB	1.19	18	8.22	23	4.01	6	15.67	17
BID	1.04	24	20.44	5	2.6	20	16.33	18
DAB	1.65	11	16.96	9	3.23	13	11	10
EIB	2.03	6	14.99	14	3.08	17	12.33	11.5
HD	1.07	22	11.73	18	1.83	29	23	25.5
KLB	2.47	4	11.61	19	5.1	3	8.67	6
LVB	3.01	2	15.01	13	4.4	4	6.33	3
MSB	1.17	19	18.54	6	2	28	17.67	19
MDB	3.16	1	9.82	21	7.2	1	7.67	5
MHB	0.22	31	4.32	30	2.12	24	28.33	28.5
MB	2.22	5	25.8	3	3.85	7	5	1
NAB	1.11	20	7.02	28	2.6	21	23	25.5
NCB	0.71	27	8.06	24	3.11	16	22.33	23
OCB	0.87	26	12.06	17	2.11	25	22.67	24
OB	1.6	13	10.26	20	4.02	5	12.67	13
PGB	2.02	8	14.82	15	3.84	8	10.33	9
STB	1.82	9	17.94	7	3.44	12	9.33	8
SGB	2.84	3	15.2	12	5.32	2	5.67	2
SCB	0.58	29	7.54	26	1.8	30	28.33	28.5
SEA	1.09	21	7.75	25	2.01	27	24.33	27
SHB	1.67	10	17.27	8	2.29	23	13.67	14
PNB	0.59	28	7.32	27	0.62	31	28.67	30
TCB	2.02	7	25.94	2	3.08	18	9	7
TPB	0.47	30	-2.16	31	2.05	26	29	31
VIB	0.87	25	12.79	16	3.15	14	18.33	21
VAB	1.22	17	9.13	22	2.35	22	20.33	22
VCAPB	1.44	15	6.32	29	3.5	10	18	20
VCB	1.57	14	21.53	4	2.65	19	12.33	11.5
CTG	1.62	12	26.87	1	3.77	9	7.33	4
VPB	1.33	16	15.7	11	3.14	15	14	15

Notes: ROAA, return on average total assets; ROAE, return on average total equity; NIM, net interest margin.

Appendix 5 Liquidity indicators for the Vietnamese banks, 2008- 2013

	LASTF		NLSTF		Group ranking	
	Average (%)	Rank	Average (%)	Rank	Average	Ranking
ACB	41.05	21	65.22	14	17.5	18
ABB	39.38	23	60.86	11	17	17
BID	37.35	24	96.14	29	26.5	28.5
DAB	27.94	28	95.87	28	28	30
EIB	50.10	14	66.25	15	14.5	12
HDB	52.71	11	59.88	10	10.5	10
KLB	41.72	20	81.95	23	21.5	21.5
LVB	81.03	2	43.13	5	3.5	3.5
MSB	71.58	4	37.69	3	3.5	3.5
MDB	70.75	5	115.84	31	18	19
MHB	52.46	12	68.76	19	15.5	14.5
MB	57.08	9	54.43	7	8	7
NAB	45.65	18	61.89	12	15	13
NCB	33.97	25	69.84	20	22.5	23.5
OCB	58.53	8	40.10	4	6	5
OB	29.06	27	89.38	26	26.5	28.5
PGB	40.73	22	71.46	21	21.5	21.5
STB	49.36	15	84.08	25	20	20
SGB	17.65	31	96.62	30	30.5	31
SCB	23.77	30	72.29	22	26	27
SEA	76.14	3	35.48	1	2	2
SHB	46.04	17	57.84	8	12.5	11
PNB	27.30	29	66.80	16	22.5	23.5
TCB	60.77	7	50.07	6	6.5	6
TPB	89.92	1	36.54	2	1.5	1
VIB	55.83	10	59.31	9	9.5	8.5
VAB	33.25	26	82.22	24	25	26
VCAPB	51.96	13	68.33	18	15.5	14.5
VCB	48.75	16	68.22	17	16.5	16
CTG	42.51	19	90.56	27	23	25
VPB	61.22	6	64.76	13	9.5	8.5

Notes: LASTF, the ratio of liquid assets to short-term funding, NLSTF, the ratio of net loan to short-term funding.

Appendix 6 Sensitivity to market risk indicator for Vietnamese banks, 2008 - 2013

	Cumulative gap	Ranking
ACB	24.11	11
ABB	23.85	13
BID	45.71	3
DAB	46.09	2
EIB	11.08	19
HDB	6.31	24
KLB	38.01	5
LVP	-1.56	27
MSB	-10.64	29
MDB	24.02	12
MHB	-5.01	28
MB	30.58	8
NAB	2.85	26
NCB	22.22	15
OCB	16.3	16
OB	27.23	9
PGB	25.72	10
STB	35.81	6
SGB	55.21	1
SCB	9.46	21
SEA	-18.27	31
SHB	15.41	18
PNB	7.82	23
TCB	16.26	17
TPB	-15.86	30
VIB	9.67	20
VAB	23.23	14
VCAPB	5.23	25
VCB	38.96	4
CTG	30.92	7
VPB	8.48	22

Notes: cumulative gap, the ratio of difference between rate sensitive assets and rate sensitive liabilities

to total assets

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