THE EFFICIENCY EFFECTS OF BANK MERGERS: AN ANALYSIS OF CASE STUDIES IN VIETNAM

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Abstract

This paper employs Data Envelopment Analysis to examine the relative efficiency for Vietnamese banks from 2008 to 2015. Efficiency level is relatively high and remains stable over the examined period, suggesting the banking system is less affected by the global financial crisis. More specifically, technical efficiency and scale efficiency in Vietnamese banking is examined when controlling for problem loans. We suggest that controlling for the exogenous impact of problem loans is important for joint-stock banks. Furthermore, our results do not support the hypothesis that acquiring banks are more efficient than the acquired banks. The efficiency improved in majority of merger cases and was not related to acquiring bank's efficiency advantage over its targets. Small-and medium- banks should be promoted in future acquisitions as a means to enjoying efficiency gains. Finally, there are mixed results on the extent to which the benefits of efficiency gains are passed on to the public.

1. INTRODUCTION

Vietnam is a rising economic star and considered as a next dragon in the Asia-Pacific region with the average GDP growth rate of 6.2% over the period 2006-2012 (World Bank 2016). Vietnamese banking system is crucial to certain fundamental aspects of the economy in terms of credit supply and plays an essential role to contributing to economic stability. The 1990 was a turning point when the Vietnamese banking system was transformed from a one-tier system in which State Bank of Vietnam (SBV) acted as both the central bank and a commercial bank, to a two-tier system where joint-stock commercial banks (JSCBs) and foreign banks (FBs) were allowed to coexist with state-owned commercial banks (SOCBs). Since then, banking reforms have been implemented under a gradual approach towards deregulation (Nguyen, Roca & Sharma 2014).

As a result of implementing banking reforms, bank size has significantly increased in recent years. Particularly, the size in 2010 was surged twice as much as that in 2007. Thus, Vietnam was ranked as second top out of ten countries with the highest asset growth of the banking sector in 2010 (Vietcombank Securities Company 2011). Also, the banking sector experienced a fast growing pace of credit and deposits over the period of 2007 to 2010. However, credit growth was much higher than that of deposits and GDP over the examined period, which may cause liquidity risk for the banking sector. Along with inefficient management of banks and the lax regulatory environment, non-performing loans (NPLs) rapidly arose due to the global financial crisis 2008-09 (Leung 2009). The Vietnamese Government (2012) thus, pronounced the 'Restructuring the credit institutions system in the period of 2011-2015' program with the main focus on bank mergers and acquisitions. The consolidation process should lead to restoring not only an intermediary function of banks but also an improvement in the efficient allocation of credits in the economy.

In contrast to the expectation of bankers and regulators, the prior studies on the impact of bank mergers indicate mixed results about benefits of mergers to merging banks or the public (DeYoung, Evanoff & Molyneux 2009; Kolaric & Schiereck 2014). A situation is even less clear in Vietnam due to the small market and the difficulty in conducting empirical study with small sample size. This necessitates conducting an empirical research on the effect of mergers on bank efficiency in Vietnam. Indeed, changes in the scale and in the organisational and market structure of the banking industry, especially when M&As activities take place in Vietnam would have critical implications on the evolution of financial markets as well as the economy as a whole.

Our paper makes several contributions on the literature on the effect of mergers on banking efficiency in Vietnam. First, the literature is dominated by studies from US and European markers while empirical evidence of bank mergers in emerging markets is scanty. Our study contributes to the literature by providing evidence on whether bank mergers would lead to technical efficiency gains. Second, we include an additional output to reflect the fact that banks have been diversifying, at the margin, away from traditional financial intermediation business and into off-balance sheet (OBS) and fee income-generating business. In contrast to Nguyen and Simioni (2015), the nominal value of OBS is used in our study rather than total operating income as a proxy for OBS because that measure may overestimate the amount of OBS.

Third, this is the first study to examine the effect of 'actual' mergers on technical efficiency of Vietnamese banks by using Data Envelopment Analysis (DEA). More specifically, we examine the size-efficiency relationship for banks for year 2008, thus providing some predictions on whether efficiency gains would be resulted from future bank acquisitions, particularly with the participation of state-owned banks. Finally, this study includes the latest banking data from 2008 to 2015 where a significant change in the Vietnamese banking sector, especially consolidation of banks has been undertaken. More importantly, a comparison between overall efficiencies and market shares would provide an answer for the continuing debate on public benefits of mergers often engaged in by policy makers such as the State Bank of Vietnam (SBV), the members of the Ministry of Finance in Vietnam.

The paper is structured as follows. Section 2 presents literature review on bank merger. Section 3 proposes a detailed description of methodological approach and data used in our study. Section 4 shows the empirical results derived. Finally, section 5 concludes the paper.

2. LITERATURE REVIEW

Over the last decades, a large number of studies have been searching on the effect of mergers in the banking industry. The literature in this field is divided into two main strands (Aggarwal, Akhigbe & McNulty 2006). The first strand uses event study methodology to investigate the stock or bond market reaction to mergers announcements. In Vietnam, the small size of the equity market and the limited number of listed banks make it extremely difficult to conduct an empirical study on the market reaction to M&A announcements (Vietcombank Securities Company 2011)[1]. Therefore, the present study focuses on the second strand studies that examine the operating efficiency gains from bank mergers and particular attention is given to studies of the Vietnamese banking sector.

The operating gains are stemming from the realisation of economies of scale and scope and transfer of assets control to better quality managers (Haynes & Thompson 1999). Simulation studies indicates mergers can produce significant cost savings when the acquiring bank's efficiency advantage over the target or closing overlapping branches (Rhoades 1993; Shaffer 1993). However, others suggest that the acquiring bank does not always maintain its pre-merger efficiency (Avkiran 1999) or it take time for the acquiring bank to integrate and improve performance (Lee, Liang & Huang 2013). Furthermore, DeYoung (1997) suggests that cost efficiency improved most often when both acquirer and acquired banks were relatively cost inefficiency. This implies that cost savings depend more on the opportunities facing management rather than the quality of that management.

In addition, the majority of studies on the impact of bank mergers fail to provide a clear relationship between M&As and performance and efficiency by using either accounting ratios or

frontier economic approach (Beccalli & Frantz 2009; DeYoung, Evanoff & Molyneux 2009). Several studies reported that bank mergers lead to efficiency gains (Akhavein, Berger & Humphrey 1997; Al-Khasawneh 2013; Figueira & Nellis 2009; Liu & Tripe 2003). However, others indicated the opposite results (Berger & Humphrey 1992; Montgomery, Harimaya & Takahashi 2014; Shih 2003).

Considerably less research attention has focused on examining mergers in the Vietnamese banking system. The first study to examine the efficiency effect of bank merger was conducted by Le (2016). He used a 4-step procedure of bootstrapped DEA to examine the effect of virtual bank mergers on technical efficiency of Vietnamese banks over the period of 2007 to 2011. He found that mergers between two efficient banks would not generate technical efficiency gains. More importantly, his findings suggest that mergers formed from joint-stock commercial banks should be promoted in future acquisitions. In contrast, our paper evaluates the effect of actual mergers on bank efficiency in Vietnam over the period of 2008 to 2015 by using DEA approach. In addition, we also investigate whether operating efficiency gains are passed on to the public.

3. METHODOLOGY AND DATA

3.1. Measuring Bank Efficiency

While mergers have some limited potential to increase performance through scale and scope economies, whether these gains are captured depends on controlling technical inefficiency (Haynes & Thompson 1999). The technical efficiency of a bank reflects the ability of managers to control costs and is measured by how close its costs are to those of fully efficient firm when the effects of scale, product mix and other exogenous variables, which may influence banking costs, are considered (Coelli et al. 2005).

The literature suggests that there is no consensus on the preferred method for determining the best practice frontier against which relative efficiencies are measured. The most common estimation techniques in the literature of bank efficiency are parametric (SFA) and non-parametric approaches (DEA)[2].

DEA method is preferred for the present study rather than SFA because of the following reasons. Firstly, this is due to the availability of data and contextual information. SFA requires the specification of a cost function, thus, requiring data on input prices. Unfortunately, the data on the number of employees is not available while data on the costs of the labour input is available for Vietnamese banks. Therefore, it is impossible to produce an accurate measure of the labour input price. Furthermore, SFA produces measures of X-efficiency, which is composed of both technical and allocative efficiency while the primary focus of the present study is on the technical efficiency. Clearly, the accuracy measurement of SFA may be

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[1] Until 2011, only 8 commercial banks were listed in the Vietnamese stock market.

[2] The advantages and disadvantages of parametric and non-parametric approaches are comprehensively discussed in Berger and Humphrey (1997); Drake and Hall (2003).

compromised by the lack of accurate input price data for labour.

Secondly, DEA can be used with small sample sizes while SFA generally requires large data set to provide a good picture of analysis (Evanoff & Israilevich 1991). In addition, Sathye (2003) suggested that DEA is sensitive to the choice of input-output variables. This is an advantage of the technique as it reveals which of the input-output variables need to be closely monitored by bank management to improve efficiency. Hence, information on peer group is relatively useful for managerial purposes because bank managers could enhance their bank's efficiency by learning from their more efficient counterparts.

Thirdly, the issue of functional form dependence in respect of SFA is particularly pertinent in the context of the present study, given the wide diversity across the banking institutions in Vietnam in respect of business mix. Mester (1997) emphasises that the failure to adequately take account of bank heterogeneity can lead to calculate bank cost efficiency inaccurately. In contrast, DEA imposes very little structure on the efficiency frontier and does not require the maintained assumption that all firms face the same unknown production technology (Drake & Hall 2003). When a comprehensive set of specified inputs and outputs is provided, DEA simply requires the existence of an input/output correspondence to produce relative efficiency measurements.

Fourthly, SFA allows for random error, the decomposition of the combined error term into the random error and inefficiency components requires an assumption concerning the appropriate distribution of the latter. Any distributional assumptions simply imposed without basis in fact are quite biased thus, resulting in significant error in calculating each firm's efficiencies (Bauer et al. 1998). In contrast, DEA assumes no random error, implying that all deviations from the estimated efficient frontier actually constitute X-inefficiencies (Resti 1997).

3.2. Economic Model of Efficiency Measurement

The variable returns to scale (VRS) in DEA is adopted in our study[3].

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: $\Psi = \{(x,y)|x \in R_+^p, y \in R_+^q, (x,y) \text{ is feasible}\}$

Where x and y are additional input and output vectors and feasibility implies that the bank under consideration can obtain output quantities given the input quantities. Thus, the input requirement set is defined as $C(y) = \{x \in R_+^p|(x,y) \in \Psi\}$

Therefore, the production set Ψ of a bank can be defined as $\Psi = \{(x,y)|x \in C(y), y \in R_+^q\}$

According to Farrell (1957), the efficient boundaries of Ψ in the input space can be

determined as $\partial C(y) = \{x|x \in C(y), \theta x \notin C(y), \forall \theta, 0 < \theta < 1\}$
$\theta(x_0, y_0) = \inf\{\theta|\theta x_0 \in C(y_0)\} = \inf\{\theta|(\theta x_0, y_0) \in \Psi\}$

Then, the DEA estimator under VRS assumption as suggested by Banker, Charnes and Cooper (1984) is defined as $\hat{\theta}_{DEA}(x_0, y_0) = \min\{\theta|y_0 \leq \sum_{i=1}^n \gamma_i Y_i; \theta x_0 \geq \sum_{i=1}^n \gamma_i X_i; \theta > 0; \sum_{i=1}^n \gamma_i = 1; \gamma_i \geq 0, i = 1, \ldots, n\}$

This equation measures the input-oriented efficiency level $\hat{\theta}_{DEA}(x_0, y_0)$ of banks and is obtained by calculating the radial distance between (x_0, y_0) and $(\hat{x}^\partial(x_0|y_0, y_0))$. Therefore, the level of the inputs that the bank should reach to lie on the efficient boundary with the same level of output and the same proportion of inputs is indicated by $(\hat{x}^\partial(x_0|y_0)$. In another word, $\hat{x}^\partial(x_0|y_0) = \hat{\theta}(x_0, y_0) x_0$

According to Farrell (1957) definition, the $\hat{\theta}_{DEA}(x_0, y_0)$ will be bounded by zero and one. The value of 1 indicates the bank is technically efficient because it is able to operate on the boundary of its production set.

3.3. Case Study Approach

Earlier studies on the efficiency effects of bank mergers used a cross-section analysis. That type of analysis typically includes a relatively larger number of mergers and the use of a statistical model. The great advocate of the cross-section approach is that it allows statistical tests that control for various other influences on merger performance, thus leading to statistically valid generalisations. However, Rhoades (1998, p. 276) argued that 'this methodology may be not adequately capturing industry-specific or firm-specific idiosyncrasies have resulted in the re-emergence of the analysis of particular industries or firms in industrial organisation.'

Due to the limited number of observations, case studies do not permit statistically valid generalisations. Nonetheless, the case study approach may provide insights into firm behaviour and performance that cannot be captured in a cross-section methodology since a case study may employ a wide range of data and institutional detail from sources that may be unique to a firm.

For the merger cases identified in this study, the relative efficiencies of the acquiring bank and the target bank were observed for a period of two years prior to the merger and that of the newly-combined banks for three years following the merger (Ralston, Wright & Garden 2001; Rhoades 1998). Three bank mergers cases are used as follows:

Case 1: The consolidation of Saigon Commercial Joint Stock Bank (SCB), First Joint Stock Commercial Bank (FicomBank) and Vietnam Tin Nghia Commercial Joint Stock Bank (TinNghiaBank) on 26th December 2011

Case 2: Hanoi Building Joint Stock Commercial Bank (HabuBank) was acquired by Saigon-Hanoi Commercial Joint Stock Bank (SHB) on 7th August 2012

Case 3: Dai A Joint Stock Commercial Bank (DaiABank) merged with Ho Chi Minh Development Joint Stock Commercial Bank (HDBANK) on 23rd November 2013. Due to the unavailability of data,

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[3] Coelli et al. (2005) suggested that the CRS assumption is only appropriate when all DMU's are operating at an optimal scale. In fact, imperfect competition, constraints on finance would cause a DMU to be not operating at optimal scale. The use of the CRS specification when not all DMU's are operating at the optimal scale will result in measures of technical efficiency (TE) which are confounded by scale efficiencies (SE). The use of the VRS specification will permit the calculation of TE devoid of these SE effects

the effect of mergers on efficiency of merged bank can only observed in two years following the merger.

3.4. Determining the Extent Efficiency Gains Are Passed on to the Public

The extent to which operating efficiency are delivered to the public following a merger is evaluated by using the change in market share. This assumes that if the price of banking and quality of services improves as a result of operating efficiencies, then it is reasonable to expect the market share of newly-combined bank to increase. This change in market share is measured by the annual per cent change in the merged banks' share of total deposits in the market in the three years after merger (Avkiran 1999).

3.5. Data

In our analysis, we focus on only Vietnamese commercial banks from the period of 2008 to 2015. We exclude from our analysis foreign and joint-venture banks as they were much more restricted in bank entry and banking activities than domestic commercial banks. Due to the data sample must be homogeneous when using DEA for assessing efficiency, this exclusion ensures maximum feasible comparability among banks. After accounting for missing data, unbalanced panel data of banks is presented in Table 1.

It is commonly acknowledged that the choice of variables in studies of banking efficiency significantly affects the results. Two approaches dominate the literature including the production approach and the intermediation approach. Berger and Humphrey (1997) proposed some issues related to the production approach as 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. Hence, this approach 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.

Alternatively, this study adopts the intermediation approach in which banks are seen as 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 Nguyen and Simioni (2015) and Casu and Girardone (2005), the inputs used in the calculation of the various efficiency measures consist of operating expenses, physical capital and loanable funds. The outputs variables capture both traditional lending activity of banks (total loans) and the growing non-lending activities (securities). The nominal value of off-balance sheet items is also included as a third output. Given the sample of 35 banks, a 3x3 set has been used in this study which is consistent with DEA literature. This suggests that sample size should be at least three times larger than the sum of inputs and outputs to discriminate between the units (Dyson et al. 2001; Nunamaker 1988).

More specifically, this third proxy is used to reflect the fact that Vietnamese banks have been diversifying, at the margin, away from traditional financial intermediation business and into off-balance sheet (OBS) and fee income-generating business. Clark and Siems (2002) proposed three measures of a bank's aggregate OBS including the total credit equivalent amount of OBS transactions according to Basle guidelines, an aggregate measure of asset equivalent and the non-interest income. 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. The last measure may overestimate the amount of OBS because fees and commissions are also drawn from on-balance sheet activities (Clark & Siems 2002). Therefore, the nominal value of OBS is utilised as an output measure, along with the nominal value of loans and other earning assets. Table 2 shows substantial variation in the financial characteristics of the sample banks.

Furthermore, it may be important to account for risk and lending quality in the investigation of bank efficiency, especially in the context of Vietnamese banking. Whether these factors should be controlled for in efficiency estimates is an ongoing debate (Berger & Humphrey 1997). In the context of DEA, the impact of problem loans is seen as an additional uncontrollable input within the DEA model and the provisions for loan losses is used as an indicator of the extent of problem loans (Drake & Hall 2003). However, this input should not be modelled as a choice input, but as an uncontrollable input reflecting the exogenous impact of problem loans.

Table 1. Changes in membership of study sample (asterisk represents presence of banks in that year)

Commercial Banks in Vietnam	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*
Asia Commercial Bank	*	*	*	*	*	*	*	*
An Binh Commercial Joint stock Bank	*	*	*	*	*	*	*	*
Bank for Investment and Development of Vietnam	*	*	*	*	*	*	*	*
Dai A Joint Stock Commercial Bank [c]	*	*	*	*	*			
Dong A Commercial Joint Stock Bank	*	*	*	*	*	*	*	
Export Import Commercial Joint Stock Bank	*	*	*	*	*	*	*	*
First Joint Stock Commercial Bank [a]	*	*	*					
Hanoi Building Joint Stock Commercial Bank [b]	*	*	*	*				
Ho Chi Minh Development Joint Stock Commercial Bank [c]	*	*	*	*	*	*	*	*
Kien Long Commercial Joint Stock Bank	*	*	*	*	*	*	*	*
LienViet Post Commercial Joint Stock Bank	*	*	*	*	*	*	*	*
Maritime Commercial Joint Stock Bank	*	*	*	*	*	*	*	*
Mekong Development Joint Stock Commercial Bank	*	*	*	*	*	*	*	
Housing Bank of Mekong Delta	*	*	*	*	*	*	*	
Military Commercial Joint Stock Bank	*	*	*	*	*	*	*	*
Nam A Commercial Joint Stock Bank	*	*	*	*	*	*	*	*
Nam Viet Commercial Joint Stock Bank	*	*	*	*	*	*	*	*
Ocean Commercial Joint Stock Bank	*	*	*	*	*	*		
Orient Commercial Joint Stock Bank	*	*	*	*	*	*	*	*
Petrolimex Group Commercial Joint Stock Bank	*	*	*	*	*	*	*	*
Sai Gon Thuong Tin Joint Stock Commercial Bank	*	*	*	*	*	*	*	*
Saigon Bank for Industry and Trade	*	*	*	*	*	*	*	*
Saigon Commercial Joint Stock Bank [a]	*	*	*	*	*	*	*	*
Southeast Asia Commercial Joint Stock Bank	*	*	*	*	*	*	*	*
Saigon-Hanoi Commercial Joint Stock Bank [b]	*	*	*	*	*	*	*	*
Southern Commercial Joint Stock Bank	*	*	*	*	*	*		
Vietnam Technological and Commercial Joint Stock Bank	*	*	*	*	*	*	*	*
TienPhong Commercial Joint Stock Bank	*	*	*	*	*	*	*	*
Vietnam Tin Nghia Commercial Joint Stock Bank[a]	*	*	*					
Vietnam International Commercial Joint Stock Bank	*	*	*	*	*	*	*	*
Viet A Joint Stock Commercial Bank	*	*	*	*	*	*	*	*
Viet Capital Bank	*	*	*	*	*	*	*	*
Joint Stock Commercial Bank for Foreign Trade of Vietnam	*	*	*	*	*	*	*	*
Vietnam Bank for Industry and Trade	*	*	*	*	*	*	*	*
Vietnam Prosperity Commercial Joint Stock Bank	*	*	*	*	*	*	*	*

Notes: [a] The consolidation of SCB, FicomBank and TinNghiaBank on 26/12/2011, [b] HabuBank acquired by SHB on 7/8/2012, [c] DaiABank merged with HDBank on 23/11/2013.

Table 2. Descriptive statistics of inputs and outputs (VND million)

Variables	*Mean*	*Std*	*Min*	*Max*
Inputs				
Operating expenses	1620172.68	1949815.26	209520.13	8253516.75
Physical capital	1271734.67	1446084.92	66150.13	5305536.63
Loanable funds	86954115.19	103709266.83	4612199.88	392491072.13
Outputs				
Nominal value of total loans	59450265.52	84499387.69	3711829.63	336324927.13
Other earning assets	38027507.26	42768493.79	2387426.50	168509299.38
Nominal value of OBS	13660399.37	23537484.82	16790.88	93948220.88

Sources: Annual reports of 35 Vietnamese commercial banks in the period of 2008 to 2015.

4. RESULTS AND ANALYSIS

4.1. Technical Efficiency of Vietnamese Banks for Year 2008

Table 3 presents the estimated efficiency scores produced by an input-oriented model under VRS assumption. The overall results indicate that average efficiency level of the Vietnamese banking system is 94% in 2008 (i.e. banks can reduce costs by 6% to achieve world best practice).

Table 3. Efficiency estimates of the Vietnamese banks for 2008

Banks	*OTE*	*PTE*	*SE*
Asia Commercial Bank	0.90	1.00	0.90
An Binh Commercial Joint stock Bank	1.00	1.00	1.00
Bank for Investment and Development of Vietnam	1.00	1.00	1.00
Dai A Joint Stock Commercial Bank	0.99	1.00	0.99
Dong A Commercial Joint Stock Bank	0.91	1.00	0.91
Export Import Commercial Joint Stock Bank	0.95	1.00	0.95
First Joint Stock Commercial Bank	1.00	1.00	1.00
Hanoi Building Joint Stock Commercial Bank	0.98	0.99	1.00
Ho Chi Minh Development Joint Stock Commercial Bank	0.94	1.00	0.94
Kien Long Commercial Joint Stock Bank	1.00	1.00	1.00
LienViet Post Commercial Joint Stock Bank	1.00	1.00	1.00
Maritime Commercial Joint Stock Bank	1.00	1.00	1.00
Mekong Development Joint Stock Commercial Bank	0.92	1.00	0.92
Housing Bank of Mekong Delta	0.91	0.94	0.96
Military Commercial Joint Stock Bank	1.00	1.00	1.00
Nam A Commercial Joint Stock Bank	0.75	0.81	0.93
Nam Viet Commercial Joint Stock Bank	0.82	0.83	0.99
Ocean Commercial Joint Stock Bank	1.00	1.00	1.00
Orient Commercial Joint Stock Bank	0.92	1.00	0.92
Petrolimex Group Commercial Joint Stock Bank	0.85	0.89	0.96
Sai Gon Thuong Tin Joint Stock Commercial Bank	0.79	0.83	0.96
Saigon Bank for Industry and Trade	0.81	0.91	0.89
Saigon Commercial Joint Stock Bank	0.81	1.00	0.81
Southeast Asia Commercial Joint Stock Bank	1.00	1.00	1.00
Saigon-Hanoi Commercial Joint Stock Bank	0.80	0.83	0.96
Southern Commercial Joint Stock Bank	0.67	0.72	0.92
Vietnam Technological and Commercial Joint Stock Bank	0.91	0.94	0.96
TienPhong Commercial Joint Stock Bank	1.00	1.00	1.00
Vietnam Tin Nghia Commercial Joint Stock Bank	1.00	1.00	1.00
Vietnam International Commercial Joint Stock Bank	0.83	0.86	0.97
Viet A Joint Stock Commercial Bank	0.70	0.77	0.90
Viet Capital Bank	0.79	0.80	0.98
Joint Stock Commercial Bank for Foreign Trade of Vietnam	1.00	1.00	1.00
Vietnam Bank for Industry and Trade	1.00	1.00	1.00
Vietnam Prosperity Commercial Joint Stock Bank	0.80	0.87	0.92
Mean	0.91	0.94	0.96
STD	0.10	0.08	0.04
Min	0.67	0.72	0.81
Max	1.00	1.00	1.00

Notes: OTE= over technical efficiency; PTE= pure technical efficiency; SE=scale efficiency, OTE=PTE*SE

4.1.1 Controlling for problem loans

Having established the basic DEA results, our study analyses the potential impact of risk and problem loans on Vietnamese banking efficiency for year 2008[4]. The results are obtained by modifying the initial DEA model to incorporate an additional (but discretionary) input in the form of provisions for loan losses.

In order to facilitate the subsequent analysis of the size-efficiency relationship in Vietnamese banking, the sample is divided into 4 size classes as measured by bank total assets in 2008. The size groups are as follows, where all the data is expressed in VND billion:

Table 4. The size groups

	Total Assets Range	*No of Banks*
Group 1	0-20,000	18
Group 2	20,001-50,000	11
Group 3	50,001-100,000	2
Group 4	above 100,000	4

Table 5 indicates that the pure technical efficiency (PTE) estimates are much more sensitive than the scale efficiency estimates when accounting for risk factors. In addition, this appears that the impact is fairly minimal for the largest banks but relatively substantial for smaller banks. For the Group 1 and Group 2, for instance, the mean PTE levels increase from 94% to 98% and from 0.94% to 98%, respectively. In the case of Group 3 (the worst performing group according to the initial results), the mean PTE score increases from 89% to 100%. This suggests that joint-stock commercial banks in Vietnam appear to be exposed to the exogenous impact of problem loans than their counterparts.

Finally, notwithstanding the favourable impact of controlling for problem loans on the efficiency of smaller Vietnamese banks, it remains that the state-owned commercial banks (Group 4) exhibit the lowest levels of technical inefficiency. It follows from this, however, these banks also have the least to gain, in terms of potential efficiency gains from mergers. Similarly, Le (2016) found that virtual bank mergers formed from state-owned commercial banks are less efficient than that formed by their counterparts.

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[4] It is worth noting that the main purpose of our study is to examine the efficiency effect of bank mergers. The analysis of controlling risk aims to provide prediction of future mergers, especially with the participation of state-owned banks. Thus, the results of efficiency scores based on modified models for 2009-2015 are not reported here.

Table 5. Mean efficiency levels before and after controlling for problem loans for year 2008

Size Group	OTE[d]	PTE[d]	SE[d]	OTE	PTE	SE
Group 1	0.94	0.98	0.95	0.90	0.94	0.96
Group 2	0.91	0.98	0.93	0.90	0.94	0.95
Group 3	0.98	1.00	0.98	0.85	0.89	0.96
Group 4	0.98	1.00	0.98	0.98	1.00	0.98

Notes: [d] The overall efficiency, pure technical efficiency and scale efficiency scores are computed based on the modified DEA after incorporating loan loss provisions as an additional input

4.2. Efficiency Level in Vietnamese Banking over the Period of 2008 to 2015

Table 6 shows the descriptive statistics of efficiency scores over the examined period. The results reveal that efficiency level of the Vietnamese banking sector is relatively high (96%) and remains constant over all years, with low standard deviations (0.07). This suggests the Vietnamese banking is less affected by the recent global financial crisis. The well performance of the banking system could be attributed to the maintaining a state direction in banking sector via regulatory restrictions and state-owned commercial banks.

Table 6. Descriptive statistics of the efficiency scores for the period from 2008 to 2015

Years	2008	2009	2010	2011	2012	2013	2014	2015	2008-2015
Mean	0.94	0.94	0.97	0.96	0.95	0.95	0.96	0.97	0.96
Std	0.09	0.08	0.05	0.06	0.06	0.07	0.06	0.05	0.07
Min	0.72	0.72	0.82	0.79	0.79	0.78	0.79	0.80	0.78
Max	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Notes: The efficiency scores are estimated following the basic DEA model under VRS assumption

4.3. The Analysis of Bank Merger Cases

Based on the prediction of the analysis of size-efficiency relationship in 2008, we investigate whether bank mergers between joint-stock commercial would result in efficiency gains.

Q1: Is there any evidence to suggest that the acquiring banks are more efficient than the target banks? Whether or not the acquiring banks maintain its pre-merger efficiency?

Table 7 summarises the DEA scores under VRS assumption for the three merger cases identified under research design. This appears that none of examined merger cases lend to support the hypothesis that acquiring banks are more efficient than the acquired banks. This is consistent with the finding of Wu (2008).

In addition, acquiring banks in three cases are not or at least as efficient as the target banks but have higher efficiency in the post-merger years. This conflicts somewhat with findings of Berger and Humphrey (1992), suggesting that benefits are most likely to achieve from mergers when the greater managerial efficiency of the acquirer is able to be transferred to the target following merger.

More analytically, there was a slight decline in technical efficiency beginning in the year prior to merger, but improving their efficiency in subsequent years. This is consistent with the findings of Avkiran (1999). In the same vein, Lee, Liang and Huang (2013) found that the cost-inefficiency for most acquiring banks increases after the first year of merger. Therefore, it would take time for the acquirers to integrate and improve performance. This finding is also consistent with early suggestion of DeYoung (1997) and Rhoades (1998), indicating that cost savings depends on opportunities facing management than the quality of that management.

Table 7. Relative efficiency scores (%) for two-year pre-merger and three-year post-merger based on the initial model

Case Merger No	Acquiring bank	Year	Target bank	
	SCB		FicomBank	TinNghiaBank
	1	2009	1	1
	0.90	2010	1	1
1	1	2011[e]	n.a.	n.a.
	0.85	2012	n.a.	n.a.
	0.96	2013	n.a.	n.a.
	1	2014	n.a.	n.a.
	SHB		HabuBank	
	0.86	2010	0.97	
	0.87	2011	1	
2	0.87	2012	n.a.	
	0.93	2013	n.a.	
	1	2014	n.a.	
	1	2015	n.a.	
	HDBank		DaiABank	
	0.81	2011	0.97	
	0.82	2012	0.91	
3	0.94	2013	n.a.	
	0.93	2014	n.a.	
	0.96	2015	n.a.	

Notes: [e] The year of merger is shown in italics throughout the table

Q2: What merger cases produce the best outcome as measured by technical efficiency and scale efficiency?

This study defines successful (unsuccessful) mergers as those where there is an increase (decrease) in efficiency scores from pre- to post-merger and the three year average increase (decrease) in efficiency from pre- to post-merger is greater than 0. The change in efficiency scores from pre- to post-merger is classified as an increase (decrease) if the two or more of the post-merger scores are higher (lower) than the pre-merger scores. The last column of Table 8 shows a scale efficiency

gains in the first two cases. This finding is consistent with the finding of Le (2016) and Minh, Long and Hung (2013), suggesting that the larger the bank is, the more efficient the bank will be, purely because of the economies of scale. Hauner (2005) explained the positive relationship between the size and efficiency could be by firstly large banks should pay less for their inputs if it related to market power. Secondly, there may be by increasing returns to scale through the allocation of fixed costs over a higher volume of services or from efficiency gains from a specialised workforce.

Table 8. SE scores for merging banks and successful (unsuccessful) mergers

| Merger No | Year of merger | SE one year prior to merger | Post-merger SE | | | Overall change in SE from pre- to post-merger | ΔSEFF |
			one year after merger	Two years after merger	Three years after merger		
1	2011	0.99	1	0.99	1	Increase	0.01
2	2012	0.95	1	1	1	Increase	0.05
3	2013	0.99	*0.96*	0.99	n.a.	n.a.	n.a.

Notes: The pre-merger SE score is the combined SE score of the acquired and acquiring banks weighted by their asset size. SE score in post-merger years that are lower than the pre-merger SE score are shown in italics.

More analytically, Table 9 shows an ex-post change in technical efficiency of the newly-combined bank in Case 1 is negative. This could be due to the managerial inefficiency suggested by Das and Ghosh (2006), asserting that the more branches the bank

has, the less technical efficiency of that bank is. Case 1 was the consolidation of three banks, thus merged bank may not have managerial capacity to address the new merged entity and realise these effects.

Table 9. TE scores for merging banks and successful (unsuccessful) mergers

| Merger No | Year of merger | TE one year prior to merger | *Post-merger TE* | | | Overall change in TE from pre- to post-merger | ΔTEFF |
			One year after merger	Two years after merger	Three years after merger		
1	2011	0.95	*0.85*	0.96	1	Increase	-0.01
2	2012	0.92	0.93	1	1	Increase	0.06
3	2013	0.84	0.93	0.96	NA	Increase	n.a.

Notes: The pre-merger TE score is the combined TE score of the acquired and acquiring banks weighted by their asset size. TE scores in the post-merger years that are lower than the pre-merger TE score are shown in italics.

The extent to which operating efficiencies are passed on to the public is measured by the change in market share of deposits for the newly-combined banks. This measure assumes a positive relationship between change in market share and change in overall operating efficiency when the benefits of

operating efficiency gains are actually delivered to the public (Avkiran 1999). Table 10 displays mixed results. Case 1 and Case 3 appear to support the contention of a positive correlation, whereas Case 2 does not.

Table 10. Overall efficiency and market share of deposits in the three years following merger

	Total deposits in the market starting in the year of merger (VND million)	Merged banks' deposits for three years following merger (VND million)	Change in merged banks' share of total deposits in market (%)	Change in overall operating efficiency for merged banks[f] (%)
Case 1: The consolidation of SCB, FicomBank and TinNghiaBank	1733763479	58633444		
	2147865657	79192921	9.02	72.5
	2612809391	147098061	52.69	0.6
	3060210801	198505149	15.22	-21.57
Case 2: SHB takes over HabuBank	2147865657	77598520		
	2612809391	90761017	-3.85	39.92
	3060210801	123227619	15.92	-30.08
	3544502729	148828876	4.27	0.19
Case 3: HDBank merges with DaiABank	2612809391	62383934		
	3060210801	65411576	-10.48	-8.85
	3544502729	74542719	-1.61	-8.46

Notes: [f] the overall operating efficiency is measured by the ratio of non-interest expense to operating income

The mixed findings could be due to the variable change in share of deposit is not a good proxy to measure whether operating efficiencies are passed on to the public. This measure assumes the price of

banking and quality of services enhances as a result of gains in operating efficiency. However, this underlying assumption does not always hold. Avkiran (1999) suggested that a decline in operating

efficiency does not always result in a reduction in price of banking and quality of services. Another possible explanation is that increased market power following a merger. The consolidated bank would be less incentive to pass on to the public any operating efficiency in the form of better prices and enhanced services. None of bank merger cases in Table 9 are formed by large banks. That is, there is no evidence of a market concentration that can be considered as a monopoly. Nonetheless, the 'Big Four' banks in Vietnam have been participated in mergers at the end of 2015, thus the impact of 'too big to fail' needs to be examined in future research.

CONCLUSION

Data Envelopment Analysis is adopted in our study to evaluate the efficiency level of Vietnamese banks over the period of 2008 to 2015. Mean efficiency scores from the initial model indicate that efficiency level of the Vietnamese banking sector is relatively high and remains constant over the examined years. This suggests that the Vietnamese banking system is less affected by the global financial crisis.

Furthermore, controlling for the impact of problem loans is potentially very important since it produced significantly changes in both scale and technical efficiency results for year 2008. Specifically, technical efficiency levels were found to improve for joint-stock commercial banks. In addition, it appears that the state-owned commercial banks exhibit the lowest levels of technical inefficiency. Thus, these banks have the least to gain, in terms of potential efficiency gains from mergers. This suggests the policy-makers should be cautious for promoting future bank mergers between state-owned banks with other banks.

In addition, the findings are not consistent with the traditional merger theory suggesting that in which well-managed acquirers improve the performance of poorly managed targets. Three merger cases shows the acquiring banks are not or at least as efficient as the target banks and also technical efficiency gains following three years merger. This is consistent with the findings of DeYoung (1997), suggesting that cost savings depend more on opportunities facing management than the quality of that management. More importantly, the finding suggests mergers between joint-stock commercial banks should be promoted in the future as a means to enjoy efficiency gains since the banking system is characterised by number of small banks.

Lastly, there is mixed evidence on the extent to which the benefits of efficiency gains are passed on to the public. Only two cases support the view that change in market share and change in overall operating efficiency are positively correlated. Thus, this implies that the consolidated bank would be less incentive to pass on to the public any operating efficiency in the form of better prices and enhanced services.

The study has some limitations. One of the main pitfalls of DEA formulations that is unable to conduct statistical inference. Therefore, a bootstrap in DEA should be used to estimate efficiency scores of DMUs in the sample (Simar & Wilson 1998; Simar & Wilson 2000). Furthermore, the present study only examines the effect of bank mergers on technical

efficiency. Some may argue that profit efficiency is more appropriate for the investigation of mergers since outputs typically change significantly subsequent to a merger. Future research needs take into account of this perspective. In addition, due to the limitation of this measure of the change in market share of deposits for the newly-combined banks in the present study, it is crucial to conduct further research on whether the public benefits from gains in operating efficiencies by using different measures (i.e. loan pricing).

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