
Profit and Cost Efficiency Analysis in Banking Sector: A Case of Stochastic Frontier Approach for Vietnam

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By using stochastic frontier analysis (SFA) approach to measure the cost and profit efficiency for data of 45 Vietnam commercial banks over the years from 2007 to 2012, this paper highlights risk and asset quality factors related to cost and profit inefficiency of the banks. Besides, cost inefficiency seems to be strongly related to bank concentration, mergers, and bank ownership. These results suggested mergers and acquisition can gain potential cost inefficiency and foster banks' competition in the banking system. Based on test of variance analysis, State owned commercial banks (SCOB) is more efficiency than other domestic, commercial banks (JSCB) and foreign banks in terms of profit efficiency, in contrast to cost efficiency, international banks are leading in cost efficiency than other national banks.

Keywords: *Cost efficiency, profit efficiency, stochastic frontier analysis, market concentration, mergers and acquisitions, non-performing loans, risks and asset quality.*

Introduction

The trend of financial liberalization and banking reforms, restructuring via merging and acquisitions activities strongly happened in developing countries due to two main biggest financial crises in 1997 and 2008. Vietnam has similar evolution as other regional countries, but it becomes the

interesting case study when the country was noticed by its achievement through overcoming successfully over these difficult times. Some evidences show Vietnam's economic growth was partial supported from the huge expansion of bank credit. Specifically, in 2001, domestic credit was from 35 per cent of GDP which had rocketed to 120 per cent by 2010 and 2012 still moving around 104.9 %. This point is a positive sign for Vietnam economy.

However, there are some arising problems to prove that Vietnam commercial banks are operating in challenging environment. First, their performance based on encouraging banking imprudent lending led to unsustainable credit growth of 32–54 per cent per year before 2011. A deposit credit rate slumps to 7 % which contributing to a drop in GDP growth to 5.03 per cent in 2012 due to lacking trusts among borrowers and investors [1]. In addition, Vietnamese banking sector also reflexes the notable weaknesses during the progress of banking reform. Since Non-performing loans (NPL) figures which measure for bad debts officially estimated at around 6–8 per cent of bank assets, and many international reports discussed about the transparencies of data. A the topic of how Vietnam can control Non-performing loan issue and remain it not to be high in the future was discussed by international conferences in East Asia region in recent years. What is more, Overbanked is also a problem, at the end of 2010 to 2011, Prime minister mandate the State bank of Vietnam (SBV) should try to have 15-17 banks by 2015. After Decision 254, the Bank enforces mergers of five financial institutions. Until now, there is very little progress, just consolidation of two banks or 4 banks into 2 other banks.

In Vietnam, total costs of the Vietnamese banking industry increased on average by 32.2 per cent per year during 2000–2006. However, Vu & Turnell, (2010) [2] found in their research, cost efficiency is around 87% of the total cost and insignificant difference among bank types. And with profit efficiency, Vu & Nahm (2013)[3] suggested that Vietnam banks' profit efficiency can be increased based on focusing on regulations from government, reduction of NPLs and cost-to-asset ratios. They found state-owned banks in Vietnam are more profit efficient than private banks on average, and domestic banks are less efficient than foreign banks in the period of 2000 – 2006. Besides, there is a few national research of banking efficiency with appropriate methodologies in Vietnam. From these facts above, whether the Vietnam banking system is healthy industry and efficient to support Vietnam economy? How Vietnamese Banks's profit and cost

efficiency change after 2008 Global Financial Crisis? What the difference between cost efficiency and profit efficiency in relation to risk and quality asset and other potential correlates? And whether Foreign Banks's cost and profit structure are more efficient than domestic banks in Vietnam are our research questions.

Literature Reviews and Theoretical framework

In the banking sector, cost efficiency and profit efficiency is two general concepts which represent to bank performance and bank efficiency. Based on that, series of researches was implemented at national level, majority studies conducted in developed countries, less studied in developing ones and at international level as cross section region as European or ASEAN. Regards as cost efficiency literature, Berger and Humphrey (1997) [4] pointed out the different the between results from the estimation of five types of frontier models, namely nonparametric approach (DEA, FDH) and parametric (SFA, TFA and DFA) for assessing cost efficiency from the results of 130 surveys of financial institution analysis across 21 countries. In general, the efficiency estimates from nonparametric methods are similar to those from parametric frontiers, but its results often obtained slightly lower mean efficiency as well as having greater dispersion than the parametric models' results. Besides, the different among efficiency rankings depend on frontier approaches. Furthermore, they stated causes or correlates of efficiency should need to be caution in efficiency measurement. From their surveys, they suggested the importance of estimates of mean efficiency can be reliable guidance for government policy and research in national and business management level. It is necessary for evaluating the effects of deregulation, market power or mergers and acquisitions on industry efficiency to inform government policy. Another study works notable from Berger & Mester (1997)[5] when these authors investigate "inside black box" to explain the Banks's efficiency with data from 6000 US commercial banks during the period of 1990 to 1995. They suggested how the choice of different design models affects efficiency measures based on the use of three kinds of economics efficiency concepts of the cost structure, standard profit as well as an alternative profit. The benefit and drawbacks of each type discussed quite clear here. In this paper, they investigated the use of the distribution free approach (DFA) and SFA, inclusion examining the

differences between the specification of the Fourier-flexible functional form and the trans log form. This study is the first research use a comprehensive set of bank size, organizational ownership and corporate governance, specific bank characteristics, market characteristics, the federal regulator and geographic restrictions by state, called potential correlates of efficiency. The results reported as new evidence when different measurement method or functional form and other variables make very little difference in terms of average banks efficiency or ranking of banks efficiency. One of the important arguments is SFA provides results more useful than other non-parametric techniques due to economic optimization. Another point is the profit efficiency negatively correlated with cost efficiency.

Hughes & Mester (2008) [6] presented the full set of theory, evidence of banking efficiency estimation. This study gives a background and discussion of two general empirical methods (nonstructure and structure approach) in measuring bank performance. Some relations between ownership and mergers with bank value that was presented here. Altunbas at all (2000) [7] examine the effects of risk and quality factors on Japanese commercial banks cost during the period of 1993 to 1996. They utilized stochastic cost frontier to measure scale efficiency, X-efficiency and technical development. They found that the financial capital has a huge influence on optimal banks size. If the risk and quality factors were taken account in bank cost estimation, the optimal banks size is smaller. If not, the optimal banks size is overstated. And scale efficiency is more sensitive to risk and asset quality than X-efficiency. They also pointed out the technical change has reduced the production's cost over times. Next, Isik, I., & Hassan, M. K. (2002)[8] also applied stochastic frontier method to investigate the effect of bank size, governance, ownership and corporate control on Turkish bank's cost and profit efficiency during the period of 1988 to 1996. The bank's profit efficiency on average is estimated around 84%. They found the linkage level of cost and profit efficiency is significant low, the meaning is high profit efficiency does not need a high cost efficiency. In their paper, they used some outputs related to short and long term loans and balance sheet items, and other earning assets. However, the difference is two step estimations. They used the inter-temporal comparison between the costs, profit efficiency with ownership, bank size and governance, corporate control. They concluded that the gap between the inefficiency banks and

efficiency bank is wider, such as in cost structure, 4% and 84% in 1996 respectively and explained reason here is technology catch-up. One of their findings is both cost and profit efficiency, when bank size increase will lead a drop systematically and monotonically.

For Asian countries data, Manlagñit, (2011) [9] interested in investigating a relationship between risk and banking efficiency of Philippine commercial banks by using stochastic frontier approach from 1990 to 1999. They included risk and asset quality measures in the cost estimation and use the one-step estimation follow Battese and Coelli (1995)[10]. The author found the 1997 Asian financial crisis may adverse effect on the cost inefficiency, banking reforms and regulatory enhanced the Philippine banking sector's strength. They proved Mergers and acquisitions have negative significant relationship with cost inefficiency. In the same research interest, Montgomery et al (2014) [11] examined the cost and profit efficiency under banking sector consolidation effects by using two step estimation with data from Japan during 1996 till 2009. Their results indicated bank merger events have significantly lower cost efficiency and little impact on profit efficiency and concluded that increasing market power by merged banks tend to be more profit and cost efficient. Their methodology separated the bank consolidation effect on cost and profit efficiency into the efficiency measurement under bank operating risks independently, ranking these scores and regressed these scores with bank market power, M&A effects.

In Vietnam, many authors employed standard accounting ratios to estimate banking efficiency. Lien. D (2013)[12] investigate the determinants of profit efficiency between foreign banks and domestic banks in relationship with bank' specific factors, multinational bank indicators and macro-economic factors by using Data from 2000 to 2012 taken from Fitch Ratings source. She concluded the international banks performed better than Vietnamese national bank because of their ownership' advantages. Vu & Turnell, (2010)[2] measure how Vietnamese bank's cost efficiency varied during 200-2006 by using Bayesian technique. They fail to incorporate monotonicity and concavity conditions into cost function estimation so it would lead to biased estimation and misleading bank rankings as well as median cost efficiency does not affect the ranking on cost efficiency. Officially, our paper aims to apply one step rather than two step estimation to reduce the bias results in estimation process and also we try to capture

determinants effects of risk and asset quality as additional variables on cost efficiency and profit efficiency..

This paper uses the stochastic cost frontier analysis independently proposed by Aigner, Lovell, and Schmidt (1977) [13] and Meeusen and van der Broeck (1977) [14], which is a means to measure the relative performance of banks by objectively providing numerical efficiency values and ranking these accordingly. To be in detail, a commercial bank is considered inefficient if its costs or profit are higher than those predicted for an efficient commercial bank producing the same output under the same existing conditions with the difference unexplainable by statistical noise. Specifically, a stochastic cost function model implies that the bank's observed total cost and operating profit will deviate from the efficient frontier. For panel data, the profit and cost function can be written as

$$\ln(Y_{it}) = \ln Y_{it}(y_{it}, w_{it}, \beta) + \varepsilon_{it} \quad (1)$$

$Y_{i,t}$: log the outcome variables, (here is profit and cost) of the i th bank ($i=1,2,\dots,N$) at time t^{th} year ($t=1,2,3,\dots, T$). N is the number of banks. y_{it} : Vector of banking output, w_{it} : the vector of input price; β : vector of unknown coefficients for the associated output and input price variables in efficiency estimation.

The composition error term or stochastic error term is $\varepsilon_{i,t}$ which was followed [13] and Collie (1988) [15], where $\varepsilon_{i,t} = v_{i,t} - u_{i,t}$ for case of profit function and $\varepsilon_{i,t} = v_{i,t} + u_{i,t}$ for case of cost function. Here, $v_{i,t}$ represents errors of approximation and other sources of statistical noise assumed to be independent and identically distributed as $N(0, \sigma_v^2)$ and $u_{i,t}$ is a random variable which is assumed to be an independently but not identically distributed non-negative random variable. The important point here, $u_{i,t}$ is estimated as functional form of vector of appropriate explanatory variables under this one-step approach, the formulation is

$$u_{it} = z_{it}\delta + \omega_{it} \quad (2)$$

Where u_{it} follows a truncated-normal distribution with mean and variances; z_{it} : is a vector of explanatory variables, i.e., risk and quality

variables and potential correlates that may influence the efficiency of the banks; δ is a vector of parameters to be estimated; and ω_{it} is defined by the truncation of the normal distribution $N(0, \sigma^2)$, such that the point of truncation is $-z_{it}\delta$. So, to assure that u_{it} is non-negative, the condition is $\omega_{it} > -z_{it}\delta$. Jondrow, J., Lovell, C., Materov, I., & Schmidt, P. (1982)[16] suggested the maximum likelihood estimation allowed to generate estimates of all parameters of the frontier function as well as estimates of the unknown parameters σ , η and γ . After solving the maximum likelihood problem, aggregate residuals ε can be derived by substituting the estimated parameter vector β into the production function (1). Technical efficiency estimation formulation

$$TE_{i,t} = E[\exp\{-u_{i,t}\} | \varepsilon_{i,t}] = \frac{1 - \Phi\left(\sigma^* - \frac{\mu^*_{i,t}}{\sigma^*}\right)}{1 - \Phi\left(-\frac{\mu^*_{i,t}}{\sigma^*}\right)} \exp\left(-\mu^*_{i,t} + \frac{1}{2}\sigma^{2*}\right) \quad (3)$$

$$\text{where : } \begin{aligned} \mu^*_{i,t} &= -\varepsilon_{i,t}\sigma_u^2 / \sigma_u^2 + \sigma_v^2 \\ \sigma^* &= \sigma_u \cdot \sigma_v / \sqrt{\sigma_u^2 + \sigma_v^2} \end{aligned}$$

$\Phi(\cdot)$ Denotes the cumulative distribution function of standard normal distribution.

Empirical Methodology and Data

Our main database in this research is Bankscope and we obtained the balance sheet and income statement 45 banks from 2007 to 2012. Data includes 5 state-owned commercial banks (SOCBs) and 4 joint - venture commercial banks, 5 Foreign Banks (FBs) and 31 Joint Stock commercial banks (JSCBs). The intermediation approach focuses on the bank's production of intermediation services and the total cost of production, including both interest and operating expenses [9]. Profit () is operating profits and Total cost are two outcomes. Two outputs are Net Loan (y_1) and Total Securities (y_2) are earning assets, obtained from database. Price of physical capital (w_1) is calculated by using total non-personnel expense over

the fixed asset. Price of labor (w_2) is calculating by dividing the personnel costs to total assets, instead of dividing the personnel expense to numbers of employees because we cannot get enough data for numbers of employees or branches. Price of loanable fund (w_3) is ratio of interest expense to deposit.

Table 3.1: Summary statistics

Variables	Obs	Mean	S.D	Min	Max
<u>Outcome</u>					
Operating profit (π)	202	994,6	1454.3	-1137.5	8386,3
Total cost (C)	202	7421,0	12297.2	31.5	86719,4
<u>Outputs</u>					
Total Loan (y_1)	201	44029,1	75882,1	117.8	440895,5
Total securities (y_2)	201	11317,3	15037,9	0.0	76582,6
<u>Input prices</u>					
Price of physical capital (w_1)	202	3,30	4,47	0,21	43,554
Price of Labor (w_2)	202	0,01	0,01	0,001	0,14
Price of loanable fund (w_3)	202	0,09	0,11	0,002	1,05
Total asset (q)	202	79342,2	110938,5	203,5	556269,9
<u>Risk and Asset quality</u>					
The ratio of total equity to total asset (E/TA)	202	0,29	0,15	0,004	0,99
The ratio of non-performing loans to total loans (NPL/L)	202	0,14	0,13	0,004	0,94
The ratio of liquid assets to total asset (LA/TA)	201	0,03	0,07	0,0	0,684
<u>Potential correlates</u>					
Mergers and acquisition (M_A)	198	0,08	0,27	0,0	1,0
Bank concentration	198	27,07	72,98	0.008	485,67
Ownership	202	0,29	0,15	0,004	0,99

Notes: Author's calculation. Obs: observation. SD: Standard Deviation.

Table 3.1 describes the sample's summary statistics, including mean, max, min and standard deviation from the Bankscope database, 202 observations were obtained.

Profit efficiency estimation¹

$$\begin{aligned}
 \ln\left(\frac{\Pi + \theta}{w_3 q}\right)_{it} &= \beta_o + \sum_{j=1}^2 \beta_j \ln\left(\frac{y_j}{q}\right)_{it} + \sum_{h=1}^2 \beta_h \ln\left(\frac{w_h}{w_3}\right)_{it} \\
 &+ \frac{1}{2} \sum_{j=1}^2 \sum_{k=1}^2 \beta_{jk} \ln\left(\frac{y_j}{q}\right)_{it} \ln\left(\frac{y_k}{q}\right)_{it} \\
 &+ \frac{1}{2} \sum_{h=1}^2 \sum_{l=1}^2 \beta_{hl} \ln\left(\frac{w_h}{q}\right)_{it} \ln\left(\frac{w_l}{w_3}\right)_{it} \\
 &+ \sum_{j=1}^2 \sum_{h=1}^2 \gamma_{jh} \ln\left(\frac{y_j}{q}\right)_{it} \ln\left(\frac{w_h}{w_3}\right)_{it} + \\
 &+ T + v_{it} - u_{it}
 \end{aligned} \tag{4}$$

Where i, t : represent for bank i and time t , and Π : ordinary profit. y_k : represent the j th and k th output; w_h : input price at h th. And u_i : indicated inefficiency of bank i at time t .

Cost efficiency estimation

$$\begin{aligned}
 \ln\left(\frac{C}{w_3 q}\right)_{it} &= \beta_o + \sum_{j=1}^2 \beta_j \ln\left(\frac{y_j}{q}\right)_{it} + \sum_{h=1}^2 \beta_h \ln\left(\frac{w_h}{w_3}\right)_{it} \\
 &+ \frac{1}{2} \sum_{j=1}^2 \sum_{k=1}^2 \beta_{jk} \ln\left(\frac{y_j}{q}\right)_{it} \ln\left(\frac{y_k}{q}\right)_{it} \\
 &+ \frac{1}{2} \sum_{h=1}^2 \sum_{l=1}^2 \beta_{hl} \ln\left(\frac{w_h}{q}\right)_{it} \ln\left(\frac{w_l}{w_3}\right)_{it} \\
 &+ \sum_{j=1}^2 \sum_{h=1}^2 \beta_{jh} \ln\left(\frac{y_j}{q}\right)_{it} \ln\left(\frac{w_h}{w_3}\right)_{it} + \\
 &+ T + v_{it} + u_{it}
 \end{aligned} \tag{5}$$

¹ Profit efficiency was estimated by the concept of alternative profit efficiency. In the banking efficiency literature it has become standard practice to use an alternative profit function, employing the same exogenous variables. The meaning of this concept is how close a bank comes to earning maximum profits given its output levels rather than its output prices. (Berger & Mester, 1997)[5]. A standard profit function would specify output prices, but output prices are not accurately measured for the banking sector

Where C: total cost, other variables was explained above. There are some way to avoid heteroskedasticity and assure for homogeneity condition by dividing output by total assets, as well as dividing cost and input prices by input when choosing put variables into equation (4) and (5). Adding risks and asset quality and examining the efficiency correlates, this study employs the Battese and Coelli (1995) model. This model allows the simultaneous estimation of the stochastic cost function and the identification of the correlates of bank inefficiencies in one-step estimation. In detail, capturing for risk and asset quality includes: The ratio of liquid asset to total asset (LA/TA), Equity to total asset (E/TA), Non-performing loans ratio (NPL/TL). Potential correlates of efficiency was examined by Ownership², Bank concentration³ and mergers and Acquisition (M&A)⁴.

Results

Table 5.1: Test of hypothesis

Null hypothesis	LR test		Critical value			Decision	
	PE	CE	10%	5%	1%	PE	C E
Test of no inefficiency $H_o : \gamma = 0$	11.84 8	24.34 0	5.528	7.04 5	10.501	Reject H_o	
Test of no risk, quality and potential correlates $H_o : \delta_1 = \delta_2 = \dots = \delta_6$	91.68	43.86	9.99 8	11.911	16.07 4	Reject H_o	
Test of no technical change over time: $H_o : \beta_3 = \beta_{i3} = 0, i = 1, 2, \dots, 5$			8.57 4	10.37 1	14.32 5	Reject H_o	
	13.43	9.12					

Notes: Author’s calculation, LLF restricted and unrestricted were obtained from model and calculated by formulation of . Where LR means generalized likelihood-ratio, and are LogLikelihood function from unrestricted and restricted model respectively. The comparison

² Ownership is also important to bank efficiency because owners have influence over bank managers and the organizational form of a bank, as well as the bank’s main operational strategies (Manlagñit, 2011) This is a dummy variable for ownership: 1= foreign banks, 0 = otherwise

³ Market concentration (HHI): a market concentration index calculated as the sum of total asset square of each bank’s total assets as a percent of the banking sector’s aggregate assets. The formulation for calculating market concentration as: where subscript i stands for bank i and t for time t [11]

⁴ This is Dummy variable for merger and acquisition; 1= acquiring and acquired banks, 0 = otherwise. If the banks implement M&A, means banks could increase its market power to result in better performance.

between the LR test and critical value followed the Chi-square distribution of Kodde and Palm (1986) [17] to give the decision for rejecting or accepting null hypothesis. PE is Profit Efficiency, CE means cost Efficiency

Table 5.1 evaluated the hypothesis testing for appropriation of representation of the profit and cost structure of the banks in our sample. In the first null hypothesis, we aim to confirm there is no inefficiency effect in our model or inefficiency effects are not stochastic. The results highlight that in cost and profit efficiency estimation, the absence of inefficiency is strongly rejected at 1% level. Thus, we also can conclude that inefficiency components are incorporated with other variables in our estimation. Next, the test of means there is no significant impact of risk and asset quality as well as potential correlates on Vietnamese Banks's profit and cost efficiency. This hypothesis is strongly rejected in profit model at 1% significant level, which implied the banks' profit and cost inefficiency can be explained by these variables in profit translog function model. The third hypothesis aims to test of no technical change over time, the null hypothesis mentions there is no existence of technological changes over time in Vietnamese banking sector. The hypothesis is rejected in both profit and cost estimation case at 10% and 5% significant level respectively, which showing that in the banking sector has technological change over period.

Through our results from some hypothesis, we can agree that using translog stochastic frontier function for evaluating profit and cost inefficiency of Vietnamese commercial banks is more appropriate than using the ordinary least square.

Table 5.2: Estimated Mean of efficiency score⁵ of Vietnam commercial banks over years

Mean by year	Profit Efficiency	Cost Efficiency
2007	68.89	16.84
2008	66.64	17.24
2009	65.97	16.63
2010	64.76	8.20
2011	63.07	19.98

⁵ were obtained from the of Frontier software [18] & [19]

2012 61.64 11.76

Notes: number in parentheses is number of banks. Source: Author's calculation

Table 5.2 provides the average percentage of efficiency of each year illustrated represents for industry efficiency per year. It is pointed out the downward trend of efficiency index in Vietnamese commercial bank's profit and cost structure from 2007 to 2012. One outstanding point is Vietnamese banks' profit efficiency is much higher than cost efficiency in 2007 and after the Global Financial Crisis in 2008, the cost ratio decreased dramatically.

Table 5.3: Group mean comparison by ANOVA analysis

Group comparison	Cost efficiency	Profit Efficiency
FBs - JSCBs	8.340***	0.772
FBs - JVCBs	5.877**	0.008
FBs- SOCBs	18.417***	2.826
JSCBs – JVCBs	0.713	1.098
JSCBs – SOCBs	6.120**	2.888*
JVCBs – SOCBs	2.356	3.954*

Source: Author's Calculation, *, **, *** represent statistically significant at the 10%, 5% and 1% level respectively. FBs, SOCBs, JSCBs and JVCBs means foreign banks, state owned commercial banks, joint stock commercial banks and joint venture commercial banks respectively.

From the table 5.3, there is strongly statistical significance for clarifying a difference of cost efficiency between foreign banks and Vietnam national banks, also between foreign banks and joint venture commercial banks. Among domestic banks, we can confirm the difference between state owned commercial banks and joint stock commercial banks is significant at 5%. Regards as profit efficiency, there is no evidence to support the difference between foreign banks and others. But we found the weak significant for distinguishing profit efficiency between state commercial banks and another type in a national region.

Table 5.4: Correlates of profit and cost inefficiency in technical efficiency estimation

Variables	Correlates of profit inefficiency		Correlates of cost inefficiency	
	Coefficient	S.E	Coefficient	S.E
Risk and asset quality				
E/TA	0.410	(0.886)	-1.500***	(0.708)

NPL/L	-0.233	(0.995)	0.291*	(0.846)
LA/TA	0.898*	(0.676)	0.884*	(0.597)
Additional variables				
Mergers And Acquisition (M-A)		(0.287)		(0.655)
Ownership	-0.263		-1.121**	
Market concentration	0.782***	(0.318)	1.033	(0.184)
Sigma-squared	-0.022**	(0.001)	-0.002***	(0.002)
Gamma	0.888***	(0.109)	0.412***	(0.088)
	0.981***	(0.021)	0.978***	(0.007)

*, **, *** represent statistically significant at the 10%, 5% and 1% level respectively. Source: Author's estimation. E/TA: the ratio of equity to total asset, NPL/L: the ratio of Non-performing loans to total loans, LA/TA: Liquid asset to total asset. Ownership: This is a dummy variable for ownership: 1= foreign banks, 0 = otherwise. Market concentration: a market concentration index calculated as the sum of total asset square of each bank's total assets as a percent of the banking sector's aggregate assets. Mergers and Acquisition: this is Dummy variable for merger and acquisition; 1= acquiring and acquired banks, 0 = otherwise. Number in parentheses is Standard Error.

The Sigma squared in both model again are all positive and strongly significant. The estimated gamma is very close to unity, such as 0.981 for a profit function and 0.978 for cost function show us the strong impact of inefficiency score to bank's profit and cost variance.

As can be seen, non-performing loans to gross loans ratio can capture risk preference in Vietnam banking sector and has a statistical significant positive effect on measured cost inefficiency this result consists to previous findings. When 1% increase in the percentage of nonperforming loans of total gross loans leads to increase 0.291 units in cost inefficiency. An unhealthy bank with high costs would have more problem loans and lower banks' cost efficient operations. In case, cost and profit inefficiency measurement, merger and acquisition has negative relationship, but is only significant with cost inefficiency. This result again achieved our expectation and followed merger literature. From our results, we can suggest that the potential cost efficiency gains when Vietnamese banks do implement in merger and acquisition. With new banking environment will lower the cost inefficiency about 1.121 units. In addition, the addition variables as bank concentration is negative and statistically significant for both cost inefficiency and profit inefficiency, which means bank has higher market shares specifies as banks' market power thus leading to an increase in Banks's total asset and rise in market concentration will lower inefficiency indexes. If the banking industry is almost monopolistic, the degree of competition is low and banks can indulge in collusive behavior. Consequently, a reinforcement of control on the part of the state would be

recommended in order to prevent the abuse of market power by a small number of banks [12]. According to this approach, a negative relationship between market concentration and profit and cost inefficiency does not necessarily reflect strong collusive behavior by several banks rather shows that large banks come to reduce the profits and cost inefficiently.

Conclusions

Our results provide some evidences such as over years, Vietnamese commercial Banks's profit efficiency is around 61%-68% and theirs cost efficiency is about from 8% to nearly 20% over the testing period. These number is quite lower compared to some researches were carried on in the past for Vietnam case. But these findings supported to banking literatures and gave new evidence for testing banking in the year from 2007 to 2012. One important thing is, there are both cost and profit efficiency which has a downward trend over time that implied relatively inefficient banks tend to remain relatively inefficient in coming years.

Consistent with previous studies, overall, some findings of this paper rely on that the banking structure as results supports risk and asset quality related to cost and profit inefficiency of the banks. Especially that non-performing loans ratio affect the banks cost inefficiency and risk management should consider for measuring the efficiency of the banks. The cost inefficiency high correlates with a better risk evaluation, while cost inefficiency is always inversely correlated with financial capital. Furthermore, cost inefficiency seems to be strongly related to bank concentration, mergers, and bank ownership. The results suggest mergers and acquisition can increase potential cost inefficiency and foster banks' competition in the banking system. Among commercial banks, the results seem to indicate that universal commercial banks are more cost inefficient than ordinary commercial banks.

From a policy perspective, our results support to strengthen bank competition capacity by focusing on measuring cost or profit efficiency of Vietnamese commercial banks by using frontier analysis. A recent change in regulation allows more foreign ownership in Vietnam banks in special cases (e.g., as part of restructurings of weak banks), subject to the prime minister's approval. We believe this may be first step in allowing foreign banks to have larger stakes in Vietnam banks and will help improve capitalization,

management, and governance of local banks. So, it is necessary when governments do accelerating and finishing restructures progress in the banking system earlier as well as tightening cross-holding situation. The profitability and cost measurement are affected by market concentration or market share, because efficient banks can increase their market share and earn high profits and gain cost efficiency even in a competitive and low-concentration business. This idea implies the policy for regulation and intervention from government are inappropriate since they might discourage the proper functioning of the market mechanism has been employed to explain the performance of the Vietnamese banking system.

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