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Using Tobit Model to Estimate the Impact of Factors on Business Efficiency of Vietnam Commercial Bankers

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ABSTRACT: With its position as the "heart" of the economy, business activities of the banking system are always the top concern, especially for the system of joint-stock commercial banks - the type that is rated as the most effective. Vietnam is a developing country with competitive pressure and great challenges coming from its commitments to opening up and integrating, so assessing the business efficiency of the system of Vietnamese joint stock commercial banks is very important. The article uses Tobit regression model to estimate the impact of factors on business efficiency of 30 Vietnamese joint stock commercial banks in the 7 year period 2016-2022. The estimation results of Tobit regression model on the impact of factors on the bank's business efficiency show that there are 6 influential factors that are: Return on Equity (ROE), Return on Asset (ROA), Bad debt ratio (NPL), Equity/Asset ratio (VCSHTS), Expense/Income Ratio (CPTN), Asset size (TTS) and in which NPL, CPTN, TTS have negative impact on the bank's business efficiency; As for the variables Risk provision ratio (DPRR), Debt/Total Assets ratio (DNTTS) are not statistically significant.

Key words: business efficiency, Tobit regression model, Joint-stock commercial bank of Vietnam.

I. RESEARCH OVERVIEW

Regarding the problem of analyzing the factors affecting the bank's business efficiency, in the world and in Vietnam, the authors use many different analytical models with different methodological approaches. Such as:

Pasiouras, F.; Sifodaskalakis, E.; Zopounidis, C. (2007) used Tobit model to estimate the influence of external and internal factors on the business efficiency of 16 joint-stock commercial banks in Greece in the period 2000- 2004. The results of the Tobit model indicate that the effect of capitalization, number of branches and number of ATM cards depends on different measures of efficiency. Gwahula Raphael (2013) used Tobit regression model to measure the factors affecting the efficiency of banks in Tanzania in the period of 7 years 2005-2011. The results show that the factors including: size of the bank, non-interest income, capital adequacy ratio have a positive correlation with the efficiency of the bank, whereas the bad debt ratio has a negative effect with the efficiency of the bank. Ji-Li Hu, Chiang-Ping Chen and Yi-Yuan Su (2006) applied the DEA non-parametric method to examine some factors affecting the efficiency of 12 commercial banks in China in the period 1996 - 2003. In the DEA model, the authors have selected 3 input variables including deposits, number of bank staff and net fixed assets; Two output variables include investment and lending. Based on the results of performance measurement, the authors used Tobit regression model to consider the influence of variables such as: type of bank ownership, size of bank operations, dummy variables that reflects the influence of the WTO accession process, the Asian financial crisis on the efficiency of 12 commercial banks in China.

Nguyen Viet Hung (2008) used Tobit regression model to analyze the factors affecting the business efficiency of 32 Vietnamese commercial banks in the period 2001-2005. The selected independent variables include: Bank size is calculated by natural logarithm of total assets, equity, total cost/total revenue, deposit/loan ratio, equity/total assets, total assets of each bank/total assets of all banks, ratio of loanable capital to total assets, ratio of bad debt, ROA, ratio of capital to labor, the ratio of profit/earnings to operations. The research results show that factors including: asset size of the bank, deposit/loan ratio, ROA, bad debt ratio, total cost/total revenue have an influence to the business performance of commercial banks in that period. Nguyen Thi Thu Thuong (2017) also applied Tobit regression model to estimate the impact of factors on the performance of 21 commercial banks in Thai Nguyen province in the period 2011-2015. Research results show that: in addition to the factors of profit/total assets, bad debt/total credit balance and total assets affect the technical efficiency of

commercial banks in Thai Nguyen province; The increase in the number of enterprises has a positive effect on the technical efficiency of commercial banks in Thai Nguyen province.

Summary, The review of studies shows that domestic and foreign studies mostly use Tobit regression model to analyze the factors affecting the bank's efficiency. The authors use a variety of independent variables and measure the dependent variable, which is the performance of ordinary banks, by the indicators Return on Assets (ROA), Return on Equity (ROE), Bad debt ratio (NPL), Capital Adequacy Ratio (CAR) or from the data run results of the DEA non-parametric analysis method is the technical efficiency or economic efficiency. Therefore, the author directs his research to measure the efficiency of 30 Vietnamese joint stock commercial banks in the period 2016-2022 as the dependent variable of the model which is "Technical efficiency varies with scale" and the independent variables are: Asset size, Bad debt ratio (NPL), Return on Asset (ROA), Return on Equity (ROE), Equity/Asset ratio, Risk provision ratio, Expense/Income Ratio, Debt/Total Assets ratio.

II. RESEARCH MODELS AND VARIABLES

Tobit regression model, also known as censored regression model, is built to estimate the linear relationship between explanatory linear variables when the dependent variable is censored. This model is suitable for estimating the factors affecting the bank's business efficiency because the dependent variable is the bank's business efficiency (TE). Business efficiency (TE) is a censored variable, limited to the range (0-1).

Based on the evaluation index according to CAMEL standards, research overview, data that can be collected from 30 joint stock commercial banks in Vietnam in the period 2016-2022, the selected variables in the Tobit regression model are:

Table 1: Summary of variables of the coded research model

Variable name		Code
Independent variables	Asset size	TTS
	Bad debt ratio	NPL
	Return on Asset	ROA
	Return on Equity	ROE
	Equity/Asset ratio	VCSHTS
	Risk provision ratio	DPRR
	Debt/Total Assets ratio	DNTTS
	Expense/Income Ratio	CPTN
Dependent variable	Business efficiency of commercial banks	TE_{VRC}

Source: Research and synthesis by the author

The dependent variable in the research model is the bank's business efficiency estimated by the DEA method to assess the technical efficiency of scale **(TE_{VRC}).**

III. STATISTICS OF RESEARCH SAMPLES

Before carrying out regression analysis of Tobit model with censored variable, the author compiles sample statistics to determine preliminary information about the sample, the dependent variable TE is censored on the left and right in the research data set.

Table 2: Statistics of research samples

Variables	Mean	Standard deviation	Minimum	Maximum
ROA	0,636	0,536	0,009	2,860
ROE	7,716	6,640	0,091	26,740
NPL	2,053	1,037	0,349	6,610
VCSHTS	8,294	3,134	2,146	23,740
DNTTS	54,809	11,673	11,958	75,548
DPRR	1,315	0,542	0,206	3,465
CPTN	53,475	15,382	9,693	105,338
TTS	203.514	247.672	14.486	1.334.038
TE	0,639	0,157	0,204	1,000

Source: Author statistics samples using STATA 17.0 software

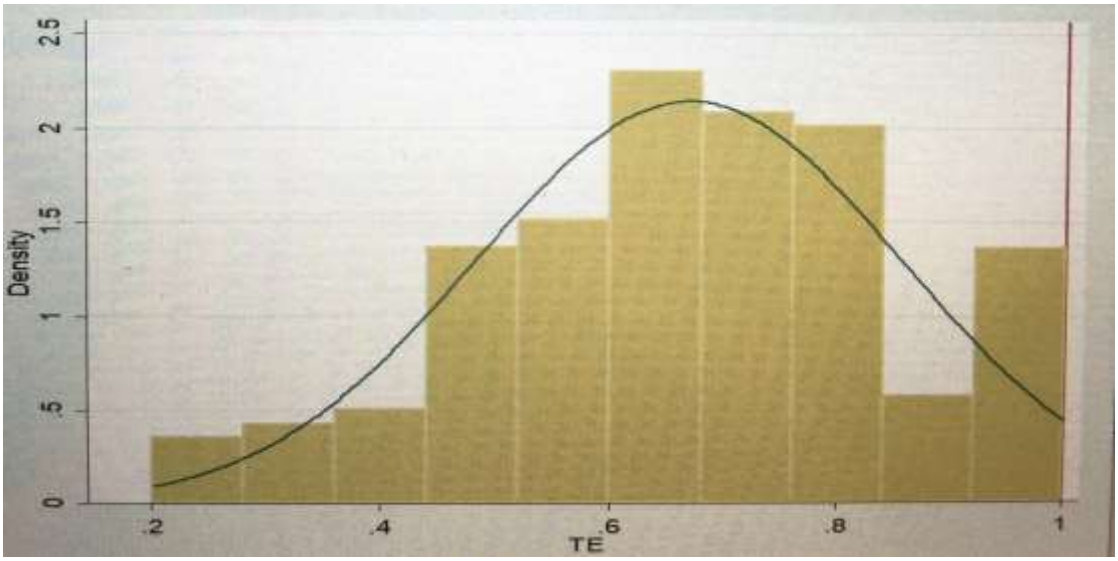
The research sample includes 30 joint stock commercial banks during the 7-year research period (2016-2022) with a total of 174 observations. According to the statistical table, the research sample includes 8

independent variables (ROA, ROE, Bad debt ratio, Equity/Asset ratio, Debt/Total Assets ratio, Risk provision ratio, Expense/Income Ratio, Asset size) and 1 dependent variable (TE- Technical Efficiency).

Statistical results of the independent variables show that: ROA has the mean of 6.36%, the minimum is 0.009% and the maximum is 2.86%; ROE has the mean of 7.716%, the minimum is 0.091% and the maximum is 26.74%; Bad debt ratio (NPL) has the mean of 2.053%, the minimum is 0.349% and the maximum is 6.61%; Equity/Asset ratio (VCSHTS) has the mean of 8.294%, the maximum is 23.74% and the minimum is 2.146%; Debt/Total Assets ratio (DNTTS) has the mean of 54.809% and the maximum is 75.548%, the minimum is 11.958%. Risk provision ratio (DPRR) has the mean of 1.315%, the minimum is 0.206% and the maximum is 3.465%; Expense/Income Ratio (CPTN) has the mean of 53.475%, the minimum is 9.693% and the maximum is 105.338%, there is a big difference in the sample with a large standard deviation of 15.382; Asset size (TTS) has the mean of 203.514 billions VND, the minimum is 14.486 billions VND and the maximum is 1.334.038 billions VND.

The dependent variable is the Bank's Technical Efficiency (TE) which has the mean of 0.639 and ranges from 0.204 to 1,000. The technical efficiency (TE) of banks ranges from 0 to 1. This shows that there is no bank in the sample whose technical efficiency (TE) is zero, below zero, with the most optimally efficient bank equal to 1. This means that the censorship is on the left of ul. (1) is occurring in the research data set.

The author uses Stata 17.0 software to analyze the factors affecting the bank's business performance. To conduct the analysis, the author must first convert the asset size (TTS) into a logarithmic variable TTS according to the command in Stata: gene TTS = log (TTS) and label this variable TTS. Histogram distribution graph of variable TE:



Source: Author uses Stata 17.0 software

Observing the Histogram distribution graph shows that: the variable TE is a continuous variable and has a semi-normal distribution, the censorship occurs in the data set. Looking at the graph shows that there are many cases in the sample where the TE technique efficiency is from 0.6 to 0.8 and above 0.9 to 1.0, there are cases that reach the optimal threshold of 1.0.

IV. TEST THE CORRELATION BETWEEN THE VARIABLES IN THE RESEARCH MODEL

Next, the author goes to test the correlation between the variables in the research model, the results are reflected in the following table:

Table 3: Correlation between variables in the research model

	ROA	NPL	VCSHTS	DNTTS	DPRR	ROE	CPTN	TTS
ROA	1,0000							
NPL	-0,1541	1,0000						
VCSHTS	0,1065	0,2463	1,0000					
DNTTS	0,2150	-0.2154	-0,0059	1,0000				
DPRR	-0,0764	0,3658	-0,1263	-0.3403	1,0000			
ROE	0,8367	-0,2451	-0,2270	0,3068	-0,0546	1,0000		
CPTN	-0,6134	0,2530	-0,0830	-0,3606	0,1046	-0,6130	1,0000	
TTS	0,2757	-0,2128	-0,6376	0,2271	0,2192	0,5048	-0,2705	1,0000

Source: Author calculated from Stata 17.0 software

Correlation analysis aims to show whether the variables in the research model have a correlation relationship. The correlation coefficient has a value of -1 to 1, the variables are correlated with each other, the closer to 1 the correlation is, and if the correlation coefficient is equal to 1, there is an absolute correlation. If the correlation coefficient is zero or approximately zero, the two variables are considered to have no correlation.

Table 3 shows that the correlation coefficients between the variables are all non-zero, the largest correlation value is 0.8367. Thus, the results of the correlation test between the variables show that the correlation between the variables in the research model with the correlation coefficient is mostly low, except for the high correlation ROE of 0.8367. However, the high correlation coefficient, the multicollinearity between the variables is easy.

V. TEST THE CORRELATION BETWEEN ESTIMATES AND OBSERVATIONS

Next, the author tests the correlation between the estimates and observations.

	TE	Yhat
TE	1,0000	
Yhat	0,7846	1,0000

This test shows that the correlation between the predicted and observed values of TE is 0.7846. If this value is squared, it shows a squared correlation with a predicted value of 61.6% in terms of variance with TE.

6. Estimating results of Tobit model of factors affecting business efficiency of Vietnamese commercial banks

After testing the correlation between variables, the correlation between estimates and observations, the author tests the impact of factors on technical efficiency (TE) using Tobit model estimation with the right limit ul(1), the estimated results are reflected in the following table:

Table 4: Estimating results of Tobit model of factors affecting business efficiency of Vietnamese commercial banks

TE	Coefficient	Standard error	t	P > t	Confidence interval 95%	
ROA	0.1005	0.0560	1.08	0.044	0.2111	0.0100
ROE	0.0148	0.0037	3.09	0.002	0.0054	0.0240
NPL	-0.0090	0.0114	0.86	0.085	-0.0126	0.0276
VCSHTS	0.0120	0.0047	2.45	0.016	0.0023	0.0213
DNTTS	0.0001	0.0090	0.14	0.862	-0.0027	0.0016
DPRR	0.0113	0.0235	0.50	0.624	-0.0350	0.0567
CPTN	-0.0074	0.0008	-9.89	0.000	-0.0098	-0.0065
TTS	-0.0365	0.0138	-2.73	0.007	-0.0576	-0.0117
_cons	1.3537	0.1835	7.20	0.000	1.0158	1.7255

Source: Estimating results of Tobit model from Stata 17.0 software

Regression results of Tobit model show that the model has Prob > Chi2 = 0.0000, so the model has statistical significance. The model estimation results show that:

ROA has a positive effect on TE technical efficiency with an impact coefficient of 0.1055 with statistical significance level P-value = 0.044 < 5%. This means that if the bank has a 1 unit increase in ROA, the TE increases by 0.1005 units. This shows that if the bank has an appropriate ROA, effective use of assets will increase the bank's operational efficiency. According to CAMEL standards, banks are most effective when ROA is 1.5%.

With statistical significance level P-value = 0.002 < 5%, ROE has an influence on technical efficiency; ROE has a positive effect with an impact coefficient of 0.0148. This means that: ROE increases by 1 unit, TE increases by 0.0148 units. The higher ROE means that if a dollar of equity generates more after-tax profit, the bank is more technically efficient. According to CAMEL's standards, banks are most effective when ROE is ≥ 22%. In Vietnam, ROE is considered good if it is between 14% - 17%.

The estimated results show that the estimated coefficient of the variable Bad debt ratio (NPL) is -0.0090 and is statistically significant at the P-value = 0.086 < 10%. This result shows that NPL has a great influence on the technical efficiency of the bank and has the opposite effect, indicating that NPL increases by 1

unit, TE decreases by 0.0090 units. This shows that if banks do not perform well in credit risk management such as loan appraisal, supervision, and compliance with regulations in lending on credit limits, credit policies will be affected leading to an increase in bad debt, thereby increasing costs, reducing profits, and reducing business efficiency of banks. The results of this study are also consistent with the results indicated from previous studies and in actual banks. According to international practice, for developing countries, including Vietnam, this rate must be ≤ 3%.

The estimated coefficient of the Equity/Asset ratio (VCSHTS) to the technical efficiency in the research results is 0.0120 and the P-value is statistically significant at 0.016 < 5%. This result shows that the Equity/Asset ratio (VCSHTS) has a positive effect on the technical efficiency, the ratio of equity increases by 1 unit, the TE increases by 0.0120. This result shows that Vietnamese joint stock commercial banks increase equity capital in order to increase financial capacity, increase competitiveness, and ensure CAR for banking operations, thereby increasing business efficiency, however, the capital increase of large banks in the condition that the banks have ensured the capital adequacy ratio in the necessary conditions, the Equity/Asset ratio is not necessary. Therefore, banks need to maintain appropriate the Equity/Asset ratio, ensure competitiveness, liquidity and maintain capital adequacy ratio as regulated.

The Expense/Income ratio (CPTN) has a negative impact on the bank's business efficiency with statistical significance at P-value = 0.000 < 1% and has an impact coefficient of -0.0074. The analysis results show that if The Expense/Income ratio (CPTN) increases by 1 unit, the technical efficiency will decrease by 0.0074 units. The higher the Expense/Income ratio (CPTN), the lower the business efficiency of the bank. This is consistent with the fact because this ratio shows that How much does the bank have to pay for a dollar of income, the higher the cost of the bank, the lower the profit of the bank, the bank's operational efficiency decreased.

The Asset size (TTS) has an impact on the bank's business efficiency with statistical significance P-value = 0.007 < 5% with impact coefficient -0.0365. The estimated results show that the asset size (TTS) of the bank has a negative impact on the business efficiency of the bank. In the system of joint-stock commercial banks, the average asset size of large banks is 205.536 billion VND, many banks have large total assets, if the total assets of banks increase sharply, it will lead many banks to face a trend of decreasing efficiency with respect to scale, which will reduce the bank's operational efficiency. Therefore, banks also need to consider raising capital to avoid negative impacts on the bank's business efficiency.

The risk provision variable (DPRR) has a positive impact on the bank's business efficiency with an impact coefficient of 0.0113, however, the P-value = 0.624 > 10%, so it is not statistically significant and removed.

Debt/Total Assets ratio (DNTTS) has a positive impact on the bank's business efficiency with an impact coefficient of 0.0001, but P-value = 0.862 > 10%, so it is not statistically significant and removed.

VI. CONCLUSION

The estimation results of Tobit regression model on the impact of factors on the bank's business efficiency show that there are 6 influential factors that are: Return on Equity (ROE), Return on Asset (ROA), Bad debt ratio (NPL), Equity/Asset ratio (VCSHTS), Expense/Income Ratio (CPTN), Asset size (TTS) and in which NPL, CPTN, TTS have negative impact on the bank's business efficiency; As for the variables Risk provision ratio (DPRR), Debt/Total Assets ratio (DNTTS) are not statistically significant.

REFERENCES

[1]. A.R. Jayaraman & M.R. Srinivasan (2014). "Performance Evaluation of Banks in India– A Shannon-DEA Approach". Eurasian Journal of Business and Economics. 7(13), 51-68.

[2]. Annual reports of 30 Vietnamese commercial banks: Agribank, Viettinbank, BIDV, Vietcombank, ACB, Abbank, LienVietPosbank, Sacombank, Techcombank, MBBank, MaritimeBank, SHB, OCB, VIB, SCB, Vpbank, Eximbank, HDBank, NamABank, NCBank, VietCapitalBank, TPB, Seabank, PvcomBank, MSB, Baoviet Bank, Bac A Bank, Vietbank, PGBank, VietABank in the years 2016 – 2022.

[3]. Gwahula Raphael (2013). Efficiency of Commercial Banks in East Africa: A Non Parametric Approach. *International Journal of Business and Management*. 8(4).

[4]. Ji-Li Hu, Chiang-Ping Chen and Yi-Yuan Su (2006). Ownership reform and efficiency of nationwide banks in China. Institute of Business and Management. National Chiao Tung University. Taiwan.

[5]. Lieu Thu Truc and Vo Thanh Danh (2012). "Analysis of business operations of the system of joint stock commercial banks in Vietnam". Scientific Journal – Can Tho University. No. 21a.158-168.

[6]. Ngo Dang Thanh (2012). "Measuring the Performance of the Banking System Case of Vietnam (1990-2010)". *Journal of Applied Finance & Banking* 2(2).289-312.

[7]. Nguyen Thi Ha Thanh and Le Hoang Viet (2018). “Analysis of the operational efficiency of the system of joint stock commercial banks in Vietnam in the period 2011-2016”. Journal of Foreign Economic Relations, No.103
[8]. Nguyen Thi Thu Thuong (2017). Operational efficiency of commercial banks in Thai Nguyen province. Journal of Science Can Tho University. 50. Part D. 52-62.
[9]. Nguyen Thu Nga (2018). Analysis of factors affecting the business performance of Vietnamese joint stock commercial banks. Summary report on science and technology topics at university level. College of Economics and Business Administration, Thai Nguyen University [10]
[10]. Nguyen Viet Hung (2008). Analysis of factors affecting the business efficiency of banks in Vietnam. Thesis of Doctor of Economics. National Economics University.
[11]. Pasiouras, F.; Sifodaskalakis, E.; Zopounidis, C.(2007). Estimating and analysing the cost efficiency of Greek cooperative banks: an application of two-stage data envelopment analysis. University of Bath School of Management. Working Paper Series.
[12]. Samangi Bandaranayake and Bohhath Jayasinghe (2013). “Factors influencing the efficiency of commercial banks in Srilanka”. Sri Lankan Journal of Management. 18(1-2).21-50.
[13]. Tran Huy Hoang and Nguyen Huu Huan (2016). "Analysis of factors affecting the performance of Vietnam's commercial banking system in the period of international financial integration". Journal of Scientific Development and Technology. 19(1).88-101.

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