

**EVALUATING THE OPERATING EFFICIENCY OF
COMMERCIAL BANKING SECTOR IN LAO PDR**



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**A Thesis Submitted in Partial
Fulfillment of the Requirements for the Degree of
Master of Economics (Business Economics)
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ABSTRACT

Title of Thesis	EVALUATING THE OPERATING EFFICIENCY OF COMMERCIAL BANKING SECTOR IN LAO PDR
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The objectives of this research are to explore the bank operating efficiency and to identify the factors that determine the operating efficiency of commercial banking sectors in Lao PDR. First, the Data Envelopment Analysis (DEA) approach is employed to compare efficiency between private and foreign banks. The results show that foreign banks have higher operating efficiency comparing to private banks under intermediation and operating activities. On the other hand, private banks are more efficient under value-added function than foreign banks. For the regression analysis, we employ the Ordinary Least Squares (OLS) model to analyze the determinants of bank efficiency using both internal (bank specifies) and external (macroeconomics) variables. The results indicate that cost control is vital for developing the efficiency of the banking sector in Lao PDR.

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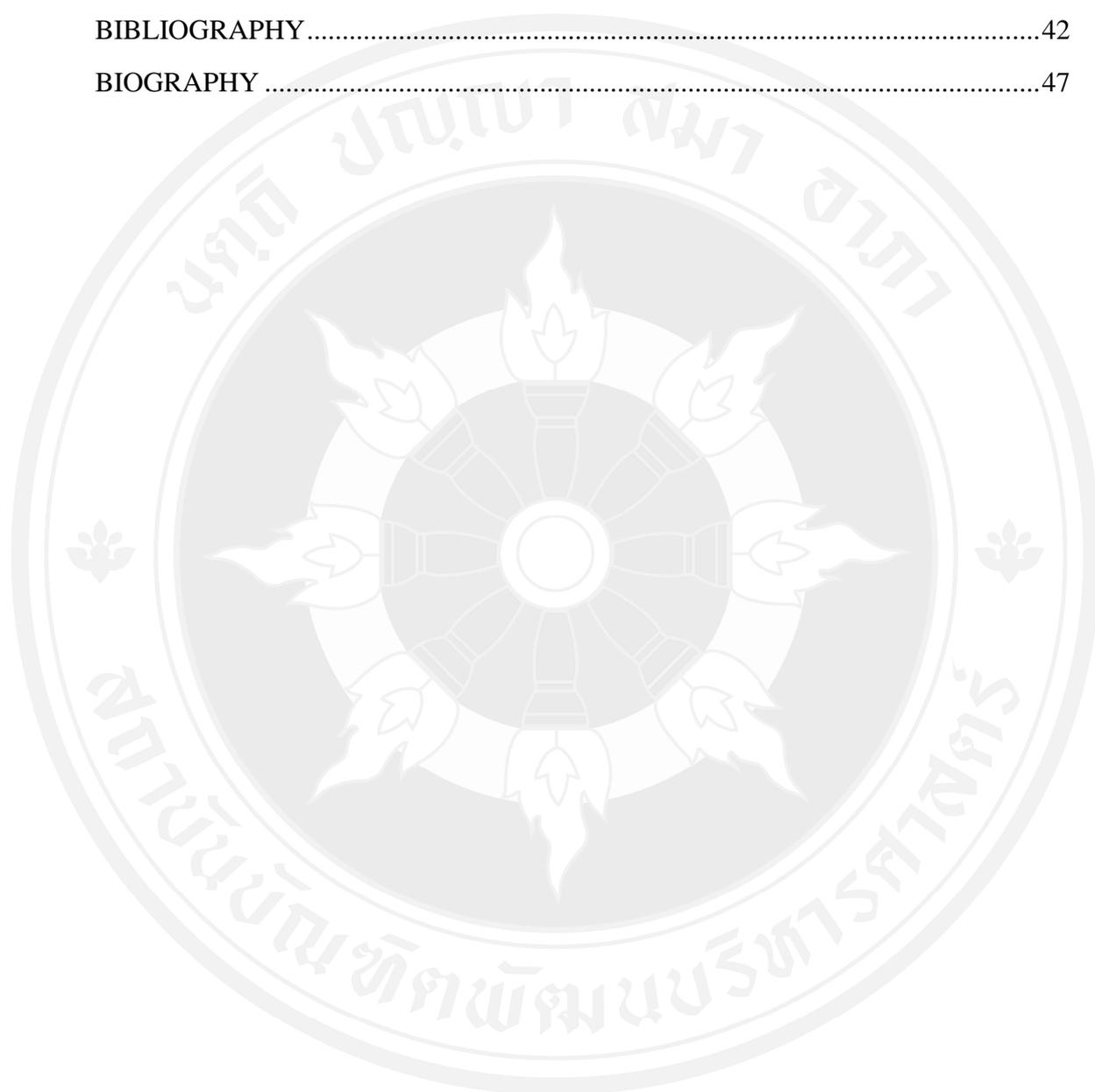
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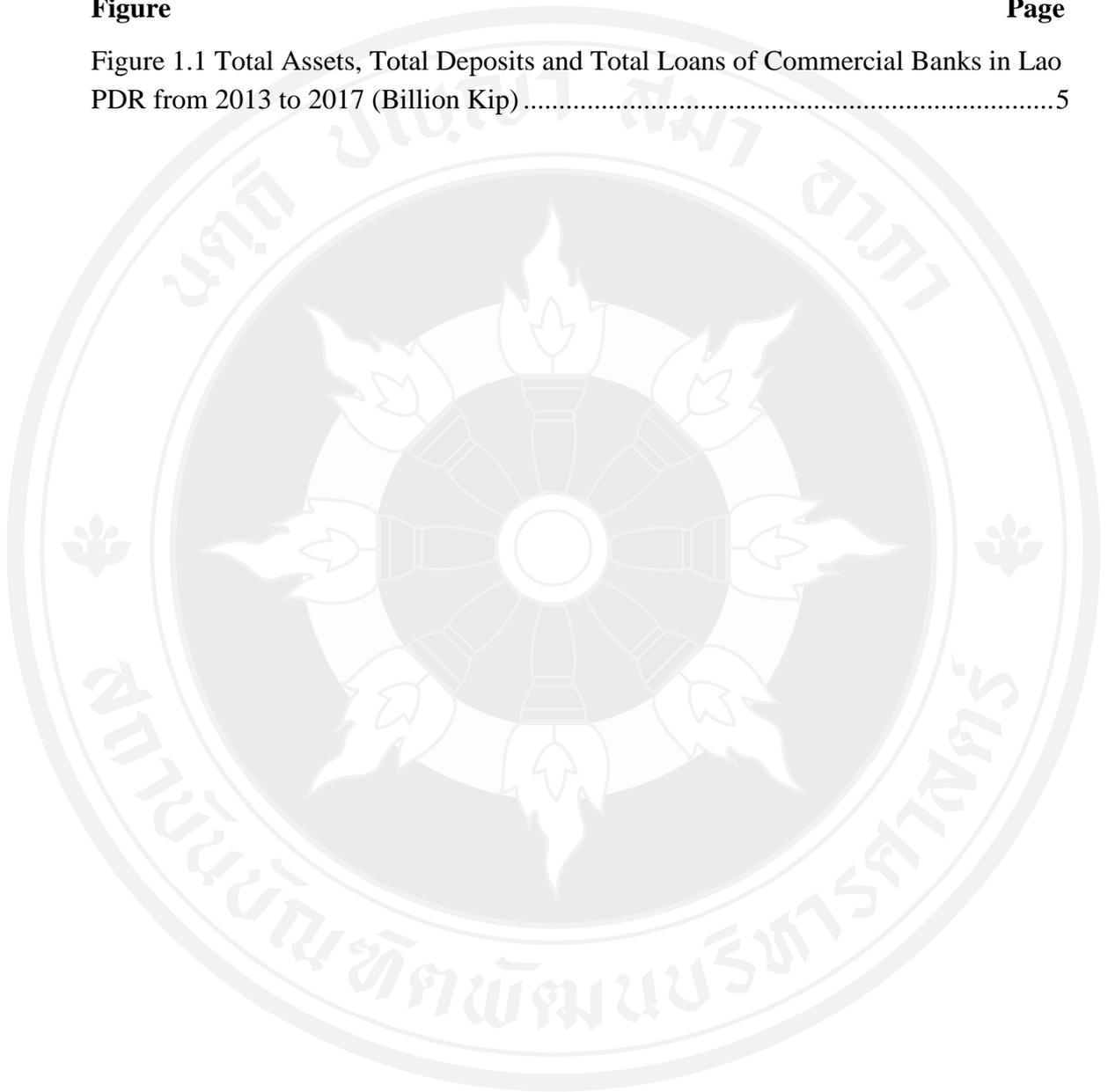


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CHAPTER 1

INTRODUCTION

1.1 Background

The competition in the banking industry has also been pronounced in response to the growing economic development and the financial sector reforms (Sanhapas Laowattanabhongse & Sorasart Sukcharoensin, 2018). The important role of banking industry is to fuel the economic transactions of the country; therefore, the banking sector serves as a financial intermediary in the economy, transferring capital from suppliers to demanders. Lao PDR has experienced a rapid economic development during the last two decades. Hasty economic growth has resulted in new and challenging reform in banking sector. The main purpose of the reform is to review financial deregulation and supervision of the financial system. The focus is on a more efficient allocation of resources and a more transparent banking systems, which enhance the economic efficiency and private sector development.

The measurement of bank operating efficiency is very important to management and regulatory authorities. The efficiency measurement of bank operation provides the management of the banks and regulators with environment scanning in their strategic planning process. The importance of efficiency measurement is to enable managers to benchmark bank performance and outline areas of inefficiency for future improvements (Mostafa, 2007). From bird's-eye view, the efficiency of the financial sector is potentially vital to the long-term growth performance of the countries and provide possible suggestions to revise regulations of the banking sector, specifically, in Lao PDR.

In early years, studies in the past relating to bank efficiency usually used conventional accounting ratios such as return on assets to evaluate the efficiency.

When analyzing the real situation, banks try to assess their strengths and weaknesses regarding products, human factor, communication policy, bank management, organization structure, apart from accounting information.

Also, bank usually assess their efficiency relative to other banks. For this purpose, banks use various methods seeking to find the most appropriate mixture of financial and non-financial assessment indicators. In economics, a production function relates output of a production process to inputs or factors of production. A bank is considered as a company with multiple input and output elements. Efficiency refers to ability of the bank to produce output with minimal resources or input, or commonly defined as the ratio of outputs over inputs (Chen et al., 2008; Sherman & Zhu, 2006). In addition, by definition, technical efficiency refers to the firm ability to maximize output with the given inputs or; produce same level of outputs with minimization of inputs (Cooper et al., 2006).

To date, there are various research articles assessing the bank efficiency in many countries. However, there are only limited number of papers documenting this issue in developing frontier market. Therefore, this paper adds to the existing literature in at least two ways. First, the paper is the pioneer articles in measuring the efficiency of banking sectors in Lao PDR. Second, it looks at many efficiency angles by using the intermediate, value-added, and operating approaches to estimate the input and outputs variables so that the policy implications could be recommended.

1.2 Evolutions of the Banking Industry in Lao PDR

During the last decades, the Lao banking system has been reformed through many stages. Turn to 1968, the Pathet-Lao Bank was constructed in the revolutionary area; Viengkay district, Huaphan province. In 1976, after the announcement of its independence, the Pathet-Lao Bank was moved the headquarter to Vientiane Capital and changed the name as “the National Bank”. In 1981, the Supreme People's Assembly announced a law on monopoly right over the banking activities No.001/SPA. During this period, bank renamed again from “the National Bank” into “the State Bank of Lao PDR”. The duty of the State Bank of Lao PDR acted as the state-monopolistic banking system, which monopoly all transaction activities in the

country, operating both central and commercial banking roles. Under the central bank function, the State Bank of Lao PDR referred as a national treasury, issued banknotes, regulated currency in circulation and managed payment system.

Under the commercial bank function, the SBL has followed to central planner's instruction. It represented as an intermediary between depositors and borrowers. It was also generated account deposits into loans for corporate enterprises. Through the afore-mentioned role, the banking sectors were inefficiently operated, resulting in lack of liquidity, poor performance and weak governance. During this period, the bank did not have many sources of budgets; it depended mainly on free budgets and some savings deposit. Generally speaking, the budgets were very weak. The use of budgets was restricted, which served only the policy of state for example loans were given to the factories and agriculture of the state-owned farms. While the private enterprises did not eligible for loans or if there were, the amount was very limited. Furthermore, the loan disbursement was ignoring proper calculation.

The late 1980s were the beginning of a new period to reform the financial institutes of Lao PDR. In 1988, the Council of Ministers announced an agreement No.11/COM on reforming the banking sector into business in line with a socialist directive. Awareness to this agreement, the State Bank amended a monopoly banking system into a two-stage bank system. The framework of this law was once issue that very important step for the extensive reformation of the bank system in Lao PDR. It permitted bank system to have divide operation between the central and commercial bank. In 1995, Lao government was an announcement "the Law of Central Bank No.05/LNA" that was established "the Bank of the Lao PDR (BOL)" as the Central Bank of Lao PDR. Central Bank referred to a "regulator" for regarding the macro-economic; such as for issuing of the monetary policies and exchange rate, commercial banks' regulation, manage the foreign reserves, issue and supervision of money supply. Moreover, the BOL was also provided the granting bank license, handling the monetary and credit system.

The end of 2006, Lao government has announced the Law on Commercial Banks to reform banking system in order to become more internationally recognized as a part of the preparation to be a membership of the World Trade Organization (WTO) in 2013. Membership means that the WTO principles of non-discrimination,

transparency, and predictability (including confidence that trade barriers aren't raised arbitrarily) are incorporated into Lao law. In addition, substantial reform measures needed to bring laws in line with WTO agreements on subsidies, price controls, trade restrictions, state enterprises, and more. At its heart are the WTO agreements, negotiated and signed by the bulk of the world's trading nations. But the WTO is not just about liberalizing trade and in some circumstances its rules support maintaining trade barriers, for example to protect consumers, prevent the spread of disease or protect the environment.

After Laos became 158th in 2 February 2013, the BOL stipulated the increase in the level of minimum registered capital to local commercial bank from 100 billion kip to 300 billion kip and stipulates foreign bank branch to increase the invested capital of at least 50 billion kip to 100 billion kip (Phetsathaphone Keovongvichith, 2012). Thus, the foreign bank that plans to invest in Laos has to be in a larger scale. In addition, the BOL has announced the business banking operation to electronic banking service. These regulations demonstrated that Laos was more liberalization, attracting foreign investors to invest in the banking sector. This would expand more commercial bank in Laos as local and foreign bank.

However, at present, banking institutions of Lao PDR still considered weak in term of capital, know-how and technology level compared with countries in the same region. There were limited in term of tools of macro-monetary protecting to follow up and prevent risk of the system. Therefore, modern payment system, has restricted the rapid growth of new products and services; among with the accounting system has not yet fully complied with international standards of International Financial Report Standards (IFRS). Finally, there were a low level of fundraising ratio, loan to GDP and ratio of access to bank services of public.

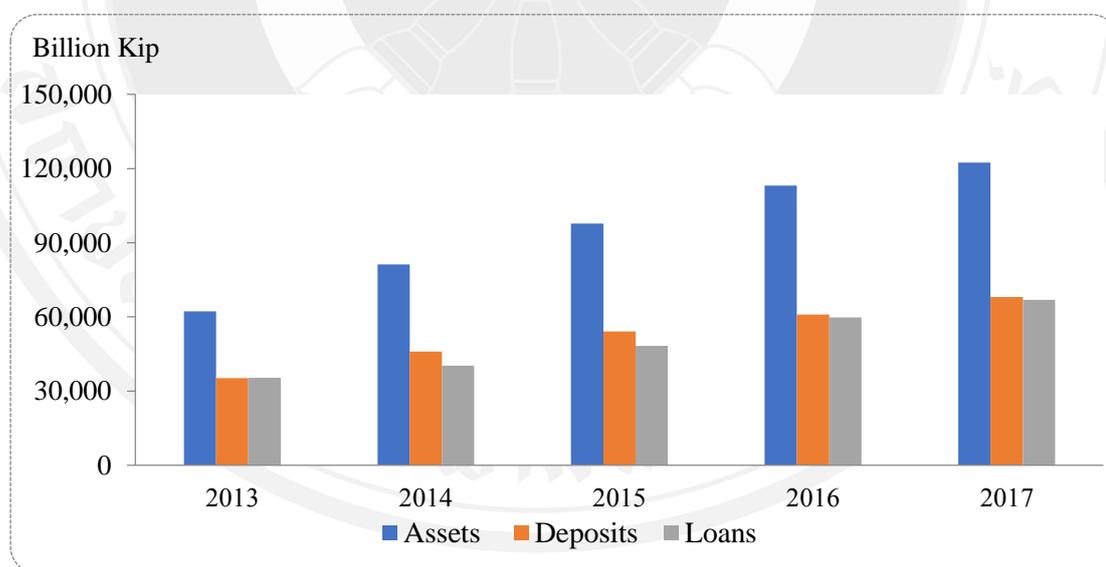
1.3 Current Banking System in Lao PDR

There are several components in the banking system in the Lao PDR. Lao financial industry includes Bank of the Lao PDR (BOL) act as the central bank of Laos, State-Owned Commercial Banks, Specialized Bank, Joint Stock Banks, Private Banks, Subsidiary Foreign Bank and Foreign Banks Branch as a Commercial banks;

and non-bank financial institutions. The commercial banks in Lao PDR refer to the financial institutions that licensed to conduct the banking businesses and provide financial services such as deposits, loans, accounts settlements, currency trading and other businesses in pursuant with the Law on Commercial Banks (Amended), No. 56/LNA, dated December 7th, 2018. The Law on Commercial Banks aims to reform banking system to become more internationally recognized. It was a significant step towards the socio-economic improvement of the Lao PDR.

From 2013 to 2017, a growing number of commercial banks; along with their total assets, total deposits and total loans have been continuously increased. The total assets of the banking industry have increased from 62,269.78 billion kip to 122,408.35 billion kip. The total deposits have amplified from 35,289.90 billion kip to 68,032.53 billion kip. Also, the total loans have also improved from 35,424.30 billion kip to 66,939.36 billion kip (see Figure 1.1)

Figure 1.1 Total Assets, Total Deposits and Total Loans of Commercial Banks in Lao PDR from 2013 to 2017 (Billion Kip)



Source: Annual Monetary Statistice Report, Bank of Lao PDR, 2013-2018

According to Laos' commercial banks' structure. The year of 2019, the amount of total commercial banks are 43 banks, namely 3 state-owned commercial banks, 1

specialize bank, 3 joint state commercial banks, 7 private commercial banks, 10 subsidiary foreign banks and 19 foreign commercial bank branches (see Table 1.1).

Table 1.1 List of Banks in Lao PDR

Bank Name	Established
State - Owned Commercial Bank	
Banque Pourle Commerce Exterieur Lao Public	Nov-89
Agricultural Promotion Bank	Jun-93
Lao Development Bank	Dec-02
Specialized Bank	
Nayoby Bank	Sep-06
Joint State Commercial Bank	
Lao-viet Bank Co.,Ltd	Mar-00
Banque Franco-Lao Ltd	Jul-10
Lao China Bank Co.,Ltd	Jan-14
Private Bank	
Joint Development Bank	Jul-89
Phongsavanh Bank Ltd	Feb-07
Indochina Bank Ltd	Nov-08
St Bank Co.,Ltd	May-09
Booyoung Lao Bank Ltd	Sep-09
Lao Construction Bank Limited	Feb-12
Maruhan Japan Bank lao Co.,Ltd	Feb-13
Subsidiary Bank	
ACLEDA Bank Lao.,Ltd	Jul-08
BIC Bank Lao Co., Ltd	Nov-08
Saigon Thuong Tin Bank Lao Co.,Ltd	Dec-08
Australia and New Zealand Banking Group Limited, Lao Branch	Jan-11
Vietinbank Lao Limited	Jan-12
Saigon-Hanoi Bank Lao Limited	Aug-12
RHB Bank Lao Limited	Apr-14
Kasikornthai Bank Limited	Oct-14

Table 1.1 List of Banks in Lao PDR (Continued)

Bank Name	Established
Canadia Bank Lao Co.,Ltd	Aug-15
Vietcombank Laos Limited	May-18
Foreign Commercial Bank Branch	
TMB Bank Public Company Limited	Sep-92
Siam Commerce Bank Ltd Vientiane branch	Nov-92
Bangkok Bank Public Co.,Ltd Vientiane Branch	Feb-93
Krung Thai Bank Limited Vientiane Branch	Feb-93
Bank of Ayudhya pcl., Vientiane Branch	Apr-94
Foreign Commercial Bank Branch	
Public Bank Berhad	Apr-95
Public Bank Wattay Branch	Feb-08
Public Berhad Bank Ltd, Savannakhet Branch	Feb-08
Bank of Ayudhya Pcl., Savannakhet Branch	Jun-09
Military Commercial Joint Stock Bank - Lao Branch	Dec-10
Industrial and Commercial Bank of China Limited Vientiane Branch	Feb-12
Malayan Banking Public Limited Company Lao Branch	Oct-12
Public Bank, Pakse Branch	Oct-12
CIMB Thai Bank Public Company Limited-Vientiane Branch	Jun-14
Cathay United Bank-Vientiane Capital Branch	Nov-14
Bank of China Limited, Vientiane Branch	Feb-15
First Comercial Bank ltd, Vientiane Branch	Mar-15
Bangkok Bank Pcl, Pakse Branch	Dec-15
Malayan Banking Berhad Nongduang Branch	Mar-16

Source: Bank of Lao PDR, 2019

The technology now has played an important role in changing the lifestyle of people, which propelled the inevitably defining the ways of the banking business operation. The investments in technology are the key in the new era of competitions. Since there have been increasing numbers of smart phone usages, the operation of the

banking sector in Lao PDR has been upgraded and more efficient. However, doing so requires a huge investment in transforming the industry's competitive landscape into digital banking system.

1.4 Objectives of the Study

- 1) To explore the bank operating efficiency in Lao PDR, particularly the private and foreign banks
- 2) To identify whether the home field advantage hypothesis or the global advantage hypothesis is predominant in Lao PDR.

1.5 Scope of the Study

The study is gathered data from two main resources, the Bank of the Lao PDR (BOL) and the published financial statement of observations. The data were downloaded from their respective website during the period 2013 to 2017. The observations are consisted of 8 banks to be analyzed, 4 of private and 4 of foreign banks. All the financial data were denominated in terms of Lao kip currency (million kip).

1.6 Benefit of the Study

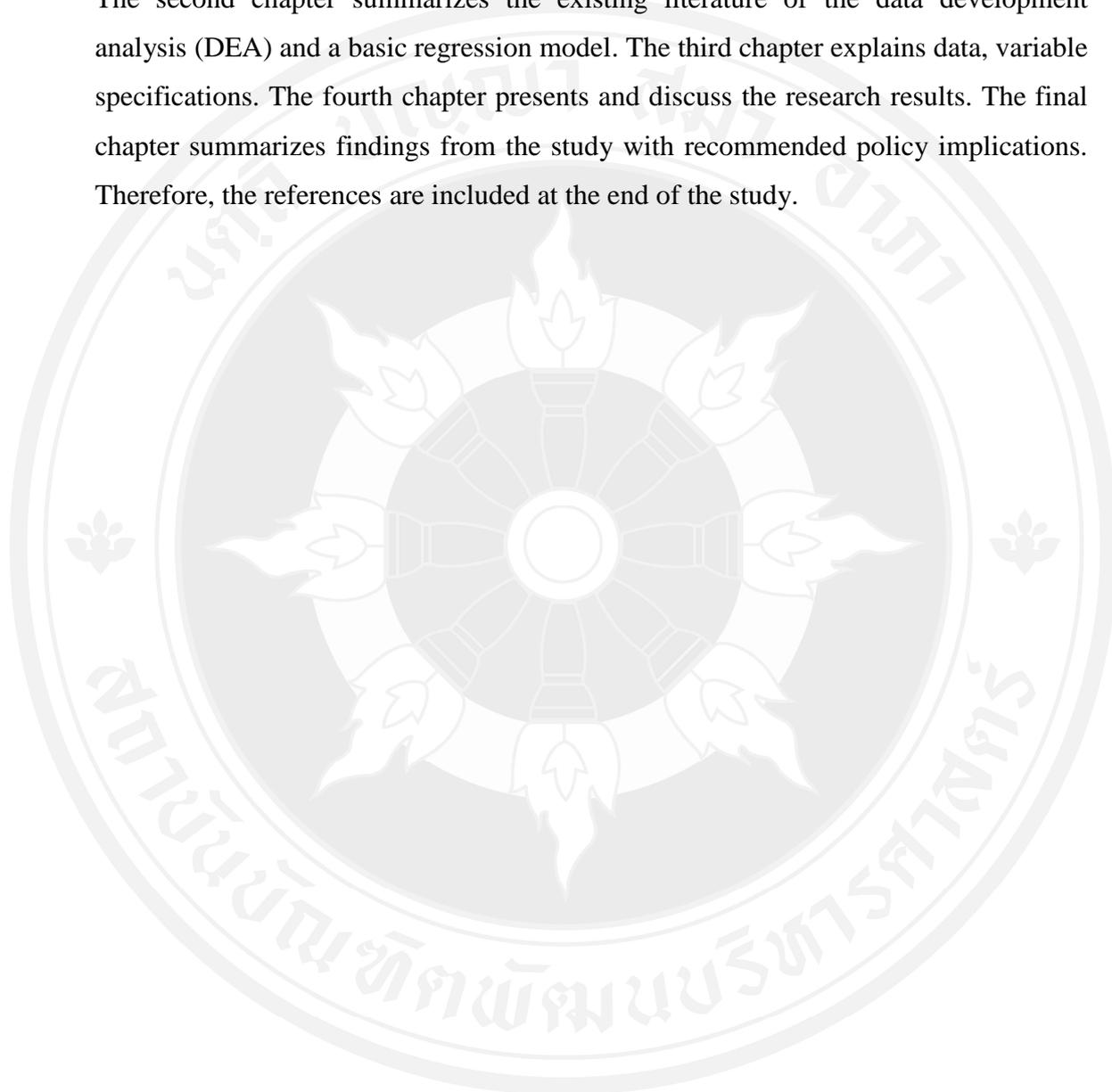
The benefits of the study can be divided into two points as follow:

- 1) Understanding of these issues will encourage the bank industry in Lao PDR
- 2) Getting suitable predicts bank efficiency regression equation.

In addition, the empirical results of this study can be used as a guideline for the policy maker decisions regarding to the bank interest rate policies. In this regard, understanding of these issues will encourage the bank industry in Lao PDR improve their efficiencies, which will finally lead to a competitive economy in the future.

1.7 Structure of the Study

The study is structured as follows. The first chapter provides introduction the important of study and background on the current banking system in the Lao PDR. The second chapter summarizes the existing literature of the data development analysis (DEA) and a basic regression model. The third chapter explains data, variable specifications. The fourth chapter presents and discuss the research results. The final chapter summarizes findings from the study with recommended policy implications. Therefore, the references are included at the end of the study.



CHAPTER 2

LITERATURE REVIEW

This chapter is focused on two sections. Section 2.1 Explain on Data Envelopment Analysis Concept and related literature review. Section 2.2 Explain on Multivariate Regression Analysis Concept.

2.1 Data Envelopment Analysis Concept

There are a variety of efficiency measurements, which are used to replace or combine with the traditional bank efficiency measure, namely "Efficient Frontier". The efficient frontier consists of the efficiency measure under parametric and non-parametric method. Parametric method includes Stochastic Frontier Approach (SFA), Distribution Free Approach (DFA) and Thick Frontier Approach (TFA). While the non-parametric method includes Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH). The efficiencies estimated under DFA and TFA approach have limitation in presenting the efficient of each unit. So, both approaches are not suitable for the study on bank efficiency. The assumption on issue of the "Relaxation of Convexity" of the FDH efficiency approach tends to make the efficient score high rather than actual score; thus, FDH is inappropriate to apply in evaluating bank efficiency.

Alongside, SFA and DEA have been used to evaluate the maximum output for a given set of inputs and has essentially been used in the appraisal of efficiency. They can be used to estimate capacity utilization. However, there are differences between both methods. For example, DEA does not consider noise in the model, inefficiency is caused only by noise of production factors. There are no assumptions required about the behavior of producer for maximum profit or minimum cost.

Standard DEA method needs only production quantity data and input variables, while SFA applies noise into model. For this reason, SFA method is suitable for studies that most data have noise and may influence the noise that we do not know such as weather, but not in evaluating bank efficiency.

The measurement of the banking sectors efficiency mostly applies Data Envelopment Analysis (DEA). The DEA approach was developed by Charnes, Cooper, & Rhodes (1978), briefly CCR. The CCR assumption is only justifiable when all decision-making units (DMUs) are operating at the optimal scale by assuming all DMUs has operating in Constant Returns to Scale (CRS), and provides the Overall Technical Efficiency (OTE). In other words, when a proportion of inputs increase, outputs proportionately upsurge in the same fashion. However, DMUs in practice might face either economic condition which CCR model does not describe the manufacturing characteristics in DMUs, which the basic model is as Equation (1) below:

Equation (1)

$$\begin{aligned} \text{Min,} & \quad \sum_{i=1}^m \omega_i x_{ik} & i = 1,2,3, \dots, m \\ \text{St,} & \quad \sum_{r=1}^n \mu_r y_{rk} = 1 & r = 1,2,3, \dots, s \\ & \quad \sum_{i=1}^m \omega_i x_{ik} - \sum_{r=1}^n \mu_r y_{rk} = 0 & j = 1,2,3, \dots, n \end{aligned}$$

Where, x_i input quantity i of DMU_k

y_r output quantity r of DMU_k

μ_r weight of input r

ω_i weight of output i

s number of output

m number of input

n number of DMU

Equation (1) considers minimum values of input at output level of each organization, which measured by weight of both input and output. There are limitations to determine performance index that relates to DMU_k has the highest value not more than 1. In addition, all DMU must be higher value than 0 of both weights determined.

Hence, Banker, Charnes, & Cooper (1984) extended the BCC model by relaxing the CRS assumption, which adding a restriction $\sum \gamma_i = 1$ called "Convexity Condition" into the original CCR equation. To solve the shortcoming of return to scale issue and to expand size of observations, the BCC model was used to estimate the efficiency of DMUs, which are characterized by Variable Returns to Scale (VRS).

The VRS assumption provides the measurement of pure technical efficiency (PTE) as Equation (2) below:

Equation (2)

$$\begin{aligned}
 & \text{Min, } k \\
 & \text{St, } -\sum_{i=1}^m x_{ij} \gamma_j + \theta_k x_{ik} \geq 0 \quad i = 1, 2, 3, \dots, m \\
 & \quad -\sum_{r=1}^s y_{rj} \gamma_j \geq y_{rk} \quad r = 1, 2, 3, \dots, s \\
 & \quad \sum_{j=1}^n \gamma_j = 1 \quad j = 1, 2, 3, \dots, k, \dots, m \\
 & \quad j \geq 0
 \end{aligned}$$

Where, k technical efficiency i of DMU_k

x_i input quantity i of DMU_k

y_r output quantity i of DMU_k

J efficiency weight of DMU_j

$-\sum_{j=1}^m x_{ij}$ sum of input for DMU_j

s number of output

m number of input

n number of DMU

The value of k is the technical efficiency of DMU_k , which if value is equal 1 indicate it is in the frontier line. The efficiency score from CCR and BCC model calculated, it is able used to compute scale Efficiency (SE) as Equation (3) below:

Equation (3)

$$SE = \frac{CCR}{BCC} \quad \text{or} \quad CCR = BCC * SE$$

If $SE = 1$ indicates that those DMU has optimal size and $SE < 1$ indicates that those DMU has non-optimal size. Thus, DMUs which have an efficiency scale must be only CRS, if DMUs are fully inefficiency of technical that indicate might be over or smaller size. IRS means that DMUs are smaller size than optimal position, while DRS mean that DMUs are oversize rather optimal position.

Efficiency Score

According to Farrell' theory (1957), DMUs on the production frontier is the DMUs that has production efficiency and DMUs outside the production frontier are inefficient DMUs (Färe, Grosskopf, & Lovell, 1994). The Overall Technique Efficiency (TE_{CRS}) score consists of Pure Technical Efficiency (TE_{VRS}) and Scale Efficiency (SE).

TE_{CRS} refers to the efficiency of the operations resulting from the business operation and then yields income from the use of production factors that are cost of sales/services, expenses liabilities and capital. TE_{CRS} can be provided from the calculation in the term of Constant Returns to Scale (CRS) by TE_{VRS} multiply SE as Equation (4) below:

Equation (4)

$$TE_{CRS} = TE_{VRS} * SE$$

TE_{CRS} score is equal one or less than one. If TE_{CRS} score is equal one ($TE_{CRS} = 1$) indicates that DMUs have overall technique efficiency and on the frontier efficiency line. If TE_{CRS} score is less than one ($TE_{CRS} < 1$) indicates that DMUs do not have overall technique efficiency and not on the frontier efficiency line.

TE_{VRS} refers to the ability of the production unit to be able to use the appropriate production techniques and get the most productivity under existing resources or from constant production factors. TE_{VRS} can be provided from the calculation in the term of Variable Returns to Scale (VRS) by TE_{CRS} divide SE as Equation (5) below:

Equation (5)

$$TE_{VRS} = \frac{TE_{CRS}}{SE}$$

TE_{VRS} score is equal one or less than one. If TE_{VRS} score is equal one ($TE_{VRS} = 1$) indicates that DMUs have pure technique efficiency and on the frontier efficiency line. If TE_{VRS} score is less than one ($TE_{VRS} < 1$) indicates that DMUs do not have pure technique efficiency and not on the frontier efficiency line. Inefficiency of DMUs from using proportionally input that not optimal in the production.

SE refer to when using the input has increased proportionately, how much the output will increase proportionately. DMUs are scale efficiency indicate if proportion inputs increasing, the resulting output will increase proportionally in the same size. Thus, DMUs which have scale efficiency must be only Constant Returns to Scale (CRS). For example, when using input of 10 percent increase, DMUs that has scale efficiency can be able to produce 10 percent as well. While, DMUs are scale inefficiency that indicate might be over or smaller size that DMUs can be able to produce more than 10 percent increasing, means that DMUs are smaller than optimal

size or calling Increasing Returns to Scale (IRS). But DMUs can be able to produce less than 10 percent increasing, means that DRS mean that DMUs are over rather optimal size as Equation (6) below:

Equation (6)

$$SE = \frac{TE_{CRS}}{TE_{VRS}}$$

SE score is equal one and less than one. If SE score is equal one ($SE = 1$) indicates that those DMU has optimal size. While, SE score is less than one ($SE < 1$) indicates that those DMU has non-optimal size.

There are numerous studies related to assessing bank efficiency by employing the DEA approach in various countries. The DEA is used as an instrument for measuring bank efficiency in many fields such as Profit Efficiency, Technical Efficiency, Cost Efficiency, Scale Efficiency and Allocative Efficiency. For example, Sufian & Habibullah (2009) used DEA approach to measure the bank efficiency in Korea in 1997, the period of Asian financial crisis. They separated the input and output variables into three different approaches, namely intermediation, value-added and operating approaches to provide the different efficient scores. The empirical result showed that the banking sector in Korea was inefficient under three approaches, while the operating approach found the inefficient in scale inefficient relative to pure technical inefficient. Besides, under the intermediation approach, it is inefficiency from pure technical relative to scale inefficiency during the pre- and post-crisis periods. Under the value-added approach, they found that the inefficient from scale outweighs pure technical inefficiency during the pre-crisis period, but the trend were imprecise during the post-crisis period.

Sufian & Habibullah (2010), also explored the efficiency over the Asian financial crisis of the Thai banking sectors by focusing only on intermediation function and classify banks into two groups as domestic and foreigner banks. The results under the DEA approach exhibited that the domestic banks had the highest efficiency in comparison to the foreign banks. Consequently, the mean technical

efficiency levels of foreign banks were lower relative to domestic banks. Nevertheless, domestic banks lacked inefficiency scale, while the foreign banks' inefficiency was still in pure technical inefficiency.

Ong, Theng, & Heng (2011) applied DEA to compared Malaysian bank efficiency between domestic and foreign banking sectors during 2002 to 2009, using the intermediation approach. The study found that the average PTE score of domestic banks was higher than foreign banks. The study also suggested that domestic banks have more advantage in terms of cost than foreign banks. Since foreign bank faced different regulations, language, culture, currency and prejudices, along with sometimes, the foreign bank's executives are faced with difficulty in management institutions from a distance.

Lim & Randhawa (2005) compare the banks that operating in Hong Kong and Singapore which have similar environment and rival national financial centers. The study separated into two points and it was found that banks in Singapore were more efficient on the production stage in term of deposit mobilization and production of financial services. Meanwhile, Hongkong banks were more efficient on the intermediation stage in term of capital used, financial intermediation, and transforming deposit into loans.

Sufian (2009) studied the efficiency of banking sectors in Malaysia during the 1997 Asian financial crisis using three different DEA approaches, namely intermediation, revenue and operating approaches. The study found that bank had the highest efficiency under the operating approach, but the lowest efficiency under intermediation approach. The study suggested that the bank efficiency was downcast under three approaches, but the effect was more noticeable under intermediation approach.

Grmanová & Ivanová (2018) explore efficiency of banks in Slovakia using DEA models and find that three largest banks at Slovak found to be efficient in both analyzed years. Jemric & Vujcic (2002) compare efficiency among old and new bank using size and ownership. The foreign-owned banks are the most efficient. The new banks are more efficient than old ones. The smaller banks are more efficient. Luciano & Regis (2007) find banking groups are less efficient than individual institutions.

Davidovic, Uzelac, & Zelenovic (2019) document that state-owned banks are permanently more efficient than private banks. Castellanos & Garza-García (2013) have examined the cost efficiency of banks in Mexico. They find that local banks are more efficient than foreign banks, contradicted to the result of Jemric & Vujcic (2002) or Nenovsky et al. (2008), which document that foreign-owned banks are the most efficient.

2.2 Multivariate Regression Analysis

There are a number of factors, which may have impacted the technique efficiency (TE) scores derived from the DEA model of bank. As described in the literature review in the previous section, the linear regression model was considered into used in this analysis due to its appropriate linear functional form. Mostly, the studies on bank-specific determinants such as Doyran (2013), Khediri & Ben-Khedhiri (2011), Ongore & Kusa (2013), employed the linear regression model to evaluate the impact of various factors that may be significant in explaining profitability. As with previous studies, a linear model is used to analyze the cross-section time series data and a simple linear equation is estimated using a pooled sample.

A pooling analysis allows obtaining more consistent estimates of the parameters within the model and it is a useable method, whereas the association between the variables is stable through cross-section units. The pooled least squares (OLS) method is the most consistent regression estimation because of its general quality of minimized bias and variance (Greene, 2004; Koutsoyiannis, 2003). Therefore, a multivariate analysis is carried out using an OLS-regression model to verify the hypotheses of this study and panel regression techniques are used to investigate the internal determinants. We select panel data because they allow measuring respectively individual variability and dynamic change of the cross-section units over time.

To examine the TE score determinants of Lao banks, we estimate a linear regression model as Equation (7) below:

Equation (7)

$$y_{it} = \alpha_t + \beta_{it}X_{it} + \varepsilon_{it}$$

Where “*i*” refers to bank; “*t*” refers to time period; “*y*” refers to the TE score of the bank in Lao PDR; “*X*” represents the bank-specific (determinants); “ ε ” is a normally distributed random variable disturbance term (error term).

2.3 Home Field and Global Advantage Hypothesis

Under the home field advantage hypothesis which propose by Berger et al., (2000). There is an assumption that domestic banks are generally more efficiency than foreign banks. The advantage may come from the local people bias against of financial services from foreign banks. Monitoring form a distant country is the problem that make it difficult to assess the behavior and performance of manager in that market and high cost for offering the good incentive for manager to work in abroad. Operating problems include the evaluate behavior and building a good relationship with households or lending, because it requires local information. Moreover, the disadvantages of foreign banks include a higher cost of providing the same financial services and lower revenue from problems in providing the same quality relative with other banks in that market. Besides the mention above, local banks have competitive advantages such as asset size, market share, language, culture and regulations.

Under the global advantage hypothesis, which has an assumption on foreign banks are generally more efficiency than domestic banks. Since, they are able to overcome these cross-border disadvantages and have higher efficiency when operating in other counties, such as lowing cost by turning use of higher technologies than human resources. They have an advantage from risk management skills or can able to spreading of risks variety through superior investment from their biggest capital and undertake higher risk higher expected return. Commonly, the prior empirical evidence advocates that foreign banks in developing have succeeded in capitalizing on their advantages and they exhibit a higher level of efficiency compared

to their domestic bank peers (e.g. Ataulah et al., 2004; Havrylchyk, 2006; Isik & Hassan, 2002; Leightner & Lovell, 1998; Sathye, 2003; Shanmugam & Das, 2004).

However, since foreign banks headquartered in distant countries have different market environment, language, culture, and regulatory structure. These could be at greater disadvantage compared to those located within the same region. This is truly an empirical issue, so we test our hypothesis based on this matter in Lao PDR. We explore whether foreign-owned banks are more efficient in Laos PDR. The home-field advantage hypothesis state that local banks should be more efficient than foreign banks since they have competitive advantages such as asset size, market share and language, culture and regulations. On the other hand, foreign banks have the advantages in terms of technology and international expertise in providing global banking services. Therefore, we test the mentioned hypothesis in this study to compare the efficiency of both kinds of banks and to test whether the home field advantage hypothesis or the global advantage hypothesis is predominant in Lao PDR.

CHAPTER 3

DATA AND METHODOLOGY

This chapter presents research methodology to assess commercial banks' operating efficiency and their determinants in Lao PDR. It is composed of three sections. Section 3.1 explains the concept of Data Envelopment Analysis (DEA) model and definition of input and output variables to measure the efficiency. Section 3.2 explains the application of the Ordinary Least Squares (OLS) model, as well as shows the definition and hypothesis of the variables. Section 3.3 explained on data collection of the study.

3.1 Data Envelopment Analysis Model

First, we apply the DEA model, using Variable Returns to Scale (VRS) method. VRS is a kind of frontier scale used in DEA method focusing on the input-oriented model to measure the efficiency of private and foreign banks in the Lao PDR. It helps to estimate efficiencies whether an increase or decrease in input or outputs does not result in a proportional change in the outputs or inputs, respectively (Cooper et al., 2011). We considered only the measurement of pure technical efficiency (PTE), which examines the bank efficiency without an overweight of scale efficiency and provides the suitable data on bank efficiency relative to the CRS assumption. The VRS assumption keeps the assessment of pure technical efficiency in Equation (8) in the same fashion of Kamarudin et al. (2019).

Equation (8)

$$\begin{aligned} & \text{Min, } k \\ & \text{Subject to, } -\sum_{i=1}^m x_{ij} \gamma_j + \theta_k x_{ik} \geq 0 \quad i = 1, 2, 3, \dots, m \end{aligned}$$

$$-\sum_{i=1}^m \gamma_{rj} \gamma_j \geq \gamma_{rk} \quad r = 1, 2, 3, \dots, s$$

$$\sum_{j=1}^n \gamma_j = 1 \quad j = 1, 2, 3, \dots, k, \dots, m$$

$$\gamma_j \geq 0$$

Where,	k	Technical efficiency i of DMU_k
	x_i	Input quantity i of DMU_k
	γ_r	Output quantity i of DMU_k
	J	Efficiency weight of DMU_j
	$-\sum_{j=1}^m x_{ij}$	Sum of input for DMU_j
	s	Number of output
	m	Number of input
	n	Number of DMU

The measure of efficiency score can be divided into two groups. An efficiency DMU has an efficiency score of 1 or “Best Practice” and efficiency DMU that has an efficiency score less than 1 indicates ineffective DMU. The most important step to measuring efficiency of DEA is to choose input and output variables appropriately (Chinpruttiwong & Sukcharoensin, 2019). Efficiency score obtained depends on the definition of variables used. Following Sufian & Habibullah (2009), this study separates the input and output variables using three different approaches including intermediation, value-added and operating approaches.

From previous literature as discussed in the previous section, we then collect a set of variables and use correlation matrix to screen out the highly correlated variables that can be used for proxy of each input to prevent multi-collinearity problem. Under the intermediation approach, the study considers deposits (X1) and personal expenses (X2) as inputs to produce loans (Y1) and operating profit (Y2). For the value-added approach, two types of inputs are assumed as interest expenses (X3) and personal expenses (X2) to produce outputs such as deposits (Y3) and loans (Y1). While, under the operating approach focus on interest expenses (X3) and personal expenses (X2) as inputs to produce interest income (Y4) and non-interest income (Y5) as outputs (see Table 3.1).

Table 3.1 Input and Output Variables

Approach	Input Variables	Output Variables
Intermediation Approach	Deposits (x_1)	Loans (y_1)
	Personal Expenses (x_2)	Operating profit (y_2)
Value-Added Approach	Interest Expenses (x_3)	Deposits (y_3)
	Personal Expenses (x_2)	Loans (y_1)
Operating Approach	Interest Expenses (x_3)	Interest Income (y_4)
	Personal Expenses (x_2)	Non-Interest Income (y_5)

3.2 Regression Analysis

It is important to describe the factors impacting bank-specific determinants and pure technique efficiency (PTE) scores gained from the DEA model. Following the described literature review above, the linear regression model is incorporated into the analysis because the linear functional form is an appropriate one. Typically, the studies on bank-specific determinants and macroeconomics conditions such as Ataullah & Le (2006); Sufian (2010); Sufian & Habibullah (2009) among other; employ the linear regression model to evaluate the impact of various factors that may be significant in explaining profitability.

After getting PTE scores from the first stage analysis, the pure technique efficiency (PTE) scores gained from the DEA analysis were described and applied to regress on a set of independent variables in the Ordinary Least Squared (OLS) model. The purpose is to allow the restricted (0,1) range of efficiency values. The statistics demonstrate that the OLS model is the most reliable regression and consistent estimation of the coefficient in the procedure involving DEA because of their general quality of minimized bias and variance.

In this stage, we apply OLS method to estimate the determinant variables and bank efficiency under three approaches, which can be classified into nine regression models (see Table 3.2). For model 1, 4 and 7, include six internal bank specific variables namely asset size (LNTA), loan quality (LLP/TL), profitability (ROA), liquidity (TL/TA), capital strength (Equity/TA) and expenses (NIE/TA). Model 2, 5 and 8, add the macroeconomics control variables such as the gross domestic product (LNGDP) and inflation rates (LNINF). The internal bank specific variables are also included in the model. Model 3, 6 and 9, contain a dummy variable (DUM_PB) which focuses on the relationship between the PTE score and a set of determinants, while the macroeconomics variables are also retained in the model. The definition and hypothesis of determinant variables are displayed in Table 3.3.



Table 3.2 Multiple Regression Models

No.	Regression Models
By applying the PTE score from Intermediation Approach as the dependent variable	
Model 1	$PTE_{it} = \beta_0 + \beta_{it}(LNNTA_{it} + \frac{LLP}{TL_{it}} + ROA_{it} + \frac{TL}{TA_{it}} + Equity/TA_{it} + NIE/TA_{it}) + \varepsilon_{it}$
Model 2	$PTE_{it} = \beta_0 + \beta_{it}(LNNTA_{it} + \frac{LLP}{TL_{it}} + ROA_{it} + \frac{TL}{TA_{it}} + Equity/TA_{it} + NIE/TA_{it} + LNGDP_{it} + LNINF_{it}) + \varepsilon_{it}$
Model 3	$PTE_{it} = \beta_0 + \beta_{it}(LNNTA_{it} + \frac{LLP}{TL_{it}} + ROA_{it} + \frac{TL}{TA_{it}} + Equity/TA_{it} + NIE/TA_{it} + LNGDP_{it} + LNINF_{it} + DUM_{PB_t}) + \varepsilon_{it}$
By applying the PTE score from Intermediation Approach as the dependent variable	
Model 4	$PTE_{it} = \beta_0 + \beta_{it}(LNNTA_{it} + \frac{LLP}{TL_{it}} + ROA_{it} + \frac{TL}{TA_{it}} + Equity/TA_{it} + NIE/TA_{it}) + \varepsilon_{it}$
Model 5	$PTE_{it} = \beta_0 + \beta_{it}(LNNTA_{it} + \frac{LLP}{TL_{it}} + ROA_{it} + \frac{TL}{TA_{it}} + Equity/TA_{it} + NIE/TA_{it} + LNGDP_{it} + LNINF_{it}) + \varepsilon_{it}$
Model 6	$PTE_{it} = \beta_0 + \beta_{it}(LNNTA_{it} + \frac{LLP}{TL_{it}} + ROA_{it} + \frac{TL}{TA_{it}} + Equity/TA_{it} + NIE/TA_{it} + LNGDP_{it} + LNINF_{it} + DUM_{PB_t}) + \varepsilon_{it}$
By applying the PTE score from Intermediation Approach as the dependent variable	
Model 7	$PTE_{it} = \beta_0 + \beta_{it}(LNNTA_{it} + \frac{LLP}{TL_{it}} + ROA_{it} + \frac{TL}{TA_{it}} + Equity/TA_{it} + NIE/TA_{it}) + \varepsilon_{it}$

Table 3.2 Multiple Regression Models (Continued)

No.	Regression Models
Model 8	$PTE_{it} = \beta_0 + \beta_{it}(LNNTA_{it} + \frac{LLP}{TL}_{it} + ROA_{it} + \frac{TL}{TA}_{it} + Equity/TA_{it} + NIE/TA_{it} + LNGDP_{it} + LNINF_{it}) + \varepsilon_{it}$
Model 9	$PTE_{it} = \beta_0 + \beta_{it}(LNNTA_{it} + \frac{LLP}{TL}_{it} + ROA_{it} + \frac{TL}{TA}_{it} + Equity/TA_{it} + NIE/TA_{it} + LNGDP_{it} + LNINF_{it} + DUM_PB_t) + \varepsilon_{it}$

Where “*i*” refers to bank; “*t*” refers to time period; “*y*” refers to the PTE score of the bank in Lao PDR; “*X*” represents the determinant variables; “ ε ” refers to the error term.

Table 3.3 Definition and Hypothesis of Determinant Variables

Variables	Definition	Hypothesis
Bank Specific Variables		
LNTA	A proxy of bank size and calculates by take the natural logarithm into total asset.	+/-
LLP/TA	A proxy of laon quality and calculates by using the ratio of loan loss provision to total loans.	-
ROA	A proxy of bank profitability and is calculated by dividing net income divides with total assets.	+
TL/TA	A proxy of liquidity and is calculated by dividing total loan with total assets.	-
Equity/TA	A proxy of capital strenght and calculates by shareholders equityto total assets.	+
NIE/TA	A proxy of expenses and calculates by non interest expenses to total assets.	-
		+

Table 3.4 Definition and Hypothesis of Determinant Variables (Continued)

Variables	Definition	Hypothesis
Macroeconomics Variables		
LNGDP	A proxy of gross domestic product and calculated by taking the natural logarithm of the national gross domestic product.	
LNINF	A proxy of inflation and calculated by the natural logarithm of inflation rate.	-
Dummy Variables		
DUM_PB	The dummy variable that takes a value of 1 if a bank is private bank, 0 otherwise.	-

3.3 Data Collection

The data is gathered from two main resources, the Bank of the Lao PDR (BOL) and published financial statements of each bank, which can be downloaded from their respective websites. As described in Table 3.4, there are six kinds of bank in Lao PDR. Each of them has its unique scope of doing business and is subject to different regulatory control, only private bank and subsidiary foreign bank are considered to be comparable. Table 3.4 shows the number of banks in Lao PDR classified by their types of banks.

Since the state-owned commercial banks are dominated at the forefront in terms of modern innovation and is outstanding from its peer. So, this study does not include State-Owned Commercial Banks into analysis. We also exclude Specialized Banks, Joint State Commercial Banks and Foreign Commercial Bank Branches due to their newly open and unable to access the data.

Moreover, these banks have no continuous and complete data to be compared for bank efficiency between 2013 to 2017. Consequently, this study evaluates only two groups of banks; Private and Subsidiary Foreign Banks (or Foreign Banks), to

determine the operating efficiency and provide the determinants of the bank operating efficiency. However, the banking industry in Lao PDR is still at its early stages of development; therefore, complete data is not available for many banks regarding the variables. Also, foreign commercial bank branches have limited access to banking services and operations, so we exclude them for the analysis. In the end, the sample of this study consists of four private and four foreign banks which have been continuously operated in the Lao PDR during 2013 to 2017.

To describe the structure of commercial banks in Lao, the total number of commercial banks are 43 banks, which can be further divided into six types, namely 3 state-owned commercial banks, 1 specializes bank, 3 joint state commercial banks, 7 private commercial banks, 10 subsidiary foreign banks and 19 foreign commercial bank branches.

The study has limited for selection the observation because the number banks in each type in Lao are still small and newly established. Thus, this study considers the banks that are established before the year of 2012, operating continuously for a period of 5 years (2013 to 2017) and able to access data.

Table 3.5 Number of Banks in Lao PDR

Bank Types	Number
State - Owned Commercial Bank	3
Specialized Bank	1
Joint State Commercial Bank	3
Private Bank	7
Subsidiary Foreign Bank	10
Foreign Commercial Bank Branch	19

Source: Bank of Lao PDR, 2019

CHAPTER 4

DATA ANALYSIS AND DISCUSSION

Chapter 4 is organized into two subsections. Section 4.1 Examines the determinants of Lao banks efficiency. Especially, this section provides an analysis and comparison between operating efficiency of private and foreign banks. Section 4.2 Identify the factors that determine the operating efficiency of commercial banking sectors in Lao PDR.

4.1 Bank Efficiency

The measurement of bank efficiency score from DEA model could be divided into 2 groups. If a bank has an efficiency score of 1 is referred to “Best Practice”. If the efficiency score of a bank is less than 1, that bank is labeled as “inefficiency bank”. DEA approach can uncover the cause of inferior performance which can be used to understand the operating efficiency of the bank and hopefully can help to improve the bank’s efficiency.

We apply input-oriented model that presents the pure technical efficiency (PTE scores) in Lao commercial banking sectors. The results are classified by private and foreign banks using three approaches that are reported in Table 4.1. The empirical results suggest that the PTE scores are not significantly different between private and foreign banks under three approaches. Interestingly, the efficiency of the foreign banks exhibits large-scale asymmetry under three approaches.

4.1.1 Efficiency of Private Banks

Table 4.1 presents average results of bank efficiency score under the three approaches for the sample of private banks. The estimations of the average efficiency score are consistently higher under operating approach, which is followed by the intermediation and value-added approach of 78.17%, 76.32% and 75.62% respectively. This evidence indicates that private banks have been inefficient in value-added, intermediation and operating aspects with average score of 24.38%, 23.68% and 21.83%, respectively. While the lowest efficiency score is found in PSV under intermediation approach, STB under value-added approach and JDB under operating approach.

Regarding intermediation approach, private banks in Lao have been inefficient in transforming deposits into loans as we can see from the average bank's efficiency score could only transform 78.17% of the inputs used for generating the same level of output. This means private banks in Lao have wasted inputs of 21.83% on average to produce the same of outputs comparing to their counterparts.

However, under intermediation approach, the results show that on average IDCN is recorded to the highest efficiency score, following by STB, JDB and PSV of 95.59%, 91.98%, 61.08% and 56.62%, respectively. If the banks improve their efficiency of intermediation, they should reduce of input level on average of 4.41%, 8.02%, 38.92% and 43.38%, respectively, to produces the same level of outputs.

Under value-added approach, the results show that on average IDCN is recorded to the highest efficiency score, followed by PSV, JDB and STB of 94.35%, 85.22%, 63.65% and 59.25% respectively. The results suggest that most banks were able to keep the input level on average of 5.65%, 14.78%, 36.35% and 40.75%, respectively, for supplying the same level of outputs under the value-added approach.

For the operating approach, on average IDCN is recorded to the highest efficiency score, followed by STB, PSV and JDB of 94.80%, 88.51%, 65.39% and 63.99% respectively. In other word, on average the banks have been inefficient or they could save 5.2%, 11.49%, 34.61% and 36.01% of inputs used for generating the same level of outputs respectively. On average, private banks in Lao have used more inputs level under value-added approach. This implies that the inefficiency of the

private banks in Lao is caused by the overuse of inputs to produces the same level of outputs compared to their ability in term of intermediation and operating aspect. However, the efficiency score does not display different variation under three functions.



Table 4.1 Average PTE score of Intermediation, Value-added and Operating Approach for Private and Foreign Banks in Lao PDR

DMU Name	Intermediation Approach	Value-Added Approach	Operating Approach
Private Banks			
JDB	0.6108	0.6365	0.6399
PSV	0.5662	0.8522	0.6539
STB	0.9198	0.5925	0.8851
IDCN	0.9559	0.9435	0.9480
Min	0.5662	0.5925	0.6399
Mean	0.7632	0.7562	0.7817
Max	0.9559	0.9435	0.9480
SD	0.2031	0.1687	0.1579
Foreign Banks			
BIC	0.8800	0.8587	0.9175
ACB	0.9469	0.3601	0.9101
SCB	0.8657	0.7415	0.8982
ANZ	0.5523	0.8171	0.8090
Min	0.5523	0.3601	0.8090
Mean	0.8112	0.6943	0.8837
Max	0.9469	0.8587	0.9175
SD	0.1762	0.2281	0.0504

Note: ACB is Aceda Bank Lao., Ltd, ANZ is Australia and Zealand Bank (Lao) Limited, BIC is BIC Bank Co., Ltd, IDCN is Indochina Bank Ltd, JDB is Joint Development Bank, SCB is Saigon Thuong Tin Bank Lao Co., Ltd, PSV is Phongsavanh Bank Ltd, STB is ST Bank Ltd,.

4.1.2 Efficiency of Foreign Banks

Interestingly, the results in Table 4.1 also show that on average foreign banks had higher efficiency in comparison with the private banks in the Lao PDR. Foreign banks have highest average efficient score under profitability function, followed by intermediation and production functions of 88.37%, 81.12% and 69.43%, respectively. On average, foreign banks were inefficient in production, intermediation and profitability functions of 30.57%, 18.88% and 11.37%, respectively.

Therefore, the results indicate that ANZ has lowest efficiency score under intermediation and profitability functions. Similarly, ACB is found to be lower efficiency score under production approach. While, ACB has higher efficiency score under intermediation function. On the other hand, BIC is observed to have higher efficiency score under production and profitability functions. Our findings reject the home-field advantage hypothesis in a sense that foreign-owned banks are more efficient than local banks, in line with (Nenovsky et al., 2008).

Using the intermediation function, foreign banks are inefficient in transforming deposits into loans that the average bank's efficiency score could only transform 81.12% of the inputs used to generate the same level of output. This means foreign banks have saved inputs of 18.88%, on average, to produce the same level of outputs.

Hence, for intermediation function, the evidence reveals that on average ACB has the highest efficiency score, followed by BIC, SCB and ANZ of 94.69%, 88%, 86.57% and 55.23% respectively. If, the banks wish to improve the efficiency of intermediation aspect, they should reduce of input level on average of 5.31%, 12%, 13.43% and 44.77%, respectively, to produces the same level of outputs.

Under production function, the study found that on average BIC has the highest efficiency score, followed by ANZ, SCB and ACB of 85.87%, 81.71%, 74.15% and 36.01% respectively. The results suggest that the banks are able to reduce inputs level on average of 14.13%, 18.29%, 25.85% and 36.01% respectively, to generate the same level of outputs under the production function.

Similarly, the profitability function is reported that on average BIC has the highest efficiency score of 91.75%, followed by ACB, SCB and ANZ of 91.01%,

89.82%, and 80.9% respectively. This implies that, on average, foreign banks (e.g BIC ACB, SCB and ANZ) could have saved 8.25%, 8.99%, 10.18% and 19.1%, respectively, of inputs to generate the same level of outputs.

On average, foreign banks in the Lao PDR used more inputs level under production function to produce the same level of outputs, in comparison with their ability in term of intermediation and profitability.

4.2 Multivariate Regression Analysis

The empirical result from the first stage indicates that, on average, the PTE score under three approaches of the Lao private banks were lower relative to their foreign banks. The second stage explores the determinant variables, including bank specific and external macroeconomics factors. Then, we test for the determinants of operating efficiencies of Lao PDR.

We apply OLS method to estimate the multivariate regression that are classified into the 9 regression models as present in Table 4.2. The regression result is based on the relationship between bank efficiency and the determinant variables. The equations include 40 firm-year observations during the period of 2013 to 2017. The value-added approach has higher adjusted R-squared, followed by intermediation approach and the operating approach. The F-test is statistically significant at 1% level under three approaches.

Table 4.2 Summary Multivariate Regression Analysis Model under Three Approach

Variable	Intermediation Approach			Value-Added Approach			Operating Approach		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
CONSTANT	0.796 (0.900)	0.962 (1.492)	0.027 (2.002)	1.178 (1.025)	3.792** (1.609)	2.064 (2.123)	1.777** (0.867)	1.047 (1.406)	-2.381 (1.649)
Bank Specific Variables									
LNTA	-0.067 (0.059)	-0.051 (0.065)	-0.010 (0.087)	-0.019 (0.067)	-0.036 (0.070)	0.039 (0.093)	-0.087 (0.057)	-0.053 (0.062)	0.097 (0.072)
LLP/TL	4.314*** (1.387)	4.292*** (1.424)	4.231*** (1.438)	0.945 (1.580)	0.630 (1.534)	0.518 (1.524)	1.105 (1.337)	1.190 (1.341)	0.967 (1.184)
ROA	4.653** (2.091)	4.237* (2.202)	4.310* (2.222)	-6.004*** (2.381)	-6.063*** (2.373)	-5.929*** (2.356)	5.871*** (2.051)	5.194*** (2.074)	5.461*** (1.830)
TL/TA	1.320*** (0.301)	1.337*** (0.310)	1.290*** (0.320)	0.333 (0.343)	0.276 (0.334)	0.189 (0.339)	0.451 (0.290)	0.502* (0.292)	0.330 (0.263)
Equity/TA	0.829** (0.421)	0.904** (0.444)	0.944** (0.451)	-0.240 (0.480)	-0.302 (0.479)	-0.228 (0.479)	0.125 (0.406)	0.275 (0.418)	0.423 (0.372)
NIE/TA	-2.381* (1.229)	-2.442* (1.261)	-2.389* (1.273)	-7.253*** (1.400)	-7.117*** (1.359)	-7.019*** (1.350)	-1.159 (1.184)	-1.315 (1.188)	-1.122 (1.048)
Macroeconomic Variables									
LNGDP		-0.064 (0.154)	-0.009 (0.174)		-0.336* (0.166)	-0.234 (0.184)		0.022 (0.145)	0.223 (0.143)
LNINF		0.020 (0.031)	0.015 (0.032)		0.057* (0.034)	0.047 (0.034)		0.012 (0.029)	-0.008 (0.027)
DUM_PB			-0.050 (0.070)			-0.092 (0.074)			-0.182*** (0.058)
R ²	0.506	0.576	0.583	0.600	0.649	0.666	0.422	0.458	0.593
Adj R ²	0.488	0.466	0.458	0.528	0.559	0.566	0.316	0.318	0.471
F-test	7.202***	5.260***	4.656***	8.264***	7.176***	6.656***	4.009***	3.278***	4.857***

Note: (1) ***, **, *, indicates significance at the 1%, 5% and 10% level, respectively. (2) Value in parentheses are standard errors.

The empirical result indicates a positive relationship between banks efficiency and loan quality (LLP/TL) which seems to be highly significant at 1% level for intermediation approach. The result suggests that both private and foreign banks in the Lao PDR can improve their efficiency by monitoring carefully the loss provision to total loans.

As Sufian (2010) suggests that the supervisor should focus seriously on the management of loan quality that has been proven to have problems in the period study. It is noted that under value-added approach, we find a negative relation between bank efficiency and ROA ratio (statistically significant at 1% level). This is inconsistent with the view that banks can increase their efficiency by improving their ability of the banks to earn higher margins. However, we document a negative relationship between bank profitability and ROA under value-added approach. The findings are consistent with Ataullah & Le (2006). Careful interpretation of this result should be conducted. Since deregulation of the banking sector in Lao PDR is quite new, some of them might not reach the break- even point, so the profits are slim comparing to their asset expansion. Therefore, the negative relationship of TSE score and ROA ratio should be interpreted as increasing total assets of Lao banks outlead the ability to make profit; therefore, the efficiency is reduced, accordingly.

In term of liquidity, we found a positive relationship between Lao bank efficiency and TL/TA under the intermediation approach and significantly at 1% level. We find that liquidity is only significant when we captured with the macroeconomics variables and significantly at 10% level (Model 8). The result suggests that the higher value of the TL/TA ratio is associated with the higher the bank operation efficiency level. This means that commercial banks in Lao are efficient in term of transforming deposits into loans. As suggested by Sufian (2009), the positive coefficient of TL/TA ratio implies that the banks could handle their operation efficiency well and save the cost of operation.

Considering the capital strength viewpoint, we find a positive relationship between Lao banks efficiency and Equity/TA ratio. The result is statistically significant at 5% level under intermediation approach. The higher level of capital strength leads to a higher bank efficiency level. As Sufian (2010) suggested, the strong capital structure is the heart of the bank's operation in developing countries.

Capital strength could help reinforce efficiency of the bank and possibly enable them to encounter financial crisis and gain more confidence from their clients during volatile macroeconomic shocks.

In term of the expenses of the banks, the NIE/TA ratio is negatively and highly statistically significant at 1%, meaning that NIE/TA has a negative impact on Lao banks' efficiency under value-added approach. Under intermediation approach, the relationship is also negatively impact on to Lao bank' efficiency. This variable is statistically significant at 10% level. Higher level of expenses leads to a lower efficiency of banking sectors in the Lao PDR. In other words, the evidence suggests that Lao banks are inefficient in managing their expenses such as wages and salary of their staff and supervisor, along with the other operating expenses. Obviously, improving cost management is an essential part for developing the efficiency of the Lao banking sector, consistent with Sufian & Habibullah (2009).

When we control the effect of macroeconomic condition as LNGDP into the regression model. we document a negative relationship between LNGDP and bank efficiency. This is significant at 10% level only under value-added approach. As Sufian & Habibullah (2009) pointed out that the demand of financial services tends to grow as economies expand and societies wealthier. They discover the negative relationship between the efficiency of Korean banks and LNGDP during the 1997 Asian financial crisis. At that time, the Korea economy are among the most volatile economic growth. This leads to higher loan defaults and poor profitability of commercial banks.

However, during the year of study, Lao economics had faced a volatile economics. Higher prices of agricultural products raised export earning, while higher price of oil raise transportation cost and hence production cost raised and higher prices of import products. As a result, the commodity in Lao trend to become a higher price, (Bank of Lao PDR, 2017). The volatile economic as mention above could directly affect the lower demand for financial services of customers, increased loan defaults and gain to poor profitability of Lao banking sectors.

On the other hand, LNINF has positive relationship and significant at 10% level. This has a great impact on bank efficiency under value-added approach. The higher inflation rate influences the potential for banks to adjust the new interest rate

and earn the higher return (Model 5). As Perry (1992) suggested that the effect of bank efficiency depended on the inflation is anticipated or unanticipated. In case of anticipated, an adjusting bank interest rate is resulted to bank revenue rise faster compared with bank costs and positively impact to the bank efficiency. In case of unanticipated, banks have decelerated of interest rates adjustment is resulted to bank cost rise faster compared with bank revenue and negatively impact to the bank efficiency. However, during the year of study, the inflation levels were anticipated by the Lao banks. This means bank in Laos gave the opportunity to adjust the interest rates accordingly and earn the higher profits.

Finally, DUM_PB has a negative relationship impact to Lao banking sector and highly significant at 1% level only in operating approach (Model 9). This supports the notion that private banks act as local banks are inefficiency comparing to subsidiary foreign banks in Lao PDR.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

This study is the first study to measure the banks efficiency in Lao PDR, applying the Data Envelopment Analysis (DEA) approach. The observations are classified into two groups as private and foreign banks over the period of 2013 to 2017. The DEA method is employed in assessing input and output variables to estimate the bank efficiency in Laos. We explore three types of DEA approaches; namely intermediation, value-added and operating approaches. Then, we apply the OLS model to explore the determinants of bank efficiency under three approaches, both bank specifies and macroeconomics variables are included into regression model.

5.1 Conclusion

The empirical results reveal that private banks have lower efficiency compared to foreign banks under intermediation and production approach. On the contrary, private banks had highest efficiency under production approach. This result is consistent with Jemric & Vujcic (2002), which document that foreign-owned banks are more efficient than local banks. However, we find that private banks do not have different variation in efficiency under three approaches, while foreign banks have higher efficiency under profitability approach, followed by intermediation approach. However, the efficiency tends to be lower in term of production aspect. Additionally, the study find that private banks present a lower efficiency score in comparison to foreign banks over the period of study.

The multiple regression analysis suggests that loan quality and liquidity had positive and highly significant on the private and foreign banks in Lao PDR under

intermediation approach. Clearly, both groups of banks were effective in allocating loans to their customers. Since banks have effective management and lower costs in terms of production, so they could take advantage of appropriate market conditions and offer loans to their customers.

The results in this study show somewhat a mixed relationship between bank profitability and bank efficiency under three approaches. The study suggests that the main resources of bank is deposit. Higher bank profitability leads to higher efficiency in generating deposit into potential. On the other hand, we find a negative and significant impact of deposits to bank profitability under value-added approach, meaning that banks were poor in transforming deposit in loans.

5.2 Recommendation

Overall, the study suggests that banks in Laos have higher costs, mainly salaries and other operating expenses. If local banks could minimize their expenses, their efficiency will increase significantly. The empirical results of this study shed light on the importance of information provided to the regulators and decision makers to review bank operating efficiency in the Lao PDR. For bankers, this study provides information and guideline in order to improve and make better decisions on future bank's operating efficiency, accordingly. To be specific, cost control is vital for bank efficiency in Lao PDR.

To improve the performance of banks, regulators may need to encourage the use of information technologies and uplift digital skills to improve profit and efficiency of the banks in Lao PDR. Basically, the ratio of non-interest expenses to total assets is significant in the regression, non-interest expenses to total assets have played major role in determining bank efficiency. Local banks have poor cost management in terms of employee and staff cost (e.g wages, salaries, bonuses, and other legally required benefits).

To support the developing economics and population growing up day by day, many banks have expanded their business and hire more staff or salary increased and consequently to become the higher staff cost. Lao banks should reduce spending on staff expenses by better management the number of staff in each service unit

appropriately. Regular overtime, when taken for granted, may discourage some staffs from finishing their work in a standard workday. Overtime work may be necessary, but get a handle on it by requiring that it be authorized and justified.

Next, Lao banks should decrease expenditure on administrative expenses. Administrative expenses are the expenses an organization incurs not directly tied to a specific function such as manufacturing, production, or sales. These expenses are related to the organization as a whole as opposed to an individual department or business unit. Therefore, these expenses should be identified for the cuts because they do not have a direct impact on a bank's main operating function.

Because administrative expenses may be eliminated without direct impact on the product being sold or produced, they are typically the first expenses that should be identified for budget cuts. The decision whether to own or rent property is generally based upon the bank's scale of operations. Ownership increase fixed costs and financial exposure for local banks.

Furthermore, staff expenses and administrative costs are related. Technology effectively reduces distance, so there is no need to require administrative persons or specialists to be physically positioned. Foreign banks have more advantage in banking technology, so they can management these costs productively so as to improve their operating efficiency. Obviously, this study demonstrates that decent cost management is important to the efficiency and growth of any bank that wants to keep up in a more competitive environment in Lao banking sectors.

A common limitation in doing research on bank efficiency in Loa PDR researchers might encounter is the problem of insufficient sample size for statistical measurement. That is why this study use DEA method, which is a parametric method to avoid small sample problem. However, we hope that future studies will make a more active attempt to minimize the amount of missing data, and that more valid statistical analyses.

Progress has been made in assessing bank efficiency in Loa PDR; however, many important research questions and model improvements still remain. Future studies can address the issue of bank's performance analysis so it can create an opportunity for governments and regulatory institutions to identify the best practices and promote them to the rest of the banking industry. Another observation from our

study is that banking efficiency analysis is usually based on defining the input–output variables under various assumptions. Academics have proposed several approaches; however, there is no consensus about the optimal input–output approaches. The issue is needed to be explored which approach is the most suitable for measuring bank efficiency in Loa PDR.



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