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# **Strategic Fit and Potential Gains of Mergers and Acquisitions in Banking: An Emerging Market Perspective**

**By**

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**A Thesis submitted to College of Business and Economics of Addis Ababa University in partial fulfillment of the requirements for Master of Business Administration (MBA in Finance)**

**Advisor: Yitbarek Takele (Associate Professor)**

**July 2020**

**Addis Ababa, Ethiopia**

### **Declaration**

I hereby declare that this thesis titled “*Strategic Fit and Potential Gains of Mergers and Acquisitions in Banking: An Emerging Market Perspective*” has been carried out by me under the guidance and supervision of my Advisor Dr. Yitbarek Takele.

The thesis is original and has not been submitted for the award of any degree or diploma to any university or institution.

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**Date**

July 2020

### **Certification**

This is to certify that Haben Mehari Redae has carried out this research work on the topic “**Strategic Fit and Potential Gains of Mergers and Acquisitions in Banking: An Emerging Market Perspective.**” Under my supervision. This research is his original work and has not been presented for a degree in any university, and all sources of materials used for the study have been duly acknowledged. Thus, it is sufficient for submission for the partial fulfillment of the requirements for the award of Master of Business Administration.

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## **Abstract**

The concerted economic reform efforts of the Ethiopian government focusing on liberalization and deregulation may cause an industry shock that could trigger merger waves in the banking industry. This research analyzes the potential gains and strategic fit from potential bank Mergers & Acquisitions that may arise due to the government's reforms. An Input-oriented Data Envelopment Analysis with both Constant Returns to Scale and Variable Returns to Scale model is adopted to analyze the potential gains. Intermediation approach is chosen for Input-Output selection. These are obtained from financial statements of 17 Local banks and 4 Foreign banks for the period from 2013 to 2018. Bank size and Ownership structure are used as contextual variables. There are 1,204 and 1,103 potential mergers from which 96.34% and 65.91% of mergers show overall efficiency gains, 63.5% and 54% show pure efficiency gains, 94.6% and 82.14% show technical efficiency gains, 63.46% and 63.37% show scale efficiency gains for Constant Returns to Scale and Variable Returns to Scale assumption respectively. 46.33% of the mergers' show scale efficiency gains indicating favorability for full mergers, contradicting other researchers. A total of 45 bootstrapped panel Tobit regressions with 50 replications for each are applied to the results. Results show most efficiency gains come from technical efficiency gains which don't necessitate full mergers. Only local private banks have slight efficiency gains by full mergers. The paper pointed out bank sizes and ownership structures that offer strategic fit and efficiency gains in potential bank Mergers & Acquisitions in Ethiopia.

**Keywords:** Ethiopia, Data Envelopment Analysis, Banking, Mergers and Acquisitions, Efficiency, CRS, VRS

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## **List of Abbreviations**

AB: Abay Bank

AdIB: Addis International Bank

AfCFTA: African Continental Free Trade Association

AIB: Awash International Bank

BBI: Bunna International Bank

BIB: Berhan International Bank

BoA: Bank of Abyssinia

CBB: Construction and Business Bank

CBO: Cooperative Bank of Oromia

COLS: Corrected Ordinary Least Squares

CRS: Constant Returns to Scale

DB: Dashen Bank

DBE: Development Bank of Ethiopia

DEA: Data Envelopment Analysis

DGB: Debub Global Bank

DMUs: Decision-Making Units

DRS: Decreasing Returns to Scale

HE: Harmony or Scope Efficiency

HSB: Housing and Savings Bank

IRS: Increasing Returns to Scale

LE: Learning or Technical Efficiency

LIB: Lion International Bank

M&A: Mergers and Acquisition

NBE: National Bank of Ethiopia

NIB: Nib International Bank

OIB: Oromia International Bank

OME: Overall Merger Efficiency

PME: Pure Merger Efficiency

PPS: Merger possibility set

SE: Size or Scale Efficiency

SDEA: Stochastic Data Envelopment Analysis

SFA: Stochastic Frontier Analysis

UB: United Bank

VRS: Variable Returns to Scale

WB: Wegagen Bank

WTO: World Trade Organization

ZB: Zemen Bank

## **Chapter One: Introduction**

This chapter presents the background of the study, problem statement, research questions, objectives of the study, research hypothesis, significance of the study, scope of the study, limitation of the study and organization of the thesis.

### **1.1. Background of the Study**

Finance and economic growth are frequently referred to have a strong link. Financial institutions especially banks play a key role in a country's economy. Banks help coordinate the best investment opportunities with accessible investment funds which can be converted into capital.

The expression "Mergers and Acquisitions" (M&A) alludes to the way toward consolidating or gaining all or part of another organization's property rights. There are numerous explanations behind merging. The internal organizational reasons include the possibility of exploiting economies of scale, economies of scope, and risk-sharing. The external or market-oriented reasons incorporate the plausibility of gaining market power via size and scope (Boetoft & Wang, 2005). Fruitful mergers can deliver numerous gains such as cost savings, increased profits, upscaling, and freeing up abundant resources. In any case, to decrease the failure rate of M&A activities, one of the basic advances that ought to be taken by a bidder company is to identify suitable companies before an M&A is to determine whether the prospective partner can offer synergies to supplement those of the acquiring company (Wanke, Barros, Azad, & Constantino, 2016).

There are various theories of M&A, which clarify the different intentions for which organizations go for M&A deals. These are classified into two major theories according to (Leepsa & Mishra, 2016). The first group is labeled as industrial organization theories that incorporate thought processes like expanding market control, improving efficiency, defensive or pre-emptive intentions. The second group is labeled as corporate governance theories which include solving agency problems, resolving internal efficiencies, and capital market imperfections.

The literature on the effect of bank mergers can be partitioned into two fundamental strands. The primary strand utilizes event study methodology to evaluate the responses of stock or security markets to merger announcements. The second strand is to investigate the impact of mergers on operating efficiency (Le T. D., 2015). This paper focuses on this second strand and in like manner, this strand is additionally separated into two sections: studies on efficiency effects of mergers using actual data on

several bank mergers and simulation studies and the focus of this paper is on the efficiency effects of mergers using simulation studies.

There have been various studies on the efficiency effects of mergers using simulation studies (Kumar, Tiwari, & Choudhary, 2019; Amin, Al-Muharrami, & Toloo, 2019; Wang & Zhang, 2018; Chen, Wanke, & Tsionas, 2018; Amin & Al-Muharrami, 2018; Shi, Li, Emrouznejad, Xie, & Liang, 2017; Wanke, Maredza, & Gupta, 2017; Sufian & Kamarudin, 2017; Bakshi & Sinha, 2017; Said, Zouari-Hadiji, & Bouri, 2017; Wanke, Barros, Azad, & Constantino, 2016; Du & Sim, 2016; Chaudhary, Shah, & Hashmi, 2016; Awan, Shah, & Hassan, 2016; Gattoufi, Amin, & Emrouznejad, 2014; Lee, 2014; Jayaraman, Srinivasan, & Arunachalam, 2014; Halkos & Tzeremes, 2013; Reda, 2013; Lozano & Villa, 2010). To the best of the researcher's knowledge, this is the first time Ethiopian banks have been analyzed in terms of potential M&A.

There are adequate reasons that can drive banks in Ethiopia to carry out mergers and acquisitions locally and soon with international financial institutions. The Ethiopian government's economic reform efforts focus on liberalization and deregulation. The Ethiopian government has taken the first step towards liberalizing the finance sector by granting a license to start business operations for a foreign-owned company in the financial sector (Wilson, 2019). The government has also ratified the African Continental Free Trade Area (AfCFTA) (African Union, 2019) and has resumed the WTO accession negotiations (World Trade Organization, 2020). Both of these initiatives push for the liberalization of the banking sector (Meseret, 2019). The National Bank of Ethiopia has plans to launch the Stock market in 2020 (Yewondwossen, 2019). These reforms might create industry shocks and start merger waves (Harford, 2005) as industry deregulation has been the most dominant factor for Mergers and Acquisitions (Ovtchinnikov, 2013).

There is also a high rate of failure in Mergers and Acquisitions (Wanke, Maredza, & Gupta, 2017) and these have been attributed to many factors including financial and market factors, cultural differences, neglect of strategic direction, poor integration, unrealistic expectations, overpayments, inefficiencies, problems in administrating the merged entities and managers' glory-seeking personal motives (DePamphilis, 2017; Steger & Kummer, 2007; Salame, 2006; Hoetzel, 2005; Gadiesh & Ormiston, 2002; Balmer & Dinnie, 1999).

To reduce the rate of failure one of the basic advances that ought to be taken is to identify suitable targets before an M&A by determining whether the prospective partner can offer synergies (Wanke,

Barros, Azad, & Constantino, 2016). The evidence in Ethiopia shows that the banking sector is inexperienced in M&As. The M&A history in the Ethiopian banking sector is characterized by consolidations between state-owned banks. The recent merger activity occurred in 2016 when Construction and Business Bank was dissolved into the Commercial Bank of Ethiopia (Meseret, 2019). This shows that the Ethiopian Banking sector is underprepared for a potential merger wave.

In the context of the above discussion, the purpose of this study is to assess whether there are potential gains and strategic fit from future mergers and acquisitions within the Ethiopian banking sector.

### **1.1.1. History of Banking in Ethiopia**

Modern Banking started in Ethiopia in 1905 with an agreement reached between Ethiopian Emperor Minilik II and Mr. Na Gillivray, a representative of the British owned National Bank of Egypt. This agreement built up Bank of Abyssinia (Mekonnen, Kedir, & Shibru, 2015). Bank of Abyssinia was managed by the National Bank of Egypt and was given full rights to issue banknotes and monitor coins which were to replace the Maria Theresa and become legal tender (Kebede, 2017). In 1908 a new development bank called Societe Nationale d'Ethiope Pour le Developpement de l'Agriculture et du Commerce and two other foreign banks Banque de l'Indochine and the Compagnie de l'Afrique Orientale were also established in Ethiopia (Meseret, 2019).

Generally, in its brief time of presence, Bank of Abyssinia had been carrying out limited business such as keeping government accounts, some export financing and undertaking different errands for the government. Additionally, the Bank confronted tremendous weight for being inefficient and purely profit-motivated. Thus by 1931 Bank of Abyssinia was legally replaced by Bank of Ethiopia shortly after Emperor Haile Selassie came to power. The new Bank, Bank of Ethiopia, was a purely Ethiopian institution and was the first indigenous bank in Africa (NBE 2009/2010) and established by an official decree on August 29, 1931, with a capital of GBP 750,000. Bank of Egypt was willing to abandon its concessionary rights in return for a payment of GBP 40,000 and the transfer of ownership took place very smoothly and the offices and personnel of the Bank of Abyssinia including its manager, Mr. Collier, being retained by the new Bank. Ethiopian government-owned 60 percent of the total shares of the Bank and all transactions were subject to scrutiny by its Minister of Finance. (Alemu, 2015)

Bank of Ethiopia assumed control over the commercial activities of the Bank of Abyssinia and was authorized to issue notes and coins. The Bank with branches in Dire Dawa, Gore, Dessie, Debre Tabor, Harar, agency in Gambella, and a transit office in Djibouti proceeded effectively until the Italian

invasion in 1935. During the invasion, the Italians established branches of their main Banks namely Banco di Italia, Banco di Roma, Banco di Napoli, and Banco Nazionale del Lavoro, and began their activities in the principal towns of Ethiopia. Nonetheless, they all stopped operation soon after liberation except Banco di Roma and Banco di Napoli which remained in Asmara. In 1941 another foreign bank, Barclays Bank, came to Ethiopia with the British troops and organized banking services in Addis Ababa, until its withdrawal in 1943. At that point on the fifteenth of April 1943, the State Bank of Ethiopia initiated full operation following 8 months of preliminary activities. It acted as the central Bank of Ethiopia and had the power to issue banknotes and coins as the agent of the Ministry of Finance. In 1945 and 1949 the Bank was granted the sole right of issuing currency and deal in foreign currency. The Bank likewise worked as the principal commercial bank in the national and engaged in all commercial banking activities. The State Bank of Ethiopia had built up 21 branches including a branch in Khartoum, Sudan, and a transit office on Djibouti until it ceased to exist by bank proclamation issued in December 1963. Then the Ethiopian Monetary and Banking law that came into force in 1963 separated the function of commercial and central banking creating the National Bank of Ethiopia (NBE) and Commercial Bank of Ethiopia (CBE). Besides, it enabled foreign banks to operate in Ethiopia limiting their maximum ownership to be 49 percent while the remaining balance should be owned by Ethiopians. There were two other banks in operation namely Banco di Roma S.C. and Banco di Napoli S.C. that later reapplied for a license as per the new proclamation each having a paid-up capital of ETB 2 million. The first privately-owned bank, Addis Ababa Bank S.C., was established on Ethiopians initiative and started operation in 1964 with a capital of 2 million in association with National and Grindlay Bank, London which had 40 percent of the total share. In 1968, the original capital of the Bank rose to 5.0 million and until it ceased operation, it had 300 staff at 26 branches. (Alemu, 2015)

Following the downfall of the imperial regime in 1974, In January 1975 all privately owned financial institutions including three private commercial banks, were nationalized and the nationalized banks were reorganized into one commercial bank; i.e. the Commercial Bank of Ethiopia and two specialized banks-the Agricultural and Industrial Bank (AIB), later renamed as the Development Bank of Ethiopia (DBE) and Housing and Savings Bank (HSB), later renamed as the Construction and Business Bank (CBB). The competitive banking situation that started to flourish during the 1960s and 1970s was nipped in the bud by the command system that reigned between 1974- 1991. Following the change of government in 1991, and the subsequent measures taken to liberalize and reorient the economy

towards a system of economy based on commercial considerations, the financial market was deregulated (Meseret, 2019). In line with this Monetary and Banking proclamation of 1994 established the National Bank of Ethiopia as a judicial entity, separated from the government, and outlined its main function (Alemu, 2015). Monetary and Banking Proclamation No. 83/1994 and the Licensing and Supervision of Banking Business No. 84/1994 laid down the legal basis for investment in the banking sector. Consequently, shortly after the proclamation the first private bank, Awash International Bank was established in 1994. Dashen Bank also comes to the scene, on September 20, 1995, as a share company. (Kebede, 2017)

### **1.1.2. History of Mergers and Acquisitions in the Ethiopian Banking Sector**

In Ethiopia's History of Banking; the main M&A operations were conducted by government decisions between state-owned banks. After the 1974 declaration of socialism, all private banks operating in the banking sector were nationalized by the Dergue regime. In 1976, the three private banks, Addis Ababa Bank, Banco di Roma, and Banco di Napoli, were combined into Addis Bank by government decision. The other merger took place between the Saving & Mortgage Corporation and the Imperial Saving & Homer Ownership Public Association to form the Housing & Saving Bank (later renamed Construction & Business Bank) by proclamation No. 60, 1975. The main objective of these mergers was to establish a strong bank by putting together those banks that perform similar activities. After four years of operation, Addis Bank itself converged by proclamation in 1980 with the Commercial Bank of Ethiopia to form the new Commercial Bank of Ethiopia, which was the nation's only commercial bank until the private banks were allowed to enter the market in 1994. The recent merger operation in the banking sector in Ethiopia occurred in 2016 when the Commercial Bank of Ethiopia took over the Construction and Business Bank. The rationale behind the decision was to stay away from duplication of effort and order redundancies as both banks were state-owned and serving common purposes (Meseret, 2019).

## **1.2. Statement of the Problem**

There has been considerable research in the area of Banks Mergers and Acquisitions (Alexandridis, Antypas, & Travlos, 2017; Du & Sim, 2016; Leepsa & Mishra, 2016; Caiazza, Clare, & Pozzolo, 2012; Awdeh & El-Moussawi, 2011; Focarelli, Panetta, & Salleo, 2002). Studies typically don't find only one rationale but several rationales for mergers and acquisitions. These motives can be divided into two groups firm-level motives and external factors (Meseret, 2019).

Under firm-level motives, there are various theories of M&A, which clarify the different intentions for which organizations go for M&A deals. These are classified into two major theories according to (Leepsa & Mishra, 2016). The first group is labeled as industrial organization theories that incorporate thought processes like expanding market control, improving efficiency, defensive or pre-emptive intentions. The second group is labeled as corporate governance theories which include solving agency problems, resolving internal efficiencies, and capital market imperfections.

Besides the above-mentioned rationales, the Ethiopian banking sector might have external pressures to carry out M&As. The Ethiopian government's economic reform efforts focus on liberalization and deregulation. The Ethiopian government has taken the first step towards liberalizing the finance sector by granting a license to start business operations for a foreign-owned company (Wilson, 2019). The government has also ratified the African Continental Free Trade Area (AfCFTA) (African Union, 2019) and has resumed the WTO accession negotiations (World Trade Organization, 2020). Both of these initiatives push for the liberalization of the banking sector (Meseret, 2019). The National Bank of Ethiopia has plans to launch the Stock market in 2020 (Yewondwossen, 2019). These reforms might create industry shocks and start merger waves (Harford, 2005) as industry deregulation has been the most dominant factor for Mergers and Acquisitions (Ovtchinnikov, 2013).

There is also a high rate of failure in Mergers and Acquisitions (Wanke, Mareza, & Gupta, 2017) and these have been attributed to many factors including financial and market factors, cultural differences, neglect of strategic direction, poor integration, unrealistic expectations, overpayments, inefficiencies, problems in administrating the merged entities and managers' glory-seeking personal motives (DePamphilis, 2017; Steger & Kummer, 2007; Salame, 2006; Hoetzel, 2005; Gadiesh & Ormiston, 2002; Balmer & Dinnie, 1999).

To reduce the rate of failure one of the basic advances that ought to be taken is to identify suitable targets before an M&A by determining whether the prospective partner can offer synergies (Wanke, Barros, Azad, & Constantino, 2016). The evidence in Ethiopia shows that the banking sector is inexperienced in M&As. The M&A history in the Ethiopian banking sector is characterized by consolidations between state-owned banks. The recent merger activity occurred in 2016 when Construction and Business Bank was dissolved into the Commercial Bank of Ethiopia (Meseret, 2019). This shows that the Ethiopian Banking sector is underprepared for a potential merger wave.

Despite the various researches concentrating on actual and potential gains from M&As (Kumar, Tiwari, & Choudhary, 2019; Amin, Al-Muharrami, & Toloo, 2019; Wang & Zhang, 2018; Amin & Al-Muharrami, 2018; Shi, Li, Emrouznejad, Xie, & Liang, 2017; Wanke, Maredza, & Gupta, 2017; Sufian & Kamarudin, 2017; Bakshi & Sinha, 2017; Said, Zouari-Hadiji, & Bouri, 2017; Wanke, Barros, Azad, & Constantino, 2016; Du & Sim, 2016; Chaudhary, Shah, & Hashmi, 2016; Awan, Shah, & Hassan, 2016; Gattoufi, Amin, & Emrouznejad, 2014; Lee, 2014; Jayaraman, Srinivasan, & Arunachalam, 2014; Halkos & Tzeremes, 2013; Reda, 2013; Lozano & Villa, 2010). Only a few researches are dealing with African banks (Wanke, Maredza, & Gupta, 2017) and (Wanke, Barros, Azad, & Constantino, 2016) hence showing an empirical gap. This issue is even of greater concern when it comes to Ethiopia, no research analyzed potential gains and strategic fits from Mergers & Acquisitions.

Given the high rates of merger failures and the meager M&A studies in the African context. This research aims to fill the empirical gaps by investigating the strategic fit and potential gains from M&As across different sizes and ownership structures.

Other additional factors add to the motivation for this research, beyond the empirical gaps. First, Due to the ratification of AfCFTA and the resumption of WTO accession negotiations, Ethiopia is expected to liberalize the banking sector. Second, Ethiopia's economic reform efforts signaled by the grant of business license to a foreign-owned company and launching a securities market in 2020 might trigger industry shocks that start merger waves. Third, the inexperience of the banking sector towards M&A might lead to the high rates of failure in M&As.

### **1.3. Research Questions:**

- What types of efficiency gains are formed with mergers and acquisitions in emerging markets?
- What types of mergers and acquisitions yield strategic fits?
- Does bank size matter in the strategic fit of mergers and acquisitions?
- Does bank ownership structure matter in the strategic fit of mergers and acquisitions?

### **1.4. The Objective of the Study**

#### **1.4.1. General Objective**

The general objective of this study is to assess the strategic fit and potential gains from future mergers and acquisitions between Ethiopian banks, and Ethiopian banks and Foreign banks.

#### **1.4.2. Specific Objectives**

To meet the general objective, the study focuses on the following specific objectives

- To identify the potential efficiency gains that would be formed in future Ethiopian banking industry M&A.
- To identify the types of M&A that yield potential strategic fits in future Ethiopian banking industry M&A.
- To determine whether bank size matters in the strategic fit of future M&As in the Ethiopian banking industry.
- To determine whether ownership structure matters in the strategic fit of future M&As in the Ethiopian banking industry.

### **1.5. Research Hypothesis:**

- H1: Foreign Banks are more efficient than Ethiopian Banks
- H2: There are potential efficiency gains in M&As
  - a. H2a: There are potential overall efficiency gains in M&As
  - b. H2b: There are potential technical efficiency gains in M&As
  - c. H2c: There are potential pure merger efficiency gains in M&As
  - d. H2d: There are potential Scope efficiency gains in M&As
  - e. H2e: There are no potential Scale efficiency gains in M&As
- H3: The strategic fit for Small private banks are Foreign banks

- H4: The strategic fit for Medium Private banks are Foreign banks
- H5: The strategic fit for Large Private banks are Foreign banks
- H6: The strategic fit for State-owned bank are Foreign banks
- H7: The strategic fit for Foreign banks is State-owned bank

### **1.6. Significance of the Study**

This study is beneficial in three ways. First, the study shows which banks are efficient or inefficient and what type of potential efficiency gains they might get from potential M&As based on bank size and ownership structure. Second, this study can help minimize M&A failure rates by suggesting the strategic fit for potential M&As. Third, this study can help regulatory authorities in the National Bank of Ethiopia when analyzing potential M&A deals.

### **1.7. Scope of the Study**

The scope of the study is restricted to analyzing the potential efficiency gains and strategic fit of mergers and acquisitions for the years 2013-2018. The year 2013 is selected because this is when the last commercial bank, Enat Bank was established (National Bank Of Ethiopia, 2014) in Ethiopia.

This study includes one state-owned commercial bank, Commercial Bank of Ethiopia (CBE); Sixteen private commercial banks, Abay Bank (AB), Bank of Abyssinia (BoA), Addis International Bank(AdIB), Awash International Bank (AIB), Berhan International Bank (BIB), Bunna International Bank (BBI), Cooperative Bank of Oromia (CBO), Dashen Bank (DB), Dehub Global Bank (DGB), Enat Bank (EB), Lion International Bank (LIB), Nib International Bank (NIB), Oromia International Bank (OIB), United Bank (UB), Wegagen Bank (WB) and Zemen Bank (ZB); Four Foreign Banks Commercial International Bank (CIB), Ecobank (ECB), Kenya Commercial Bank (KCB) and Standard Bank (SB).

### **1.8. Limitation of the Study**

Many variables can be used to assess the efficiency and potential gains of mergers and acquisitions. This study has adopted the intermediation approach for the selection of inputs and outputs. The variables considered were chosen because they were regularly discovered in the literature review.

The second limitation of the study is the contextual variables selected for the regression analysis. The contextual variables selected for the study are based on the ownership structure and asset size of the

banks. The contextual variables are Foreign bank, State-Owned Bank, Small Private Bank, Medium Private Bank, and Large Private Bank.

The focus of this research is the potential efficiency gains from mergers and acquisitions. Differences of culture, organizational identity and human (behavioral) aspect of M&A are not considered in this study.

### **1.9. Organization of the Paper**

The rest of this paper is organized as follows, Chapter two reviews the literature which includes the history of banking in Ethiopia and Prior mergers and acquisition experience. Theoretical literature reviews the theories that influence Mergers and Acquisitions and prior empirical researches in this area. conceptual framework, and knowledge gap. Description and sources of the data, the definition of the variables including the methodology employed are discussed in Chapter three. Chapter four discusses the results of the analysis. The final chapter constitutes the conclusions and recommendations.

## **Chapter 2: Literature Review**

This chapter presents the theoretical literature review, empirical literature review, research gap and conceptual framework of the study.

### **2.1 Theoretical Literature Review**

#### **2.1.1 Mergers and Acquisitions in Banking**

The term mergers and acquisitions (M&A) alludes to the way toward consolidating or acquiring all or part of another company's property rights. M&A is a significant vital move made by a company to boost its performance management. Effective mergers can deliver numerous additions, including cost savings, increased profits, upscaling, and freeing up abundant resources (Wanke, Barros, Azad, & Constantino, 2016).

Significant research in the area of M&A shows that the reasons for it are varied. The most commonly expressed motive is to exploit economies of scale in terms of an increase in size, production, and a concurrent decrease of fixed costs. This can reduce the number of competitors in the market and increase the market share of the new firm. Another common motive is efficiency gains, as the new firm achieves economies of scale or scope, it will need less resource to deliver a similar yield as they can integrate production facilities utilize progressively effective strategies. Other than that, efficiency gains can happen through a transfer of knowledge and management skills which is a means to improve the administrative proficiency of the consolidated banks. Diversification is one of the other benefits of bank merger activity, especially cross-border operations. Through merger operations, diversity of customers and assets can be expanded by extending the geographic scope, adding new customers to existing customers, and increasing the range of products and services provided. A further benefit of a bank merger is value maximization, the value of the new entity will surpass the value of the individual entities to be merged. (Meseret, 2019)

There are several theories of M&A that describe the different reasons companies are going for M&A transactions. (Leepsa & Mishra, 2016) categorized motives of M&A into two theories. The first category is named Industrial Organization theories that include motivations such as increasing market power, improving efficiency, and motives that are protective or preemptive. Such motives analyze the value of the company's increasing activity leading to an increase in future profits and thus maximizing shareholder value. The second group is labeled theories of corporate governance which include motives such as solving agency problems, solving agency problems, solving internal inefficiencies,

and imperfections on the capital market. These motives do not focus on shareholders' interests but the interests of company managers. Synergies occur due to economies of scale, the presence of effective management, the advancement of production techniques, and the use of complementary tools. M&A improves business efficiency by including the acquirer company's management in the management of the target company, which had not performed well before the M&A due to incompetent managers.

The Economic theory behind M&A is explained by (Le T. D., 2015) as M&As can improve bank performance and efficiency, these potential benefits are extracted from economies of scale and scope, targeted redeployment of assets, a transition of inventory management to better quality managers, and tacit labor contract renegotiation.

M&A can be used to achieve efficiencies, Efficiency theory suggests that if two businesses had different strengths and weaknesses, through combining one company's management, productivity is passed to an ineffective management company that results in both social benefit and private gain because it not only increases company's performance but also saves resources of the economy (Leepsa & Mishra, 2016).

In the Synergy gain theory, M&A is undertaken to achieve synergistic gains out of the combined firms. The combined firm's valuation is likely to be higher than the individual companies. These benefits are extracted from financial and operational synergies through economies of scale. It means that when the two firms combine, their fixed cost is distributed among the large scale of production leading to a lower fixed cost (Leepsa & Mishra, 2016) and (Küçükkocaoğlu & Bozkurt, 2018). This view is contested by (Asongu & Odhiambo, 2019) with research-backed up arguments that big banks worldwide are less efficient than small banks, they provide two arguments to explain these paradoxes. The first view argues that as big banks get bigger they tend to abuse their power by using monopolistic practices, the second view argues that beyond a certain threshold there will be diseconomies of scale as banks grow beyond a certain threshold making them inefficient.

Another school of thought which is represented by Market Power Theory states that M&A is carried out to increase the company's market shares. The new entity will gain more influence in the business with increased market shares. The market power theory suggests that market power is growing with the company's increase in size. Inefficient management theory suggests that M&A serves as a means of disciplining managerial markets where the only way to get rid of inept management is by taking over the company. (Leepsa & Mishra, 2016)

### **2.1.2 Merger Waves**

The term merger wave is introduced as mergers and acquisitions arise in recurring cycles with a lot of M&As occurring at a given time, then time with little to no M&As. (Dieudonne, Cretin, & Bouacha, 2013). There are Four efficiency-based market force arguments of mergers waves in banking (Nissan, 2001). Gains can come from the absorption of weak and failing banks, from breaking into new geographic markets, from product-line diversification, and economies of scale. This has also been one of the factors that triggered U.S bank merger waves according to (Dymski, 2002) The other argument for driving merger waves are government regulations. Industry deregulation has been the most dominant factor for Mergers and Acquisitions. These deregulations happen because of either industry shocks or as a response to external pressures (Ovtchinnikov, 2013)

Two frameworks are frequently used to analyze merger waves, behavioral and Neoclassical views. Under the Neoclassical view, there are two main theories: The Industry shock theory which states that merger waves result from industry shocks (Harford, 2005) and the Q-theory which is based on the Q-theory of investment in which high Q companies acquire low Q companies which leads to effective reallocation of resources as a result of M&As with better run firms. (Ching, 2018)

There are three theories under the Behavioral view. The market timing theory where managers try to capitalize on their overvalued assets to acquire lesser valued firms. (Lorenzen, 2015). The agency cost theory states that managers of firms acquire other firms not to maximize shareholder value but for profit maximization which in-turn helps them keep their jobs. (Ching, 2018) Managerial Discretion theory theorizes that the managers go for mergers because their benefits are directly tied to the growth or because they get the feeling that they are powerful. (Gugler, Mueller, & Yurtoglu, 2006)

### **2.1.3. Foreign Entry**

One issue with the industry shock for Ethiopian banking is the Liberalization of the sector. This means that Foreign banks might be allowed to operate in the country. Ethiopia has already taken the first steps towards by granting a license for a foreign-owned company to operate in the financial sector (Wilson, 2019).

Foreign banks tend to be more efficient than domestic banks according (Ofori-Sasu, Mensah, Akuma, & Doku, 2019) (Detragiache, Tressel, & Gupta, 2008) This is further supported by empirical research among single-country studies of emerging markets analysis in China, Croatia, Czech Republic,

Hungary, Pakistan, Romania, Russia and Turkey and also multi-country studies (Wezel, 2010). When it comes to the entry of foreign banks, there are two ways of entering the market: Greenfield or acquisitions. The research by (Harzing, 2002) shows that compared to Greenfields, Acquisitions show a higher level of local responsiveness, modification of products, and R&D. But making successful acquisitions is much more complex than managers assume. Successful acquirers utilize a two-way learning process that involves adopting the best practices from both firms. Strategic fit considerations may determine the potential value of an acquisition and organizational fit considerations may determine the difficulty of realizing those benefits (Haspeslagh & Jemison, 1991).

## **2.2. Empirical Literature Review**

In this section, the research paper discusses the studies that have used Data Envelopment Analysis with Constant Returns to Scale and Data Envelopment Analysis and with Variable Returns to Scale for evaluating gains from Mergers and Acquisitions. The objective of constructing a Data Envelopment Analysis model is to check whether there are efficiency gains from mergers.

### **2.2.1. M&A studies based on Constant Returns to Scale**

The first model that the paper discusses is the Constant Returns to Scale model. This model was developed by (Charnes, Cooper, & Rhodes, 1978). This model is also called the CCR model based on the last names of the originators Charnes, Cooper, and Rhodes. Constant Returns to Scale DEA models assume that the DMUs are automatically working in their scale efficient size, which implies that an efficiency frontier is a straight plane (Du & Sim, 2016). This model has been modified to analyze efficiency gains in Mergers and Acquisitions in Banking.

The selection of inputs and outputs are very important for the correct specification of DEA models. Most researchers use the intermediation approach where banks are considered as financial intermediaries that transform deposits, purchase funds, and labor into loans and other assets to select inputs and outputs which gives the flexibility of selection. (Wanke, Maredza, & Gupta, 2017) used employees fixed assets and operational expenses as inputs, Deposits, and loans as intermediate inputs/outputs and interest income and non-interest income as outputs. (Chaudhary, Shah, & Hashmi, 2016) used three different input-output models; Income-based model, which used interest expenses and operating expenses as inputs and interest and non-interest income as outputs, Loan-based model which used interest and operating expense as inputs and loans & advances and investment as output and the Intermediation approach used labor, physical and financial capital as inputs and loans & advances and investment as outputs. In (Kumar, Tiwari, & Choudhary, 2019) Fixed assets, Number of employees, and the sum of deposits and borrowing were used as inputs while interest income and noninterest income were chosen as outputs. (Sufian & Kamarudin, 2017) used total expenditures on employees, deposits, and PPE as inputs and total loans, investments, and non-interest income were used as outputs. (Bakshi & Sinha, 2017) used Cost of deposits, cost of borrowings, number of bank branches, and number of employees as inputs and return on advances, return on investments, and profit after tax as outputs.

After the selection of input and outputs researchers use two types of time horizons, some researchers use data from pre-merger for potential gains from mergers (Wanke, Marenda, & Gupta, 2017; Bakshi & Sinha, 2017) and others use the pre- and post-merger periods to analyze the realized gains. (Kumar, Tiwari, & Choudhary, 2019; Sufian & Kamarudin, 2017; Chaudhary, Shah, & Hashmi, 2016; Lee, 2014).

The results after the DEA CRS analysis are also varied and sometimes leading opposite conclusions. (Bakshi & Sinha, 2017) indicated that consolidation of banks considering asset size and ignoring scale category does not generate a successful merger, capital adequacy can be used instead to create successful mergers. (Sufian & Kamarudin, 2017) concluded that the banking sector in Malaysia has increased productivity level during the post-merger level but their findings do not provide conclusive evidence that banks of lower productivity would be a target for acquisitions. (Wanke, Marenda, & Gupta, 2017) argued that there are potential gains to be had from mergers and that greater emphasis should be given to merging commercial banks with investment banks and vice versa. (Kumar, Tiwari, & Choudhary, 2019) agreed that there are gains to be had but the gains come from market-driven mergers and that forced mergers would decrease bank efficiency. While (Chaudhary, Shah, & Hashmi, 2016) after their analysis concluded that efficiency decreases post-M&A, (Lee, 2014) went even further and advised that M&As do not provide a short cut against the process of organic growth.

### **2.2.2. M&A studies based on Variable Returns to Scale**

The second model that the paper discusses is the Variable Returns to Scale model. This model was developed by (Banker, Charnes, & Cooper, 1984). This model is also called the BCC model based on the last name of the originators' Banker, Charnes, and Cooper. Variable Returns to Scale DEA model assumes that the frontier is a convex curve and the DMUs could be achieving increasing returns to scale at low output levels compared with the observations on the frontier (Du & Sim, 2016). This model has been modified to analyze efficiency gains in Mergers and Acquisitions in Banking.

The selection of inputs and outputs is similar to CRS DEA models as most researchers use the intermediation approach for input and output selection. (Reda, 2013) used interest expense and non-interest expense as inputs and interest income, non-interest income, and total loans and advances as outputs. (Amin, Al-Muharrami, & Toloo, 2019) used the same inputs but reduced loans and advances from the outputs and used only interest income and non-interest income. (Du & Sim, 2016) and (Gattoufi, Amin, & Emrouznejad, 2014) also used Non-interest operating expenses and interest

expenses were used as inputs and net interest income and other operating income as outputs. (Shi, Li, Emrouznejad, Xie, & Liang, 2017) used fixed assets, labor costs, and other operating expenses as inputs, deposit for intermediate input/ output, and non-interest income and interest income as outputs. (Amin & Al-Muharrami, 2018) used similar inputs in personnel expense and fixed assets but they added total deposits as inputs and used gross loans, other operating income, other earning assets, and off-balance sheet items as outputs. (Said, Zouari-Hadiji, & Bouri, 2017) used operational expense, personnel expenses, and purchased funds as inputs and real estate loans, commercial and industrial loans, consumer loans, and all other loans as outputs. (Jayaraman, Srinivasan, & Arunachalam, 2014) used cost of deposits and cost of borrowing were used as inputs and return on advances and return on investments were used as outputs. (Halkos & Tzeremes, 2013) used total deposits, labor fixed assets were taken as inputs, and loans and securities were used as outputs. (Wanke, Barros, Azad, & Constantino, 2016) used as inputs, the researchers used Accumulated impairments, Financial investments, investment properties, Net accumulated write-offs, Gross accumulated write-off, total resources, number of employees, number of branches, interest and similar costs, impairments and provisions, costs of charges and commissions, other operating expenses, employee costs, other administrative costs, depreciation, total costs, and shareholders' equity while Total assets, loans, and advances, non-current assets held for sale, financial assets held, available for sale financial, long term financial, financial assets recognized at fair value through profit or loss, intangible assets (Net), intangible assets (gross), other tangible assets (net), other tangible assets (gross), customer resources, credit institutions' resources, loans, and debt securities, income before tax, net profit as outputs.

There are also different variations of DEA methodologies employed such as inverse DEA (Amin, Al-Muharrami, & Toloo, 2019; Amin & Al-Muharrami, 2018; Gattoufi, Amin, & Emrouznejad, 2014). Other researchers decomposed the overall efficiency into its parts technical, harmony, and scale efficiency (Shi, Li, Emrouznejad, Xie, & Liang, 2017). (Halkos & Tzeremes, 2013) proposed a bootstrapped Data Envelopment Analysis to evaluate the short-run operating efficiency gains of a potential merger or acquisition.

Some researchers used multiple country datasets (Amin & Al-Muharrami, 2018) used a dataset of 46 banks in the Gulf Cooperation Council (GCC) countries. (Gattoufi, Amin, & Emrouznejad, 2014) used a data set of 42 banking units in Gulf Corporation Council countries. (Du & Sim, 2016) used a dataset

that contains 960 observations between 2002 and 2009 from 120 banks distributed across six countries: China, India, Indonesia, Malaysia, Russia, and Thailand.

The period used is varied as well with some choosing to use two periods, the pre- and post-merger period (Reda, 2013) which used two periods, the first from 2000-2003 as pre-consolidation period and 2007-2010 as the post-consolidation period. (Jayaraman, Srinivasan, & Arunachalam, 2014) used bank data from three years before and after the merger to compare the efficiency of merged banks with non-merged banks. Other researchers use the pre-merger period to calculate potential gains of mergers and acquisitions or target setting for mergers (Amin, Al-Muharrami, & Toloo, 2019; Shi, Li, Emrouznejad, Xie, & Liang, 2017; Amin & Al-Muharrami, 2018; Wanke, Barros, Azad, & Constantino, 2016; Du & Sim, 2016; Halkos & Tzeremes, 2013 and Gattoufi, Amin, & Emrouznejad, 2014).

The conclusion of these studies shows varied opinions. Mergers have positive effects on managerial efficiency (Reda, 2013), technical improvement and harmony efficiency favor mergers and there are significant potential cost savings arising from mergers (Shi, Li, Emrouznejad, Xie, & Liang, 2017), Mergers and acquisitions improve overall efficiency (Said, Zouari-Hadiji, & Bouri, 2017), Efficient M&A emerges when foreign and government owned banks are merged (Wanke, Barros, Azad, & Constantino, 2016), M&A can lead to improved efficiency for target banks (Du & Sim, 2016) but even though mergers had a positive effect on managerial efficiency, capitalization of banks, risk management practices, intermediation function and bank profitability still remained weak according to (Reda, 2013), scale effect may work against mergers and that in most cases full scale mergers are not advised (Shi, Li, Emrouznejad, Xie, & Liang, 2017), mergers decrease shareholders value (Said, Zouari-Hadiji, & Bouri, 2017), M&As did not improve efficiency for the acquiring banks (Du & Sim, 2016), effect of M&A on profitability and operational cost is not significant during the initial three years of merger (Jayaraman, Srinivasan, & Arunachalam, 2014). M&A between two efficient banks doesn't ensure efficient banks and potential M&As a year before and after the Greek fiscal crisis were unable to generate operating efficiency gains (Halkos & Tzeremes, 2013).

### **2.2.3. M&A studies based on both assumptions**

(Wang & Zhang, 2018) used the DEA-Tobit method to analyze the impact of M&A on the efficiency of enterprises. Asset, the sum of business costs which included operating costs, business taxes, and surcharges, and the sum of costs which included financial costs, management fees, and sales costs as

inputs and operating income and total profit were considered for outputs. The research uses six limited Tobit models in the second stage and runs the regression analysis based on the acquirer's perspective of various ways of M&A and based on the acquiree's perspective of various ways of M&A. The researchers concluded that asset acquisition by enterprises, directly adds the physical assets of enterprises, which led to the problem of excessive scale inefficiencies. In M&A advantages of management, knowledge is obtained which would lead to pure merger efficiency, the scale efficiency works against the merger with results showing that the size of M&A will become too large which will inhibit the development of enterprises which results in inefficiencies. (Awan, Shah, & Hassan, 2016) used Data Envelopment Analysis and Malmquist approach to calculate cost efficiency measures among firms that have carried out acquisitions, the sample was chosen where all financial and non-financial firms that faced acquisition of shares above 51% during 2004-2012. Different input-output combination of financial and non-financial firms. Total deposits and interest expense were chosen as inputs and Total loans and interest income were chosen as outputs for financial firms while total assets and total shareholder's equity were used as inputs and earnings before interest and tax (EBIT), sales, and earnings after tax were used as outputs. The study found statistically insignificant improvements in cost efficiency three years after the acquisition for both financial and non-financial firms in Pakistan.

There are disagreements in the literature about using either of the models. Both CRS and VRS methodologies offer advantages, the CRS form of DEA provides a reference by constructing the smallest best-practice convex cone that fits the observed data, this model also has a faster statistical convergence rate, higher variation inefficiency and has greater discriminatory power relative the VRS. Decision-Making Units (DMUs) which are very inefficient concerning the so-called minimum efficient scale may still be deemed perfectly efficient by DEA VRS simply because they have no available peers and thus attain spuriously high-efficiency scores which make the results misleading and jeopardize the results (Du, Worthington, & Zelenyuk, 2018). (Le, Harvie, Arjomandi, & Borthwick, 2019) argue in favor of DEA VRS model, the constant returns to scale assumptions are only appropriate when all firms are operating at their optimal scale since in the banking sector banks are strongly impacted by regulations imposed by central banks and since in some cases private banks are discriminated against relative to state-owned banks which causes an imperfect business environment amongst different bank groups which makes private banks to not perform at the optimal scale. In this research paper both Constant returns to scale and variable returns to scale of input-

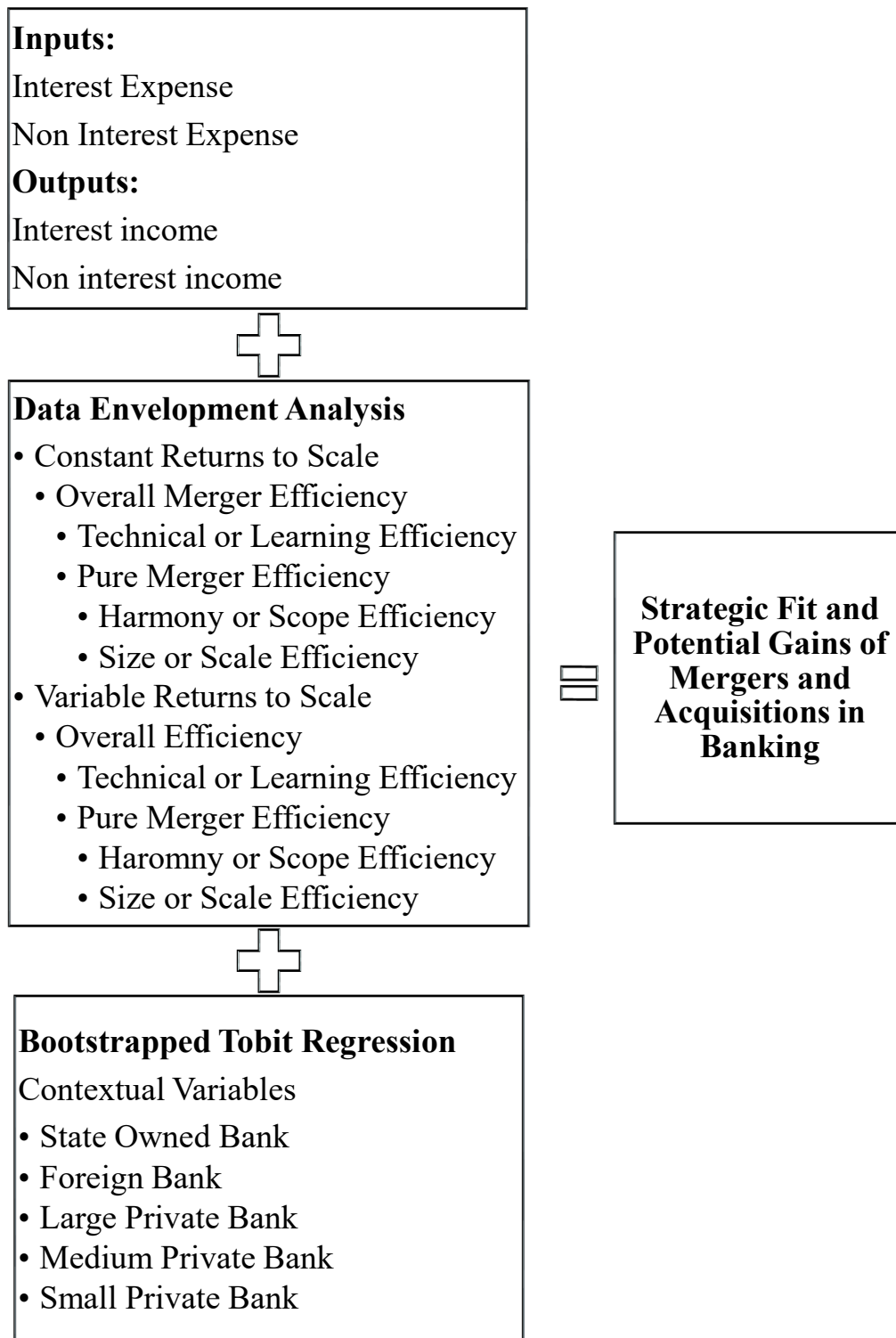
oriented Data Envelopment Analysis are used since there is no such thing as a common technology for all banks in the sample.

### **2.3. Research Gap**

Despite the various examinations concentrating on impacts of M&A in banking efficiency utilizing Data Envelopment Analysis (Kumar, Tiwari, & Choudhary, 2019; Amin, Al-Muharrami, & Toloo, 2019; Wang & Zhang, 2018; Amin & Al-Muharrami, 2018; Shi, Li, Emrouznejad, Xie, & Liang, 2017; Wanke, Marenda, & Gupta, 2017; Sufian & Kamarudin, 2017; Bakshi & Sinha, 2017; Said, Zouari-Hadiji, & Bouri, 2017; Wanke, Barros, Azad, & Constantino, 2016; Du & Sim, 2016; Chaudhary, Shah, & Hashmi, 2016; Awan, Shah, & Hassan, 2016; Gattoufi, Amin, & Emrouznejad, 2014; Lee, 2014; Jayaraman, Srinivasan, & Arunachalam, 2014; Halkos & Tzeremes, 2013; Reda, 2013; Lozano & Villa, 2010). Only a few researches are dealing with African banks (Wanke, Marenda, & Gupta, 2017 and Wanke, Barros, Azad, & Constantino, 2016) hence showing a literature gap. This issue is even of greater concern when it comes to Ethiopia, to the best of the researchers' knowledge, no research used Data Envelopment Analysis in terms of Mergers and Acquisitions. This research thus would be the pioneering research with regards to the study of potential gains and strategic fit from mergers and acquisitions in emerging markets, focusing on the Ethiopian banking sector.

### **2.4. Conceptual Framework**

Capitalizing on the research gap, the study proposed the following conceptual framework which the research believes can help to analyze the strategic fit and potential gains in future bank M&A in Ethiopia.



*Figure 1.1: Conceptual Framework of the Study*

## **Chapter Three: Research Methods**

### **3.1. Introduction**

The preceding chapter presented a review of the existing literature in mergers and acquisitions and identified the knowledge gap. The results from the review of literature are used to establish expectations for the relationship of inputs and outputs and contextual variables. The purpose of this chapter is to present the definition of the variables, the research designs, sample selection, data collection techniques, analysis of the collected data, and limitations.

### **3.2. Operational Definition of variables / Research Approach/**

Two approaches are widely used to identify a bank's inputs and outputs: the production approach and the intermediation approach. Under the production approach, banks are treated as a firm to produce loans, deposits, and other assets by employing labor and capital. However, under the intermediation approach, banks are considered as financial intermediaries that transform deposits, purchase funds, and labor into loans and other assets. More specifically, deposits are treated as an output under the production approach and input under the intermediation approach. In this research, the intermediation approach is used for this research. The two inputs considered are interest expenses and non-interest expenses. Interest expenses include expenses for deposits and other borrowed funds while non-interest expenses represent the cost of converting deposits into loans, including service charges, commissions, expenses of general management affairs, salaries, and other expenses. Those inputs represent the costs of labor, administration, equipment, and funds for operations, loans, and investment. The two outputs for the analysis are interest income and non-interest income. The interest income includes interest on loans and income from the government securities. The non-interest income includes service charges on loans and transactions, commissions, and other operating income. These outputs represent bank revenues and the major profit generated by the banking service. Interest expenses can be seen as a proxy for deposits and interest income as a proxy for loans. This makes the model in line with the intermediation approach traditionally using deposits, interest expenses, and non-interest expenses as inputs and loans, interest income, and non-interest income as outputs. (Gattoufi, Amin, & Emrouznejad, 2014)

Monetary inputs and outputs used in this research are converted to and expressed in USD to make different currency units' uniform. These monetary units were converted using the rates from exchange-rates.org. In addition to these inputs and outputs, it should be noted that contextual variables such as

Foreign Bank ( 1=yes/ 0=no), State-Owned Bank (1=yes/ 0=no), Large Private Bank (1=yes/ 0=no), Medium Private Bank (1=yes/ 0=no) and Small Private Bank (1=yes/ 0=no) are also collected. Let us look into the variables in detail:

### 1) **Inputs**

- a) **Interest expense:** interest expense includes expenses for deposits and other borrowed funds.
- b) **Non-interest expense:** non-interest expenses represent the cost of converting deposits into loans, including service charges, commissions, expenses of general management affairs, salaries, and other expenses.

### 2) **Output**

- a) **Interest Income:** The sum of interest on loans and advances, interest on deposits and interest on treasury bills
- b) **Non-interest Income:** commission, fees, and charges on the letter of credit and other incomes

### 3) **Contextual Variables**

- a) **Foreign Bank:** A dummy variable designating the foreign banks which are Commercial International Bank (CIB), Ecobank (ECB), Kenya Commercial Bank (KCB) and Standard Bank (SB)
- b) **State-Owned Bank:** A dummy variable designating the state-owned bank; Commercial Bank of Ethiopia (CBE)
- c) **Large Private Bank:** A dummy variable designating a large bank which is located at the third quartile (75<sup>th</sup> percentile) based on their respective asset size.
- d) **Medium Private Bank:** A dummy variable designating a medium bank which is located between the third quartile (75<sup>th</sup> percentile) and first quartile (25<sup>th</sup> percentile) based on their respective asset size.
- e) **Small Private Bank:** A dummy variable designating a small bank that is located at the first quartile (25<sup>th</sup> percentile) based on their respective asset size.

### **3.3. Research Design /Methods/**

The general objective of this study is to assess the strategic fit and potential gains from future mergers and acquisitions between Ethiopian banks, and Ethiopian banks and Foreign banks. To achieve the objective of the research, quantitative research methodologies using panel data are employed. The research uses secondary sources of data obtained from the financial statement of the selected banks. In line with this, the study uses Input Oriented Data Envelopment Analysis with both Constant Returns to Scale and Variable returns to scale assumptions, bootstrapped Tobit regression analysis, and descriptive statistical tools.

### **3.4. Sampling Method**

This study seeks to assess the strategic fit and potential gains of mergers and acquisitions in the Ethiopian banking sector. Thus, for the study, the target population would be all commercial banks that are operational in the country and selected foreign banks interested in entering the Ethiopian market. Currently, in Ethiopia, there is one state-owned commercial bank, Commercial Bank of Ethiopia, and sixteen private commercial banks that are operating throughout the country. Since the latest bank that started operation was Enat Bank in 2013, the start year for the analysis is chosen to be 2013. There are a lot of foreign banks interested in entering the Ethiopian market, four representatives are chosen from four regions of Africa. These selected banks are Standard Bank which is headquartered in Johannesburg, South Africa, Kenya Commercial Bank headquartered in Nairobi, Kenya, Ecobank headquartered in Lome, Togo, and Commercial International Bank S.A.E headquartered in Cairo, Egypt. The researcher believes that this sample size is sufficient enough to make a sound conclusion about the population as the 125 observations are larger than 99 observations (Wanke, Barros, Azad, & Constantino, 2016) and 90 observations (Wanke, Maredza, & Gupta, 2017).

### **3.5. Data Collection Techniques**

Financial statements of twenty-one banks are collected. These banks are Commercial Bank of Ethiopia (CBE), Abay Bank (AB), Bank of Abyssinia (BoA), Addis International Bank(AdIB), Awash International Bank (AIB), Berhan International Bank (BIB), Bunna International Bank (BBI), Cooperative Bank of Oromia (CBO), Dashen Bank (DB), Debu Global Bank (DGB), Enat Bank (EB), Lion International Bank (LIB), Nib International Bank (NIB), Oromia International Bank (OIB), United Bank (UB), Wegagen Bank (WB) and Zemen Bank (ZB); Four Foreign Banks which are

Commercial International Bank (CIB), Ecobank (ECB), Kenya Commercial Bank (KCB) and Standard Bank (SB). The data collected is from annual reports of the banks from 2013 to 2018.

### **3.6. Model Specification**

This paper utilizes two models Input-oriented Data Envelopment Analysis with both Constant returns to scale and variable returns to scale. Both models are adopted from (Bogetoft & Otto, 2011). How bank mergers are studied are presented in the first section. The next section deals with an introduction of DEA. Merger analysis in DEA is discussed in the succeeding sections.

#### **3.6.1. Impact of Bank Mergers**

The literature on the impact of bank mergers can be separated into two basic branches. The primary strand utilizes the approach of event analysis to evaluate the response of stock or security market to merger announcements. The second group examines the operational efficiency effect on M&As. This paper focuses on this second strand and likewise, this strand is further split into two sections: studies on efficiency effects of mergers utilizing actual data on a variety of bank mergers and simulation studies. This focus of this paper is on the efficiency effects of mergers using simulation studies.

Efficiency effects of mergers are analyzed using simulation studies using two approaches, models which are parametric and nonparametric. Parametric and non-parametric methods differ primarily in the underlying assumption they use when estimating efficient frontiers. Parametric models, for which the best known is SFA, are based on an econometric estimate of the efficiency frontier. In this approach, the error term is decomposed into two, an error term representing inefficiency and statistical noise. (Fall, Al-Mouksit, & Wassongma, 2018). Parametric models are described a priori except for a finite collection of unknown parameters calculated from the results. In contrast, nonparametric models are distinguished by a priori being much less constrained (Bogetoft & Otto, 2011). This is because it doesn't require a specification of the functional form making it more flexible and the mathematical estimation of a linear programming function that binds inputs and outputs (Fall, Al-Mouksit, & Wassongma, 2018). DEA is the widely used nonparametric model in literature, DEA doesn't depend on predictions about the shape of the efficient frontiers or their distribution of probabilities. On the other hand, DEA doesn't allow for random errors in the optimization problem, in such a manner that all exceptions are deemed inefficient. (Silva, Tabak, Cajueiro, & Dias, 2017). The key question in the decision between DEA and SFA is whether one requires flexibility in the mean

or accuracy in noise reduction (Bogetoft & Otto, 2011). Below are the alternative frontiers of the different approaches adopted from (Bogetoft & Otto, 2011).

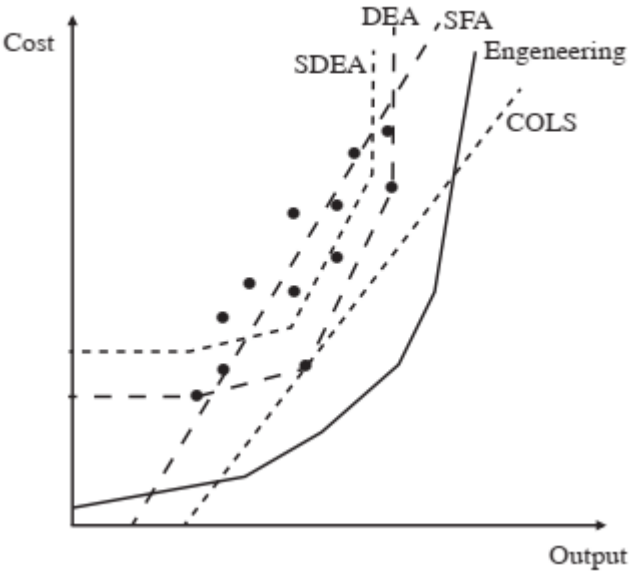


Figure 3.2: Alternative frontiers adopted from (Bogetoft & Otto, 2011)

In this research, Data Envelopment Analysis is chosen due to the following reasons: DEA can be used in small sample sizes, while SFA generally requires a large collection of data set to get a good analysis. DEA is also adaptive to the set of input-output variables. This is an advantage of the methodology as it shows which of the input-output variables that need to be closely monitored by bank management to improve performance. DEA places very little structure on the efficiency frontier, when a complete collection of specified inputs and outputs are given, DEA only requires the existence of an input/output relationship to produce relative efficiency measurements. Finally, SFA allows for the decomposition of the error term into random error and inefficiency components require an assumption concerning the appropriate distribution of the inefficiency. Any distribution assumption enforced without justification will result in a significant error in the estimation of the output. On the other hand, DEA claims no random error, meaning that all anomalies from the estimated efficient frontier constitute inefficiency. (Le T. D., 2015).

**3.6.2. Data Envelopment Analysis**

Data Envelopment Analysis got its beginning by the need to develop better productivity assessment methodologies and models. (Farrell, 1957) argued that while efforts to solve the problem typically

created diligent measurements, they were also restrictive because they couldn't combine multiple input measurements into any acceptable overall efficiency metric. He suggested an approach that could deal with the problem more effectively. His work was limited to single-output instances, and his outline of extension to multiple outputs did not provide what was required for large dataset applications. (Cooper, Seiford, & Zhu, 2011). (Charnes, Cooper, & Rhodes, 1978) developed the dual pair of linear programming to get what was required in the computationally implementable form.

Data Envelopment Analysis (DEA) is a data-oriented method for assessing the efficiency of a group of peer entities called Decision-Making Units (DMUs), which transform multiple inputs into multiple outputs (Cooper, Seiford, & Zhu, 2011). In this method, first, with the aid of the actual observations of the firm, a production possibility set is created, in this set, it is possible to check whether there is a better point under consideration than the DMU. If there is a better point, the unit will be inefficient, otherwise, it will be efficient (Lotfi, Ebrahimnejad, Vaez-Ghasemi, & Moghaddas, 2020)

DEA is a frontiers-oriented approach rather than central tendencies. Instead of trying to fit a regression plane through the center of the data as in statistical regressions. Frontier methods identify and assess the locations or instances within the study of best performance or best practice, i.e. those found on the "frontier". The frontier defined by DEA indicates the best performance within the category of operational units being assessed and does not guarantee or even imply that these represent the theoretically best performance. (Paradi, Sherman, & Tam, 2018) Due to this viewpoint, DEA is particularly adept at uncovering interactions that would remain hidden from other methodologies (Cooper, Seiford, & Zhu, 2011).

DEA is particularly useful as a performance calculation and evaluation tool in a situation where Decision-making units (DMU), have multiple inputs and outputs, which function under similar circumstances. DEA permits the assessed DMU to look as good as possible, a provision that can be interpreted to provide a "fair" evaluation of DMUs that would reduce complaints amongst DMUs over their evaluations. This trait derives from DEA's fundamental optimization, in which DEA gives each DMU the highest efficiency rating according to the set of DMUs being evaluated. From a management perspective, DEA will be less likely to incorrectly classify as an inefficient unit and the ones classified as inefficient will have significant potential for improvement. (Paradi, Sherman, & Tam, 2018)

By estimating  $T^*$  from observable historical or cross-sectional data on actual production activities, DEA overcomes the problem of knowledge of the Technology set. The unique thing about the DEA method

is how the approximation of the technology is constructed and the resulting properties of the evaluations. The minimal extrapolation principle is used to construct the empirical reference technology  $T^*$  which is the estimate of the technology  $T$  in DEA.  $T^*$  is the smallest subset of  $R_+^m \times R_+^n$  that contains the data  $(x^k, y^k), k = 1, \dots, K$  and satisfies certain technological assumptions specific to the given approach (Bogetoft & Otto, 2011).

### 3.6.3. Data Envelopment Analysis Model for M&A

Consider the case where each of  $n$  Decision-Making Units (DMUs),  $i \in I = \{1, 2, \dots, n\}$  transforms  $p$  inputs to  $q$  outputs. Let  $x^i = (x_1^i, \dots, x_p^i) \in R_0^p$  be the inputs consumed and  $y^i = (y_1^i, \dots, y_q^i) \in R_0^q$  the outputs produced in  $DMU^i, i \in I$ . Also, let  $T$  be the production possibility set.

$$T = \{(x, y) \in R_0^{p+q} \mid x \text{ can produce } y\}$$

And let  $x \rightarrow P(x)$  and  $y \rightarrow L(y)$  be the associated production and consumption correspondences

$$P(x) = \{y \mid (x, y) \in T\} \quad L(y) = \{x \mid (x, y) \in T\}$$

According to (Bogetoft & Otto, 2011) the basic DEA models mainly differ in the assumptions that they make about the technology  $T$ . The most important assumptions are

**A1 Free disposability:** Any extra inputs or outputs can be dispensed; that is,  $(x, y) \in T, x' \geq x$  and  $y' \geq y \Rightarrow (x', y') \in T$

**A2 Convexity:** Any weighted average of feasible production plans is feasible as well:  $(x, y) \in T, (x', y') \in T, \alpha \in [0, 1] \Rightarrow \alpha(x, y) + (1 - \alpha)(x', y') \in T$

**A3  $\gamma$ -returns to scale:** Production can be scaled with any of a given set of factors:  $(x, y) \in T, k \in \Gamma(\gamma) \Rightarrow k * (x, y) \in T$

**A4 Additivity, replicability.** The sum of any two feasible production plans is feasible as well:  $(x, y) \in T, (x', y') \in T \Rightarrow (x + x', y + y') \in T$

Where for  $\gamma = \text{CRS, DRS, IRS or VRS}$  and where the sets of possible scaling factors

Given a technology, efficiency has to do with the ability to reduce inputs without affecting outputs or to increase outputs without requiring more inputs. In the case of multiple inputs and outputs, the efficiency of DMU measures:

$$E^i = \text{Min}\{E \in R_0 | (Ex^i, y^i) \in T\} \text{ or } F^i = \text{Max}\{F \in R_0 | (x^i, Fy^i) \in T\}$$

Where  $E^i$  is the maximal contraction of all inputs and  $F^i$  is the maximal expansion of all outputs that are feasible in T.

The estimate of T, the empirical reference technology  $T^*$  with correspondences  $P^*(.)$  and  $L^*(.)$ , is constructed according to the minimal extrapolation principle.  $T^*$  is the smallest subset of  $R_0^{p+q}$  that contains the actual production plans  $(x^i, y^i)$ ,  $i \in I$ , and satisfies certain technological assumptions specific to the approach. The (relative) efficiency of  $DMU^i$  may then be measured in input or output space by using the Farrell-measures above with  $T^*$  substituted for T.

Different DEA models invoke different assumptions about technology. The original constant returns to scale (CRS) DEA model proposed by Charnes, Cooper, and Rhodes (1978, 1979) assumes A1, A2 and A3(CRS) while the decreasing returns to scale (DRS) and (local) variable returns to scale (VRS) models developed by Banker (1984) and Banker, Charnes, and Cooper (1984) appeal to A1, A2 and A3(DRS) and A1, A2 and A3(VRS), respectively. DEA provides an inner approximation of the underlying production possibility set. The efficiency estimates are therefore optimistic and the potential inputs saving and output expansions are underestimated. This applies also to the merger gains estimated below.

Return to scale indicates rescaling may be feasible. Different assumptions have been made about this, the weakest assumption is that there are no rescaling possible  $\gamma=1$  which is called variable returns to scale, the strongest assumption is constant returns to scale  $\gamma \geq 0$ . Between Variable returns to scale and constant returns to scale, it is assumed that any degree of downscaling is possible but not any degree of upscaling  $\gamma \leq 1$  meaning that it cannot be disadvantageous to be small but it may be disadvantageous to be large, this assumption is also called decreasing returns to scale. The last assumption is called increasing returns to scale  $\gamma \geq 1$ , which means that it is not a disadvantage to be large but it may be a disadvantage to be small. (Bogetoft & Otto, 2011)

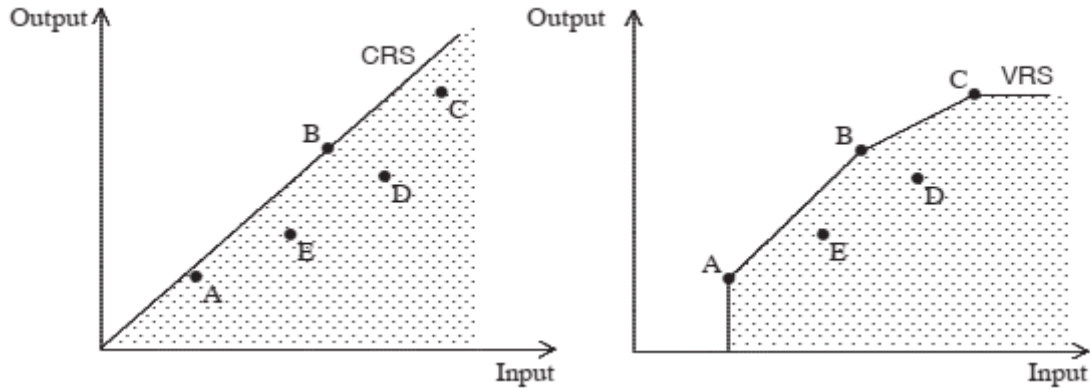


Figure 3.2: DEA technology sets under CRS and VRS (Bogetoft & Otto, 2011)

(Bogetoft & Otto, 2011) explain the mathematical formulation of Data Envelopment Analysis as below:

The minimal extrapolation technology is:

$$T^*(\gamma) = \{(x, y) \in R_+^m \times R_+^n \mid \exists \lambda \in \Lambda^k(\gamma) : x \geq \sum_{k=1}^K \lambda^k x^k, y \leq \sum_{k=1}^K \lambda^k y^k\}$$

On the input side, The Farrell efficiency of firm  $o$  is measured as the *input efficiency*

$$E^o = E((x^o, y^o); T^*) = \min\{E \in R_+ \mid (Ex^o, y^o) \in T^*\}$$

If the formulation of  $T^*(\gamma)$  is inserted from above:

$$\begin{aligned} & \min_{E, \lambda^1, \dots, \lambda^K} E \\ & s. t. Ex^o \geq \sum_{k=1}^K \lambda^k x^k, \\ & y^o \leq \sum_{k=1}^K \lambda^k y^k, \\ & \lambda \in \Lambda^k(\gamma) \end{aligned}$$

For the sake of clarity, somewhat compact vector form in coordinate form is shown below

$$\min_{E, \lambda^1, \dots, \lambda^K} E$$

$$s. t. Ex_i^o \geq \sum_{k=1}^K \lambda^K x_i^k, \quad i = 1, \dots, m$$

$$y^o \leq \sum_{k=1}^K \lambda^K y_i^k, \quad j = 1, \dots, n$$

$$\lambda \in \Lambda^k(\gamma)$$

Where

$$\Lambda^k(vrs) = \{\lambda \in R_+^K \mid \sum_{k=1}^K \lambda^K = 1\} \text{ for Variable Returns to Scale}$$

$$\Lambda^k(vrs) = \{\lambda \in R_+^K \mid \sum_{k=1}^K \lambda^K \text{ free}\} \text{ for Constant Returns to Scale}$$

DEA identifies a specific reference unit, most often a weighted average of the existing units, and that the reference unit may vary with the evaluated unit. The units with positive weights are typically called *peer units*, i.e.

$$Peer Units = \{k \in \{1, \dots, K\} \mid \lambda^K > 0\}$$

DEA identifies explicit real peer-units for every evaluated unit. When more inputs and outputs are included in the research, more firms will have an efficiency score of one hence making the method to lose its ability to distinguish between high performance and others (Bogetoft & Otto, 2011). To protect from this, DEA researchers have come up with a suggested rule of thumb for the relationship between the number of inputs and outputs and the number of Decision-making units (DMUs). The number of Decision-making units (DMUs) must be greater than three times the number of inputs plus the number of outputs, and the number of Decision-making units (DMUs) must be greater than the product of the number of inputs and the number of outputs. This research paper has used this rule of thumb as well.

#### 3.6.4. Measures of Potential Merger Gains

When assessing merged entities, the same rationale is applied in evaluating individual entities. (Bogetoft & Otto, 2011). The larger the distance to the efficient frontier, the more inefficient the merged firm, being inefficient also implies a potential for improvement. Thus, leading to the Corporate synergy which occurs as firms may generate more services with a given set of resources or create a given set of services with fewer resources. Synergies from a merger can be captures by the increases in improvement potential as the firms move from independent to joint operations.

### 3.6.5. Integration gains

According to (Bogetoft & Otto, 2011) Two firms  $P^1$  and  $P^2$  individually transform vectors of inputs (resources),  $x^1$  and  $x^2$ , respectively, into vectors of outputs (services),  $y^1$  and  $y^2$ . If two firms integrate but continue to operate as two independent entities, they transform the vector of inputs  $x^1 + x^2$  into the vector of outputs  $y^1 + y^2$ . To evaluate the potential efficiency gains from the merger, therefore, evaluate the efficiency of the latter transformation, i.e., the use of  $x^1 + x^2$  to produce  $y^1 + y^2$  can be utilized.

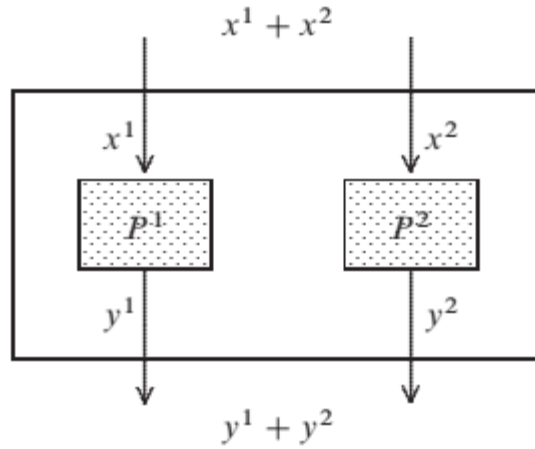


Figure 3.3: Horizontal integration (Bogetoft & Otto, 2011)

The merged units which are denoted by  $DMU^J$  are found by the direct pooling of inputs and outputs which has used  $\sum_{j \in J} x^j$  to produce  $\sum_{j \in J} y^j$ . Therefore, an input-based measure of potential gains from merging becomes

$$E^J = \text{Min}\{E \in R_0 \mid \left( E \begin{bmatrix} \sum_{j \in J} x^j \end{bmatrix}, \sum_{j \in J} y^j \right) \in T$$

If  $E^J < 1$ , entities can save by merging. If  $E^J > 1$ , the merger is costly. The corresponding DEA based operational measure is given below

$$\begin{aligned} & \text{Min } E^J \\ & E^J, \lambda \\ & \text{s.t. } E^J [\sum_{j \in J} x^j] \geq \sum_{i \in I} \lambda^j x^i \end{aligned}$$

$$\left[ \sum_{j \in J} y^j \right] \leq \sum_{i \in I} \lambda^j y^i$$

$$\lambda \in \Lambda^k(k)$$

Where

$\Lambda^k(vrs) = \{\lambda \in R_+^K \mid \sum_{k=1}^K \lambda^k = 1\}$  for Variable Returns to Scale

$\Lambda^k(crs) = \{\lambda \in R_+^K \mid \sum_{k=1}^K \lambda^k free\}$  for Constant Returns to Scale

### 3.6.6. Decomposing Merger Gains

There are three types of merger gains decomposed from Overall Merger gains ( $E^J$ ): technical (learning) efficiency gains ( $T^J$ ), Harmony (scope) efficiency gains ( $H^J$ ) and Size (scale) efficiency gains ( $S^J$ ). The latter two combined give us pure merger efficiency gains ( $E^{*J}$ ).

$$E^J = T^J * E^{*J} \text{ and } E^{*J} = H^J * S^J \text{ therefore } E^J = T^J * H^J * S^J$$

#### 3.6.6.1. Technical or Learning Efficiency

Technical efficiency gains occur when everyone learns the best practices but remains an independent firm. (Bogetoft & Otto, 2011) To calculate technical efficiency gains the original units are projected to the production possibility frontier and the projected plans are used as the basis for evaluating the remaining gains from the merger. Thus  $(x^j, y^j)$  is projected into  $(E^j x^j, y^j)$  for all  $j \in J$ , where  $E^j = E^{[j]}$  is the standard efficiency score for the single  $DMU^j$ , and use the projected plans  $(E^j x^j, y^j)$ ,  $j \in J$ , as the basis for calculating the pure (adjusted) overall gains from the merger

$$E^{*J} = \text{Min}\{E \in R_0 \mid \left( E \left[ \sum_{j \in J} E^j x^j \right], \sum_{j \in J} y^j \right) \in T\}$$

Technical efficiency becomes  $T^J = E^J / E^{*J}$  Where  $T^J \in [0,1]$

#### 3.6.6.2. Harmony or Scope Efficiency

Harmony or scope efficiency measures the average output vector's minimum cost compared to the average of the individual learning costs corrected (Bogetoft & Otto, 2011). This is calculated by:

$$H^J = \text{Min}\{H \in R_0 \mid \left( H \left[ |J|^{-1} \sum_{j \in J} E^j x^j \right], |J|^{-1} \sum_{j \in J} y^j \right) \in T\}$$

Where  $H^J$  is the harmony efficiency and  $|J|$  is the number of elements in  $J$ . The corresponding DEA operation is:

$$\begin{aligned}
 & \text{Min } H \\
 & H, \lambda \\
 \text{s.t. } & H[|J|^{-1} \sum_{j \in J} E^j x^j] \geq \sum_{i \in I} \lambda^j x^i \\
 & \left[ |J|^{-1} \sum_{j \in J} y^j \right] \leq \sum_{i \in I} \lambda^j y^i \\
 & \lambda \in \Lambda^k(k)
 \end{aligned}$$

### 3.6.6.3. Size or Scale Efficiency

The size or scale efficiency measures the cost of operating at the full (integrated) size compared with the average size of the original firms (Bogetoft & Otto, 2011). This is calculated by:

$$S^J = \text{Min}\{S \in R_0 \mid \left( S \left[ H^J \sum_{j \in J} E^j x^j \right], \sum_{j \in J} y^j \right) \in T\}$$

The corresponding DEA based operational measure of the size gains is:

$$\begin{aligned}
 & \text{Min } S \\
 & S, \lambda \\
 \text{s.t. } & S[H^J \sum_{j \in J} E^j x^j] \geq \sum_{i \in I} \lambda^j x^i \\
 & \sum_{j \in J} y^j \leq \sum_{i \in I} \lambda^j y^i \\
 & \lambda \in \Lambda^k(k)
 \end{aligned}$$

The decompositions of the potential gains from merging DMUs into a technical efficiency measure, a harmony efficiency measure, and a size efficiency measure are important because full-scale mergers are typically not the only organizational option available and it may be that alternative organizational changes may be easier to implement.

### 3.6.7. Merger Production Possibility Set (PPS) for Variable Returns to Scale assumption

Under Variable Returns to Scale assumption sometimes the hypothetical merged firm might be very big and surpass the PPS constructed which leads to an unsolvable linear program. (Shi, Xiao, Emrouznejad, Xie, & Liang, 2017). This is one of the drawbacks of using the Variable Returns to Scale assumption.

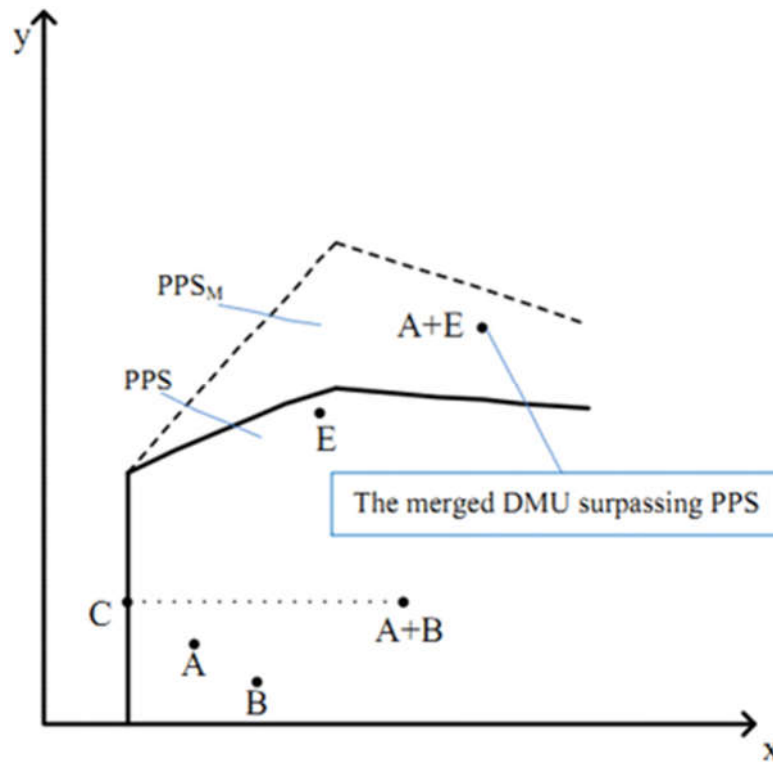


Figure 3.4: Merger Efficiency surpassing PPS adopted from (Shi, Li, Emrouznejad, Xie, & Liang, 2017)

### 3.7. Bootstrapped Tobit Regression

The Tobit model was first used by Tobin in 1958. The most common approach used to investigate if a set of continuous variables may explain the variations inefficiency is to conduct a Tobit regression. Tobit regression is similar to ordinary regression analysis except that the noise term is truncated. This model is widely applied in DEA analysis.

When the dependent variable is censored, the underlying values of this variable are not observed in all cases. Values in a specific range are reported as a single value. Therefore, the model becomes

$$E = \begin{cases} 0, & \text{if } az + e \leq 0 \\ az + e, & \text{if } 0 < az + e < 1 \\ 1 & \text{if } az + e \geq 1 \end{cases}$$

The challenge is to estimate  $a$  based on the observed efficiencies  $E^k$  from  $K$  firms  $K=1, \dots, K$ .

In general, there are no firms with reported efficiency of 0. Therefore, let  $K_1$  be the number of firms for which  $E=1$  (i.e. the number of efficient firms) and  $K_0$  be the number of firms for which  $E<1$ . Then  $K=K_0 + K_1$ .

The probability that  $E=1$  is the probability that  $az+e \geq 1$ . Let  $F$  be the probability distribution function for  $e$  and  $f$  the corresponding density function. Then the probability of  $E=1$  is:

$$\begin{aligned} \Pr(E=1) &= \Pr(az+e \geq 1) = 1 - \Pr(az+e < 1) \\ &= 1 - \Pr(e < 1-az) = 1 - F(1-az) \end{aligned}$$

And the probability that  $E=0$  is

$$\Pr(E=0) = \Pr(az+e \leq 0) = \Pr(e < -az) = F(-az)$$

The case wherein  $0 < E < 1$  corresponds to  $E=az+e$  or  $e=E-az$  such that the density, in this case, is  $f(E-az)$ .

The likelihood function for  $K$  observations of efficiencies is then given as the product of the  $K$  individual terms for the cases mentioned above.

$$\begin{aligned} L &= \prod_{k:E^k=1} \Pr(E^k = 1) \prod_{k:0 < E^k < 1} f(E^k - az^k) \\ &= \prod_{k:E^k=1} (1 - F(1 - az^k)) \prod_{k:0 < E^k < 1} (f(E^k - az^k)) \end{aligned}$$

$E$  in the theory could be equal to 0 is not taken into account. Because the number of such observations is 0, the corresponding likelihood factor is 1 irrespective of the value of  $\Pr(E=0)$

In the Tobit framework,  $EV$  is used for the mean or expectation of a random variable to be able to distinguish the mean  $EV$  from efficiency  $E$ . The conditional expectation consists of three parts corresponding to the three parts of the model for  $E$ .

$$\begin{aligned}
EV(E|z) &= \int E dPr(E|z) \\
&= \int 0 dPr(E = 0|z) \\
&+ \int E dPr(0 < E < 1|z) \\
&+ \int 1 dPr(E = 1|z) = \int_{-az}^{1-az} \varepsilon dPr(\varepsilon|z) + 1 - Pr(\varepsilon < 1 - az|z)
\end{aligned}$$

The two probability terms are calculated separately. The last calculated by assuming the error term is normally distributed i.e  $\varepsilon \sim N(0, \sigma^2)$ . The first term involves integration. The final result is that.

$$EV(E|z) = az \left( \Phi\left(\frac{1-az}{\sigma}\right) - \Phi\left(\frac{-az}{\sigma}\right) \right) + \sigma \left( \phi\left(\frac{-az}{\sigma}\right) - \phi\left(\frac{1-az}{\sigma}\right) \right) + 1 - \Phi\left(\frac{1-az}{\sigma}\right)$$

The last two terms,  $1 - \Phi$ , correspond to the effect of the firms where  $E=1$  multiplied by the probability of this event. The first term is the linear effect  $az$  multiplied by the probability that  $0 < E < 1$ . The second term is the effect of the error term  $e$ .

Based on the above

$$EV(E|0 < E < 1, z) = az + \sigma \frac{\phi\left(\frac{-az}{\sigma}\right) - \phi\left(\frac{1-az}{\sigma}\right)}{\Phi\left(\frac{1-az}{\sigma}\right) - \Phi\left(\frac{-az}{\sigma}\right)} = az + \sigma M(az)$$

Now how  $EV(E|z)$  varies with  $z$  is determined by finding the derivative of  $EV(E|z)$  concerning  $z$ . To do so, derivatives of the individual terms are found in  $EV(E|z)$ . By collecting terms and canceling out where possible:

$$\frac{\partial EV(E|z)}{\partial z_h} = a_h \left( \Phi\left(\frac{1-az}{\sigma}\right) - \Phi\left(\frac{-az}{\sigma}\right) \right)$$

The term  $a_h$  corresponds to the linear term found for OLS models but here, it is corrected for the probability that  $0 < E < 1$ . If  $E=0$  or  $E=1$ , then a marginal change in  $z$  will not change  $E$ . (Bogetoft & Otto, 2011).

Residuals of Tobit estimation are often non-normally distributed and/or heteroscedastic (and serially correlated in panel applications), and neglecting these features causes misleading SEs. Modeling

heteroscedasticity in Tobit models is not an easy task and may be arbitrary, scholars cannot simply use a “robust version of their Tobit model, because there is not a Huber-White-type estimator for Tobit models that corrects for heteroscedasticity and serial correlation. However, bootstrapping SEs may solve the issue of heteroscedasticity. (Amore & Murtinu, 2019) Bootstrapping treats the obtained data as if that is an accurate reflection of the population, and draw many bootstrapped samples by repeated sampling, with replacement from a pseudo-population consisting of the obtained data. Since the sampling is from the actual data, this is called nonparametric bootstrapping. The assumption here is that the data is a reasonable representation of the population. This paper uses the `vce(boot)` command of STATA to handle bootstrapping with fifty bootstrap replications.

The upper limit of one for the Tobit regression models is utilized for this research since merger efficiencies above one make mergers costly and inefficient.

## Chapter Four: Results and Discussion

In this section, the results of the study are presented and discussed, afterwards the research hypothesis and research questions are adequately addressed.

### 4.1. Contextual Variables

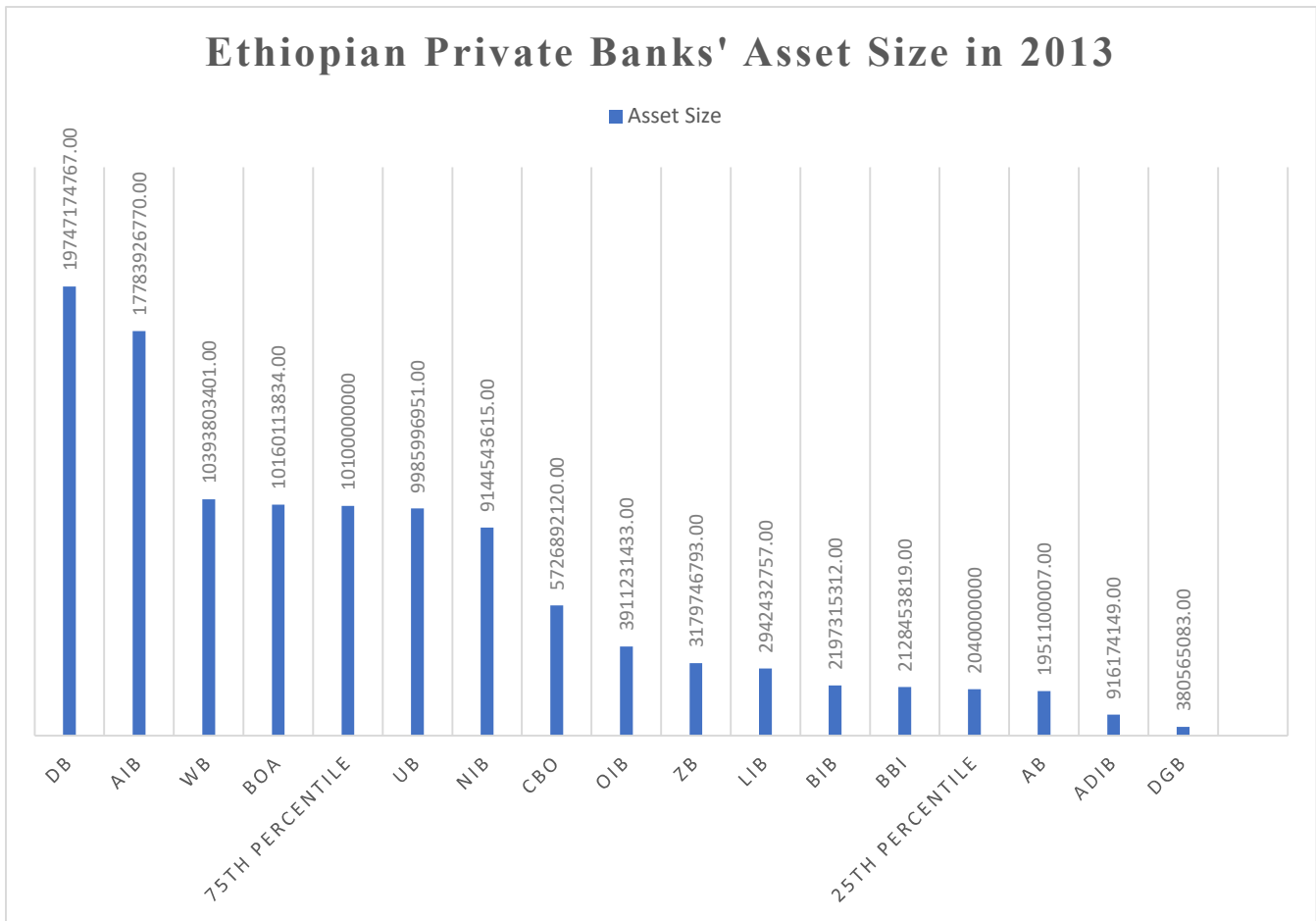
The contextual variables are selected based on size and ownership structure. The contextual variables are Foreign bank, State-Owned Bank, Small Private Bank, Medium Private Bank, and Large Private Bank. The variables Small Private Bank, Medium Private Bank, and Large Private Bank are proxies for the Asset size of Ethiopian Private Banks. The banks above 75<sup>th</sup> percentile based on their asset size are designated as a Large Private Bank, the banks lower than 25<sup>th</sup> percentile based on their asset size are designated as a Small Private Bank while the remaining banks are designated as a Medium Private Bank. The 75<sup>th</sup> and 25<sup>th</sup> percentiles were obtained using STATA, below is the methodology used for the computation.

To obtain the  $p$ th percentile, let us denote it as  $x_{[p]}$ , Let  $P = np/100$ . Let

$$W_{(i)} = \sum_{j=1}^i w(j)$$

Find the first index  $i$  such that  $W_{(i)} > P$ . The  $p$ th percentile is then

$$x_{[p]} = \begin{cases} \frac{x_{(i-1)} + x_{(i)}}{2} & \text{if } W_{(i-1)} = P \\ x_{(i)} & \text{Otherwise} \end{cases}$$



*Figure 4.1: Asset size of Ethiopian Private Bank in ETB for 2013 with 75th and 25th Percentiles*

In 2013 the 75<sup>th</sup> percentile was ETB 10,100,000,000, Ethiopian Private banks that had asset sizes larger than the 75<sup>th</sup> percentile were DB (ETB 19,747,174,767), AIB (ETB 17,783,926,770), WB (ETB 10,393,803,401) and BoA (ETB 10,160,113,834). These banks are designated as Large Private Bank. Ethiopian Private banks that had asset sizes between the 75<sup>th</sup> percentile (ETB 19,747,174,767) and the 25<sup>th</sup> percentile (ETB 204,000,000) were UB (ETB 9,985,996,951), NIB (ETB 9,144,543,615), CBO (ETB 5,726,892,120), OIB (ETB 3,911,231,433), ZB (ETB 3,179,746,793), LIB (ETB 2,942,432,757), BIB (ETB 2,197,315,312) and BBI (ETB 2,128,453,819). These banks are designated as Medium Private Bank. Ethiopian Private banks that had asset sizes below the 25<sup>th</sup> percentile (ETB 2,040,000,000) were AB (ETB 1,951,100,007), AdIB (ETB 91,617,414) and DGB (ETB 38,056,508). These banks are designated as Small Private Bank.

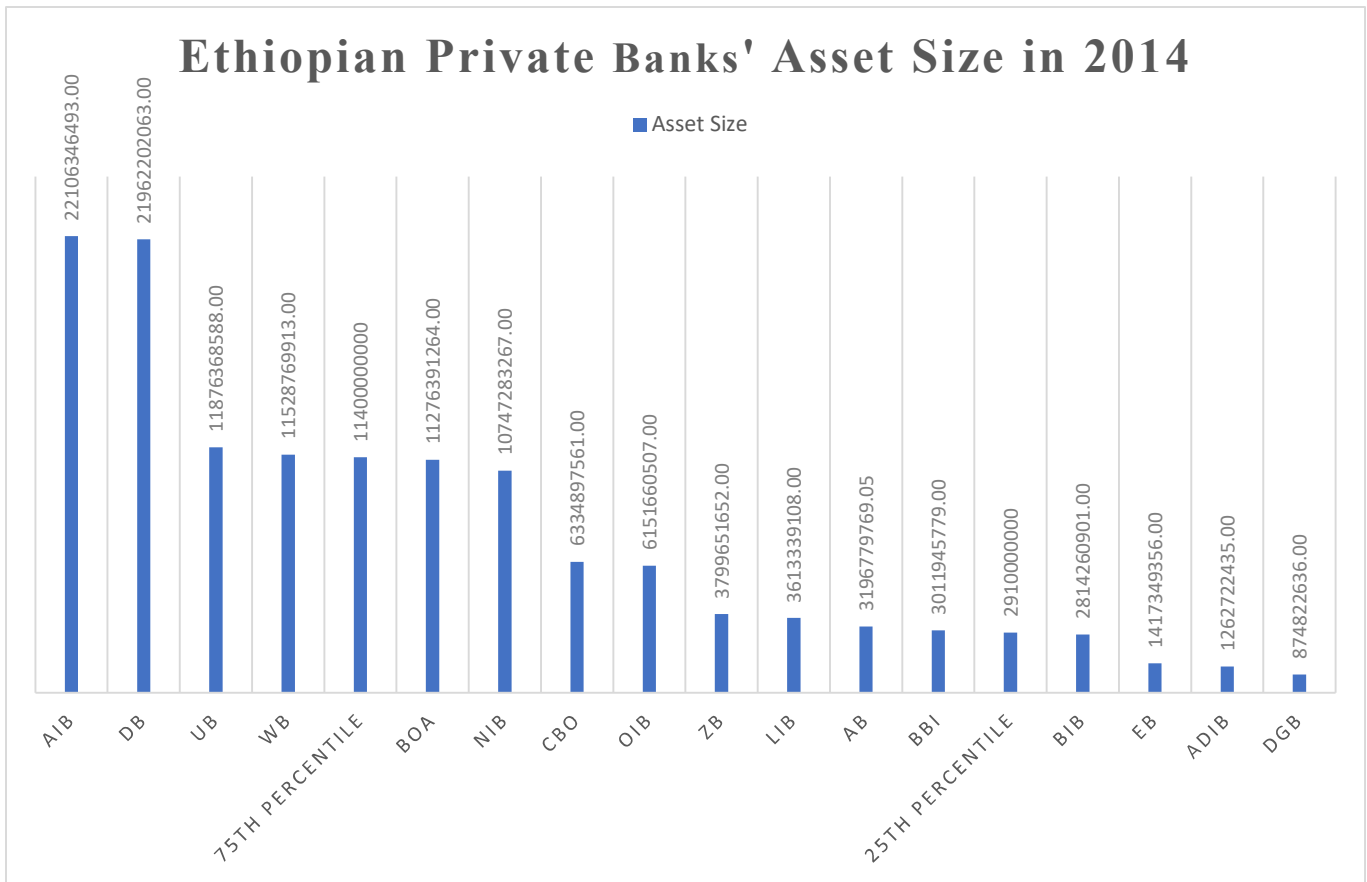


Figure 4.2: Asset size of Ethiopian Private Bank in ETB for 2014 with 75th and 25th Percentiles

In 2014 the 75<sup>th</sup> percentile was ETB 11,400,000,000, Ethiopian Private banks that had asset sizes larger than the 75<sup>th</sup> percentile were AIB (ETB 22,106,346,493), DB (ETB 21,962,202,063), UB (ETB 11,876,368,588) and WB (ETB 11,528,769,913). These banks are designated as Large Private Bank. Ethiopian Private banks that had asset sizes between the 75<sup>th</sup> percentile (ETB 11,400,000,000) and the 25<sup>th</sup> percentile (ETB 2,910,000,000) were BoA (ETB 11,276,391,264), NIB (ETB 10,747,283,267), CBO (ETB 6,334,897,561), OIB (ETB 6,151,660,507), ZB (ETB 3,799,651,652), LIB (ETB 3,613,339,108), AB (ETB 3,196,779,769) and BBI (ETB 3,011,945,779). These banks are designated as Medium Private Bank. Ethiopian Private banks that had asset sizes below the 25<sup>th</sup> percentile (ETB 2,910,000,000) were BIB (ETB 2,814,260,901), EB (ETB 1,417,349,356) AdIB (ETB 1,262,722,435) and DGB (ETB 874,822,636). These banks are designated as Small Private Bank.

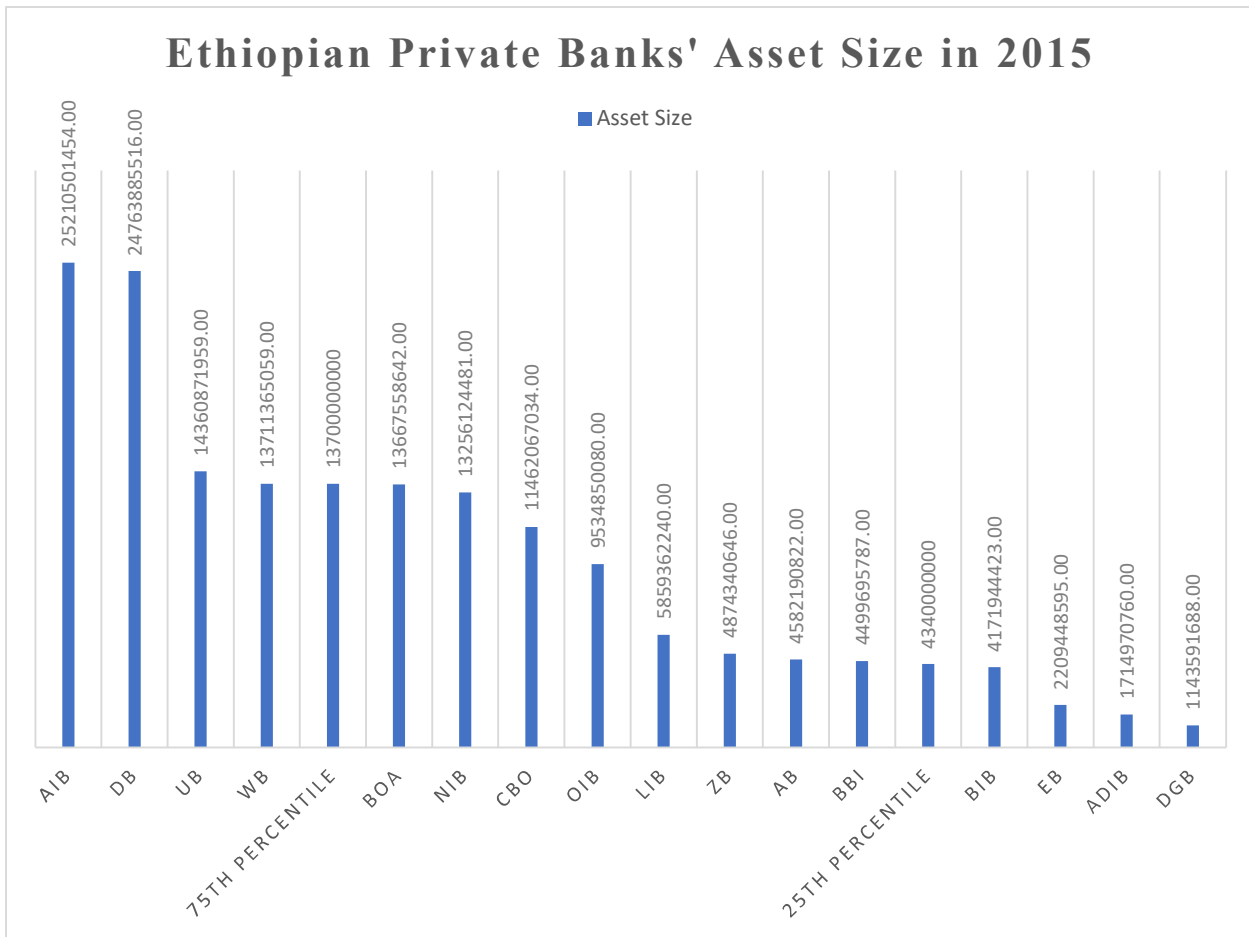
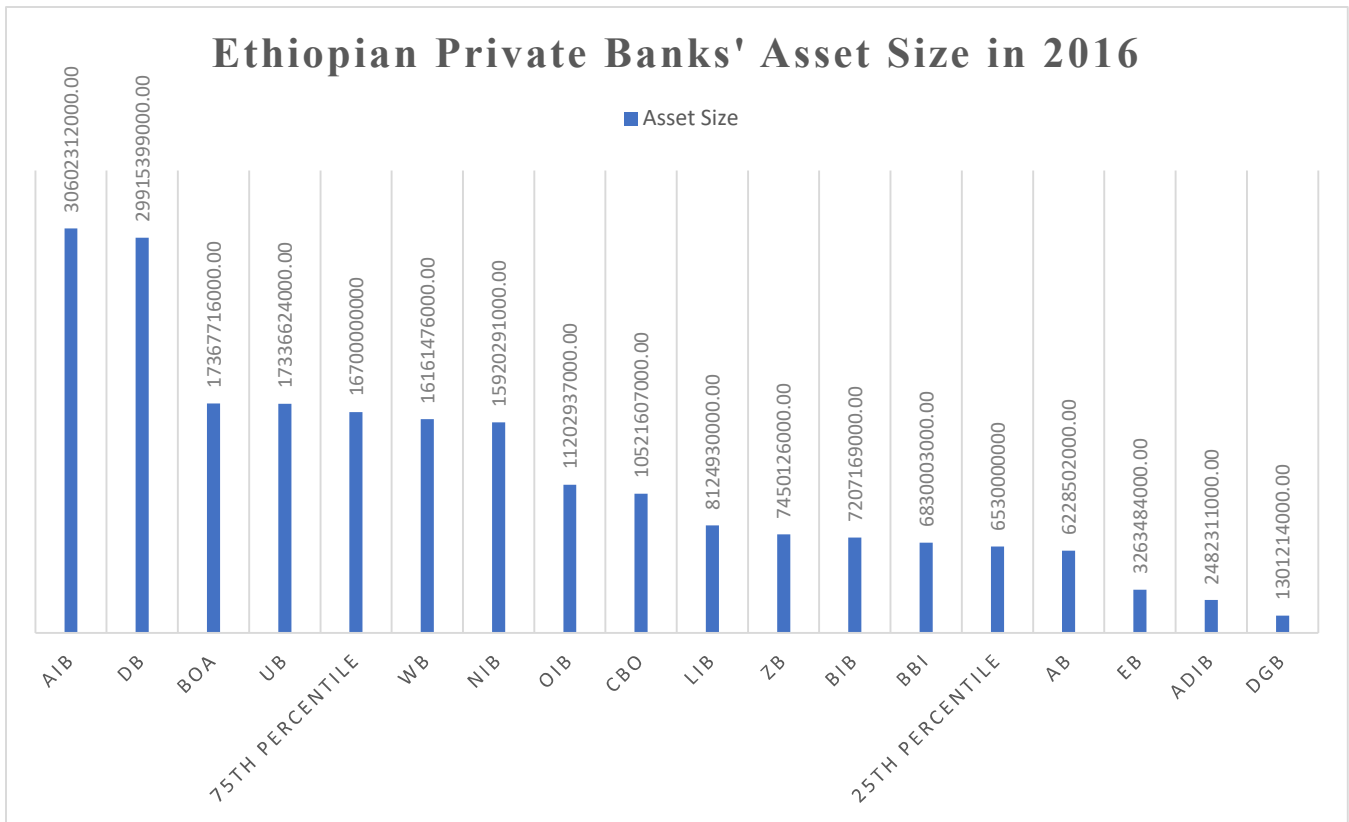


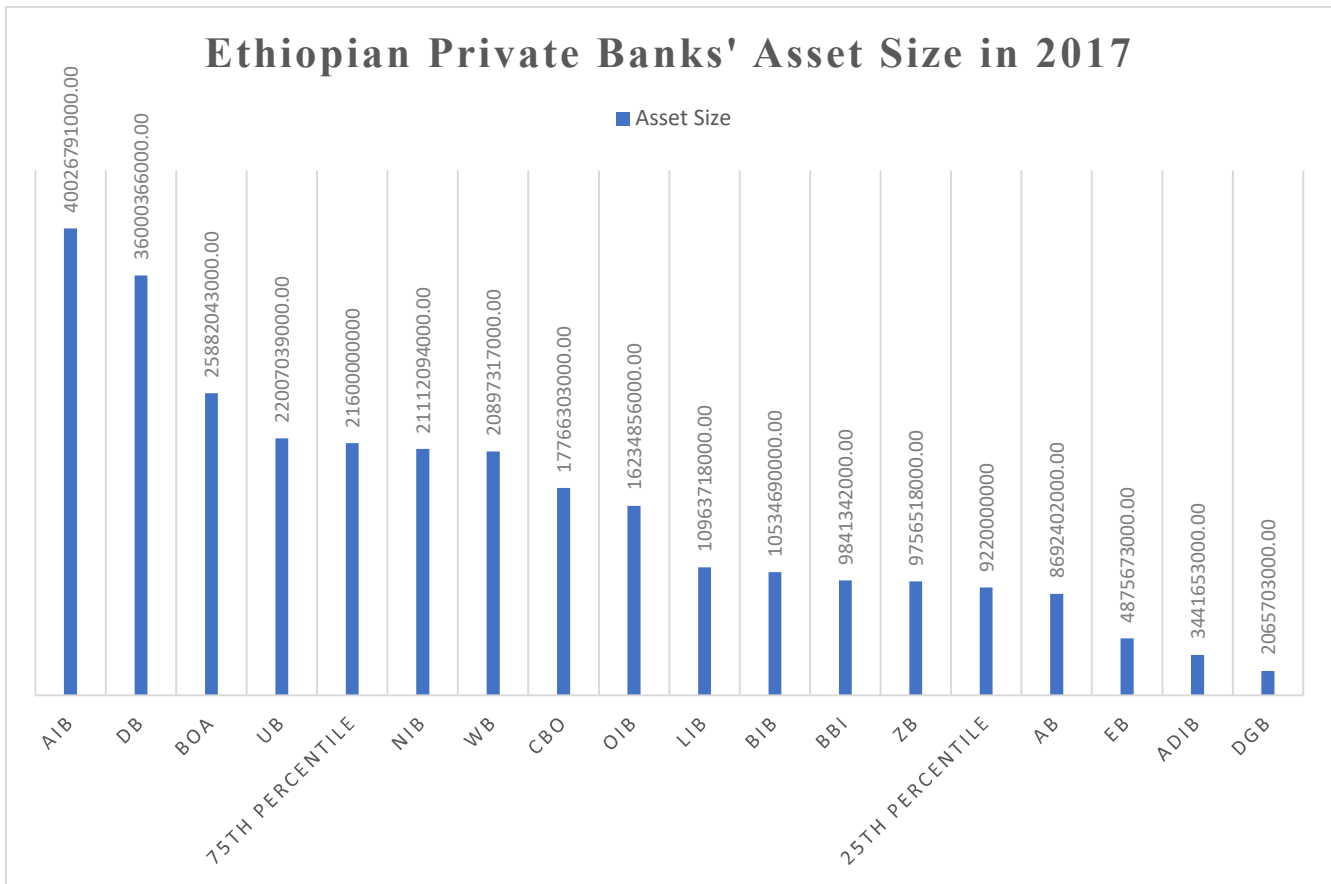
Figure 4.3: Asset size of Ethiopian Private Bank in ETB for 2015 with 75th and 25th Percentiles

In 2015 the 75<sup>th</sup> percentile was ETB 13,700,000,000, Ethiopian Private banks that had asset sizes larger than the 75<sup>th</sup> percentile were AIB (ETB 25,210,501,454), DB (ETB 21,962,202,063), UB (ETB 14,360,871,959) and WB (ETB 13,711,365,059). These banks are designated as Large Private Bank. Ethiopian Private banks that had asset sizes between the 75<sup>th</sup> percentile (ETB 13,700,000,000) and the 25<sup>th</sup> percentile (ETB 4,340,000,000) were BoA (ETB 13,667,558,642), NIB (ETB 13,667,558,642), CBO (ETB 11,462,067,034), OIB (ETB 9,534,850,080), LIB (ETB 5,859,362,240), ZB (ETB 4,874,340,646), AB (ETB 4,582,190,822) and BBI (ETB 4,499,695,787). These banks are designated as Medium Private Bank. Ethiopian Private banks that had asset sizes below the 25<sup>th</sup> percentile (ETB 4,340,000,000) were BIB (ETB 4,171,944,423), EB (ETB 2,209,448,595) AdIB (ETB 1,714,970,760) and DGB (ETB 1,143,591,688). These banks are designated as Small Private Bank.



*Figure 4.4: Asset size of Ethiopian Private Bank in ETB for 2016 with 75th and 25th Percentiles*

In 2016 the 75<sup>th</sup> percentile was ETB 16,700,000,000, Ethiopian Private banks that had asset sizes larger than the 75<sup>th</sup> percentile were AIB (ETB 30,602,312,000), DB (ETB 29,915,399,000), BoA (ETB 17,367,716,000) and UB (ETB 17,336,624,000). These banks are designated as Large Private Bank. Ethiopian Private banks that had asset sizes between the 75<sup>th</sup> percentile (ETB 16,700,000,000) and the 25<sup>th</sup> percentile (ETB 6,530,000,000) were WB (ETB 16,161,476,000), NIB (ETB 15,920,291,000), OIB (ETB 11,202,937,000), CBO (ETB 10,521,607,000), LIB (ETB 8,124,930,000), ZB (ETB 7,450,126,000), BIB (ETB 7,207,169,000) and BBI (ETB 6,830,003,000). These banks are designated as Medium Private Bank. Ethiopian Private banks that had asset sizes below the 25<sup>th</sup> percentile (ETB 6,530,000,000) were AB (ETB 6,228,502,000), EB (ETB 3,263,484,000) AdIB (ETB 2,482,311,000) and DGB (ETB 1,301,214,000). These banks are designated as Small Private Bank.



*Figure 4.5: Asset size of Ethiopian Private Bank in ETB for 2017 with 75th and 25th Percentiles*

In 2017 the 75<sup>th</sup> percentile was ETB 21,600,000,000, Ethiopian Private banks that had asset sizes larger than the 75<sup>th</sup> percentile were AIB (ETB 40,026,791,000), DB (ETB 36,000,366,000), BoA (ETB 25,882,043,000) and UB (ETB 22,007,039,000). These banks are designated as Large Private Bank. Ethiopian Private banks that had asset sizes between the 75<sup>th</sup> percentile (ETB 21,600,000,000) and the 25<sup>th</sup> percentile (ETB 9,220,000,000) were NIB (ETB 21,112,094,000), WB (ETB 20,897,317,000), CBO (ETB 17,766,303,000), OIB (ETB 16,234,856,000), LIB (ETB 10,963,718,000), BIB (ETB 10,534,690,000), BBI (ETB 9,841,342,000) and ZB (ETB 9,756,518,000). These banks are designated as Medium Private Bank. Ethiopian Private banks that had asset sizes below the 25<sup>th</sup> percentile (ETB 9,220,000,000) were AB (ETB 8,692,402,000), EB (ETB 4,875,673,000) AdIB (ETB 3,441,653,000) and DGB (ETB 2,065,703,000). These banks are designated as Small Private Bank.

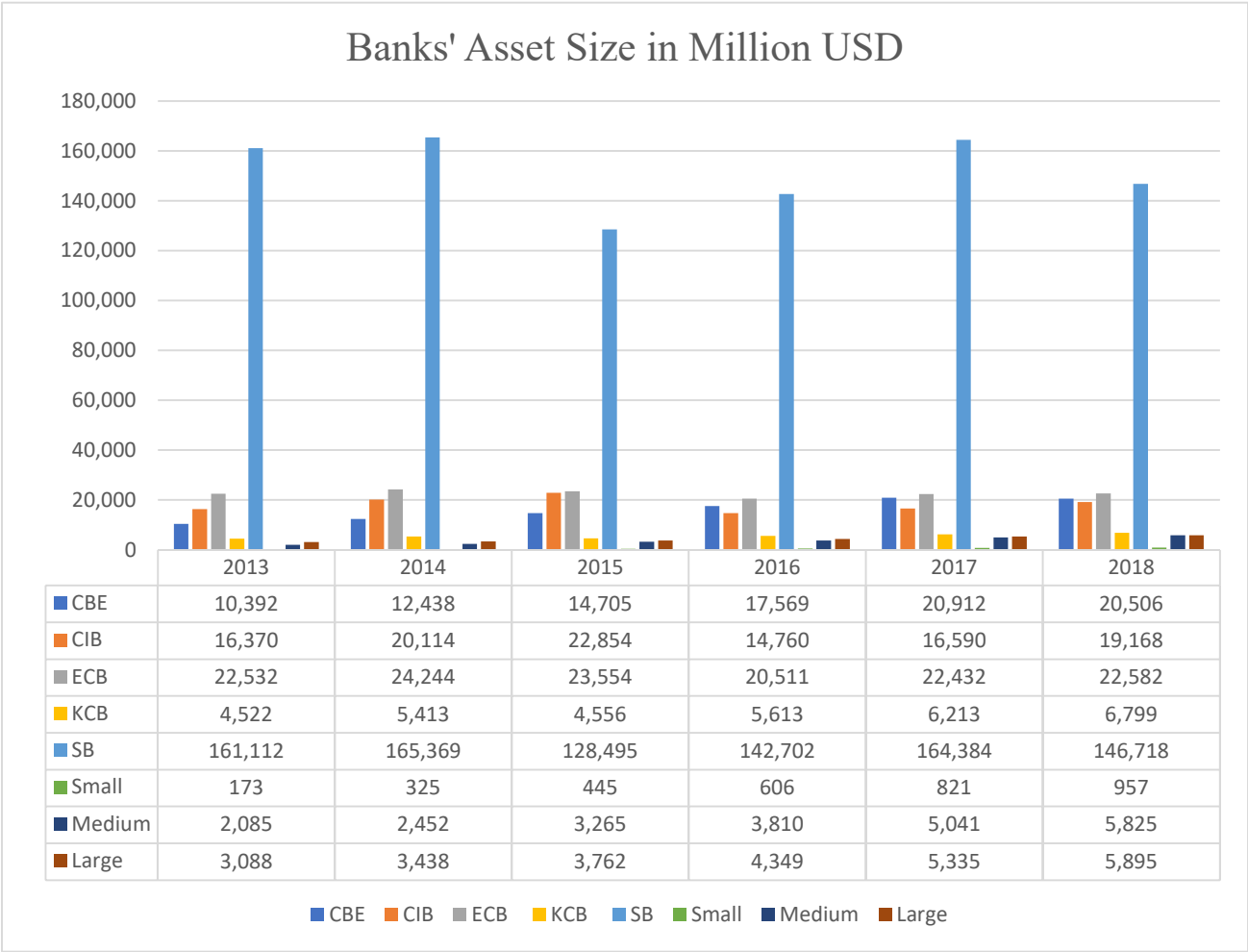


*Figure 4.6: Asset size of Ethiopian Private Bank in ETB for 2018 with 75th and 25th Percentiles*

In 2018 the 75<sup>th</sup> percentile was ETB 29,000,000,000, Ethiopian Private banks that had asset sizes larger than the 75<sup>th</sup> percentile were AIB (ETB 55,268,107,000), DB (ETB 45,425,378,000), BoA (ETB 31,983,036,000) and CBO (ETB 29,888,034,000). These banks are designated as Large Private Bank. Ethiopian Private banks that had asset sizes between the 75<sup>th</sup> percentile (ETB 29,000,000,000) and the 25<sup>th</sup> percentile (ETB 12,700,000,000) were UB (ETB 28,030,918,000), WB (ETB 27,390,906,000), NIB (ETB 26,688,922,000), OIB (ETB 23,796,732,000), LIB (ETB 14,319,598,000), BIB (ETB 14,067,979,000), AB (ETB 13,325,060,000) and BBI (ETB 13,021,152,000). These banks are designated as Medium Private Bank. Ethiopian Private banks that had asset sizes below the 25<sup>th</sup> percentile (ETB 12,700,000,000) were ZB (ETB 12,438,906,000), EB (ETB 6,482,374,000) AdIB (ETB 4,209,059,000) and DGB (ETB 3,260,693,000). These banks are designated as Small Private Bank.

Now that the designations of Small, Medium, and Large private banks have been established. The next section discusses the comparisons of assets of these banks in addition to State-owned and Foreign banks.

**4.2. Bank Asset Size Comparison**



*Figure 4.7: Bank Asset size Comparison grouped by year, origin and ownership structure*

The figure above shows the disparity in asset growth between Ethiopian banks and foreign banks. The state-owned bank Commercial Bank of Ethiopia has grown by an average of 14.9%, the large private banks have grown by an average of 13.91%, the medium private banks have grown by an average of 23.06% and small private banks have grown by an average of 42.60%. The foreign banks selected from across the region of Africa show smaller growth than their Ethiopian counterpart. Kenya Commercial Bank (KCB) has grown by 9.44%, Commercial International Bank (CIB) has grown by

an average of 5.8%, Ecobank (ECB) has grown by an average of 0.373% while Standard Bank, the largest bank of all, has contracted by 0.83%.

Even though Ethiopian banks have been growing, there are still very small as compared to their foreign counterparts. If all of the banks sum up their assets, the largest bank in Ethiopia, the Commercial bank of Ethiopia had 4.72% of the assets in 2013 and had 8.98% of the total asset in 2018. The collection of the largest private banks in Ethiopia were 1.4% of the total asset in 2013 and 2.58% in 2018. Medium private banks made up 0.95% of the total assets in 2013 and 2.55% in 2018. Small Private banks made up 0.08% in 2013 and 0.42% in 2018. Their foreign counterparts are also dwarfed by Standard bank, Standard bank constituted 73.14% which meant that it was larger than all the other selected banks combined in 2013 and this has continued as it constituted 64.22% in 2018 still larger than all the other banks combined.

The selected foreign banks were also larger than the Ethiopian state-owned bank, Commercial Bank of Ethiopia but CBE is gaining more ground as time progresses. Standard Bank, a private bank, was 15.5 times as large as Commercial Bank of Ethiopia in 2013 and this has reduced to 7.15 times as large in 2018. Commercial International Bank (CIB) was 1.58 times as large as Commercial bank in 2013 but was overtaken by CBE in 2016. CBE in 2018 was 1.07 times larger than CIB. Ecobank was 1.38 times larger than the CBE in 2013 and is 1.18 times as large as CBE in 2018.

The Asset size difference is much starker when looked into the Ethiopian banking sector. Commercial bank of Ethiopia in 2013 was 60.07 times as large as the whole Small Private Banks combined, 4.98 times as large as Medium Sized Banks combined and 3.37 times as large as Large Private banks combined. This has shown improvement for Small and Medium Private Banks which in 2018 CBE was 21.43 and 3.52 times as large respectively while the ratio has increased for Large Private banks, CBE was 3.48 times as large as the Large Private Banks in 2018.

When it comes to the characteristics of the private banks. Large private banks were 17.85 as large and 6.50 times as large as Small Private Banks in 2013 and 2018 respectively. Large private banks were 1.48 times as large and 1.06 times as large as Medium Private banks in 2013 and 2018 respectively.

Private Ethiopian banks have also shown a large size difference between the largest and smallest banks. Based on Asset size, in 2013, the largest private bank, Dashen bank was larger than 8 of the smallest banks combined. In 2014 and 2015 the largest private bank, the largest private bank, Awash

International bank was larger than 7 of the smallest banks combined. In 2016, 2017, and 2018 the largest private bank, Awash International Bank was larger than 6 of the smallest banks combined.

### **4.3. Descriptive Statistics**

This research has relied on the intermediation approach to select the list of input variables (interest expense and non-interest expense) and output variables (interest income and non-interest income). Table 1-5 presents the summary statistics of those variables. As it is shown, there are 125 observations of 20 banks for 2013 (Enat bank is not included because data was not available) and 21 banks for the remaining years (2014-2018). The descriptive summary has been decomposed by the contextual variables as below. Three major observations can be made about the data.

First, the data are heterogeneous. For example, the Interest expense range from 63,301.73 to 1.6e+07 with a standard deviation of 3,989,656 for Small Private Banks, from 2,084,088 to 3.72e+07 with a standard deviation of 7,674,713 for Medium Private Banks, from 9,165,179 to 5.36e+07 with a standard deviation of 1.19e+07 for Large Private Banks, from 1.27e+08 to 5.35e+08 with a standard deviation of 1.49e+08 and from 9.98e+07 to 5.19e+09 with a standard deviation of 1.55 e+09 from Foreign banks. The same issue is seen on the other variables also, indicating that the VRS assumption is more appropriate than CRS (Shi, Li, Emrouznejad, Xie, & Liang, 2017).

Second, Non-interest expense is a larger expense than Interest expense for the private banks in Ethiopia, contradicting what has been found by (Du & Sim, 2016). But interest expense becomes larger than Non-interest expense in state-owned banks and foreign banks agreeing with what has been found by (Du & Sim, 2016).

Third, net interest income becomes by far the most important source of revenue, as the banks become larger. The mean interest income is 26.6% larger than mean non-interest income in Small Private Banks, The mean interest income is 88.48% larger than mean non-interest income in Medium Private Banks, the mean interest income is 107.05% larger than mean non-interest income in Large Private Banks, the mean interest income is 276.27% larger than mean non-interest income in State-Owned bank and the mean interest income is 58.43% larger than mean non-interest income in foreign banks. This is in line with what (Du & Sim, 2016) have found in their research in emerging markets.

### Small Private Banks

Variable	Obs	Mean	Std. dev.	Min.	Max.
<b>Interest expense in USD</b>	23	3,998,824	3,989,656	62,301.73	1.6e+07
<b>Non-interest expense in USD</b>	23	5,744,977	3,851,637	914,206.6	1.68e+07
<b>Interest income in USD</b>	23	7,976,243	6,706,066	375,093.6	2.58e+07
<b>Non-interest income in USD</b>	23	6,299,790	3,574,749	40,766.93	1.53e+07

*Table 4.1: Small Private Bank Descriptive Statistics*

### Medium Private Banks

Variable	Obs	Mean	Std. dev.	Min.	Max.
<b>Interest expense in USD</b>	48	1.12e+07	7,674,713	2,084,088	3.72e+07
<b>Non-interest expense in USD</b>	48	8.17e+08	5.54e+09	1,103,692	3.84e+10
<b>Interest income in USD</b>	48	3.11e+07	1.98e+07	4,629,353	8.21e+07
<b>Non-interest income in USD</b>	48	1.65e+07	9,581,536	3,557,837	5.44e+07

*Table 4.2: Medium Private Bank's Descriptive Statistics*

### Large Private Banks

Variable	Obs	Mean	Std. dev.	Min.	Max.
<b>Interest expense in USD</b>	24	2.75e+07	1.19e+07	9,165,179	5.36e+07
<b>Non-interest expense in USD</b>	24	3.73e+07	1.52e+07	1.41e+07	7.09e+07
<b>Interest income in USD</b>	24	6.75e+07	3.04e+07	3.10e+07	1.52e+08
<b>Non-interest income in USD</b>	24	3.26e+07	1.33e+07	1.46e+07	5.53e+07

*Table 4.3: Large Private Bank's Descriptive Statistics*

### State-Owned Bank

<b>Variable</b>	<b>Obs</b>	<b>Mean</b>	<b>Std. dev.</b>	<b>Min.</b>	<b>Max.</b>
<b>Interest expense in USD</b>	6	2.91e+08	1.49e+08	1.27e+08	5.35e+08
<b>Non-interest expense in USD</b>	6	2.65e+08	1.3e+08	5.61e+07	4.2e+08
<b>Interest income in USD</b>	6	8.88e+08	3.04e+08	5.07e+08	1.3e+09
<b>Non-interest income in USD</b>	6	2.36e+08	9.84e+07	4.53e+07	3.11e+08

*Table 4.4: State Owned Bank's Descriptive Statistics*

### Foreign Banks

<b>Variable</b>	<b>Obs</b>	<b>Mean</b>	<b>Std. dev.</b>	<b>Min.</b>	<b>Max.</b>
<b>Interest expense in USD</b>	24	1.33e+09	1.55e+09	9.98e+07	5.19e+09
<b>Non-interest expense in USD</b>	24	1.35e+09	1.5e+09	9.82e+07	4.62e+09
<b>Interest income in USD</b>	24	2.63e+09	2.75e+09	4.81e+08	1.01e+10
<b>Non-interest income in USD</b>	24	1.66e+09	2.16e+09	1.79e+08	6.27e+09

*Table 4.5: Foreign Bank's Descriptive Statistics*

#### 4.4. Data Envelopment Analysis

The next step of the analysis is to estimate the DEA score for each bank in each year using both Constant Returns to Scale and Variable Returns to Scale. Table 6 reports some summary statistics on the DEA CRS scores for each bank. The mean DEA score in CRS ranges from 0.6897 (BoA) to 1 (CIB) during the period. Table 7 reports some summary statistics on the DEA VRS scores for each bank. the mean DEA score in VRS ranges from 0.72845 (BoA) to 1 (EB, ZB, CIB, and KCB).

##### 4.4.1. Efficiency Scores for the Banks using CRS

No.	Banks	2013	2014	2015	2016	2017	2018	Average
1	AB	0.7907	0.6402	0.6835	0.4393	0.8141	0.9348	0.7171
2	BoA	0.4901	0.6792	0.6165	0.7079	0.8026	0.8419	0.6897
3	AdIB	0.8742	0.8181	0.8487	0.7676	0.9752	0.9093	0.8655
4	AIB	0.5572	0.736	0.6242	0.7431	0.8922	0.9104	0.7439
5	BIB	0.8501	0.7266	0.7104	0.9816	1	0.8144	0.8472
6	BBI	0.817	0.8133	0.6112	0.8178	0.7829	0.8679	0.785
7	CBE	1	1	1	1	1	0.9476	0.9913
8	CBO	1	1	0.7649	0.9041	0.8168	0.7851	0.8785
9	DB	0.6035	0.7266	0.8496	0.745	0.8562	0.7942	0.7625
10	DGB	1	0.7659	0.6045	1	1	1	0.8951
11	EB	-	0.7582	0.8085	0.8158	0.7897	0.8709	0.8086
12	LIB	0.9647	0.7423	0.8997	0.8945	0.8737	0.892	0.8778
13	NIB	0.7427	0.8115	0.6759	1	1	0.8393	0.8449
14	OIB	0.7257	0.8053	0.6623	0.8361	0.815	1	0.8074
15	UB	0.654	0.7094	0.5833	0.6797	0.7471	0.7886	0.6937
16	WB	0.7856	0.7503	0.6527	1	0.9274	0.9444	0.8434
17	ZB	1	1	0.9565	0.9821	1	0.9477	0.9811
18	CIB	1	1	1	1	1	1	1
19	ECB	0.6644	0.6831	0.5648	0.7798	0.8308	0.8482	0.7285
20	KCB	1	0.9847	1	1	1	1	0.9975
21	SB	0.5699	0.6172	1	0.8577	0.9058	1	0.8251

Table 4.6: DEA scores using CRS assumption

#### 4.4.2. Efficiency Scores for the Banks using VRS

No.	Banks	2013	2014	2015	2016	2017	2018	Average
1	AB	0.8271	0.6958	0.7713	0.5206	0.995	0.9362	0.791
2	BoA	0.5007	0.7255	0.6635	0.7135	0.8926	0.8749	0.72845
3	AdIB	1	0.9614	1	0.9559	1	0.9897	0.9845
4	AIB	0.5615	0.8369	0.6503	0.7457	0.8477	0.9316	0.76228
5	BIB	1	0.8112	0.8521	1	1	0.8517	0.91917
6	BBI	1	0.8743	0.7797	0.8355	0.857	0.9307	0.87953
7	CBE	1	1	1	1	0.8644	1	0.9774
8	CBO	1	1	0.8221	0.9209	1	0.822	0.9275
9	DB	0.7067	0.9553	0.8576	0.7465	1	0.7945	0.84343
10	DGB	1	1	1	1	0.9691	1	0.99485
11	EB	-	1	1	1	1	1	1
12	LIB	0.9647	0.7967	0.948	0.9089	0.9538	0.9796	0.92528
13	NIB	0.7427	0.8199	0.7378	1	0.7835	0.8844	0.82805
14	OIB	0.7257	0.8261	0.7353	0.847	0.9966	1	0.85512
15	UB	0.654	0.7212	0.6232	0.6857	1	0.8262	0.75172
16	WB	0.7856	0.7542	0.6977	1	1	0.9447	0.8637
17	ZB	1	1	1	1	1	1	1
18	CIB	1	1	1	1	1	1	1
19	ECB	0.6644	1	0.6845	1	1	1	0.89148
20	KCB	1	1	1	1	1	1	1
21	SB	0.5699	1	1	1	1	1	0.92832

Table 4.7: DEA score using VRS assumption

## Average DEA Efficiency Scores Using CRS And VRS

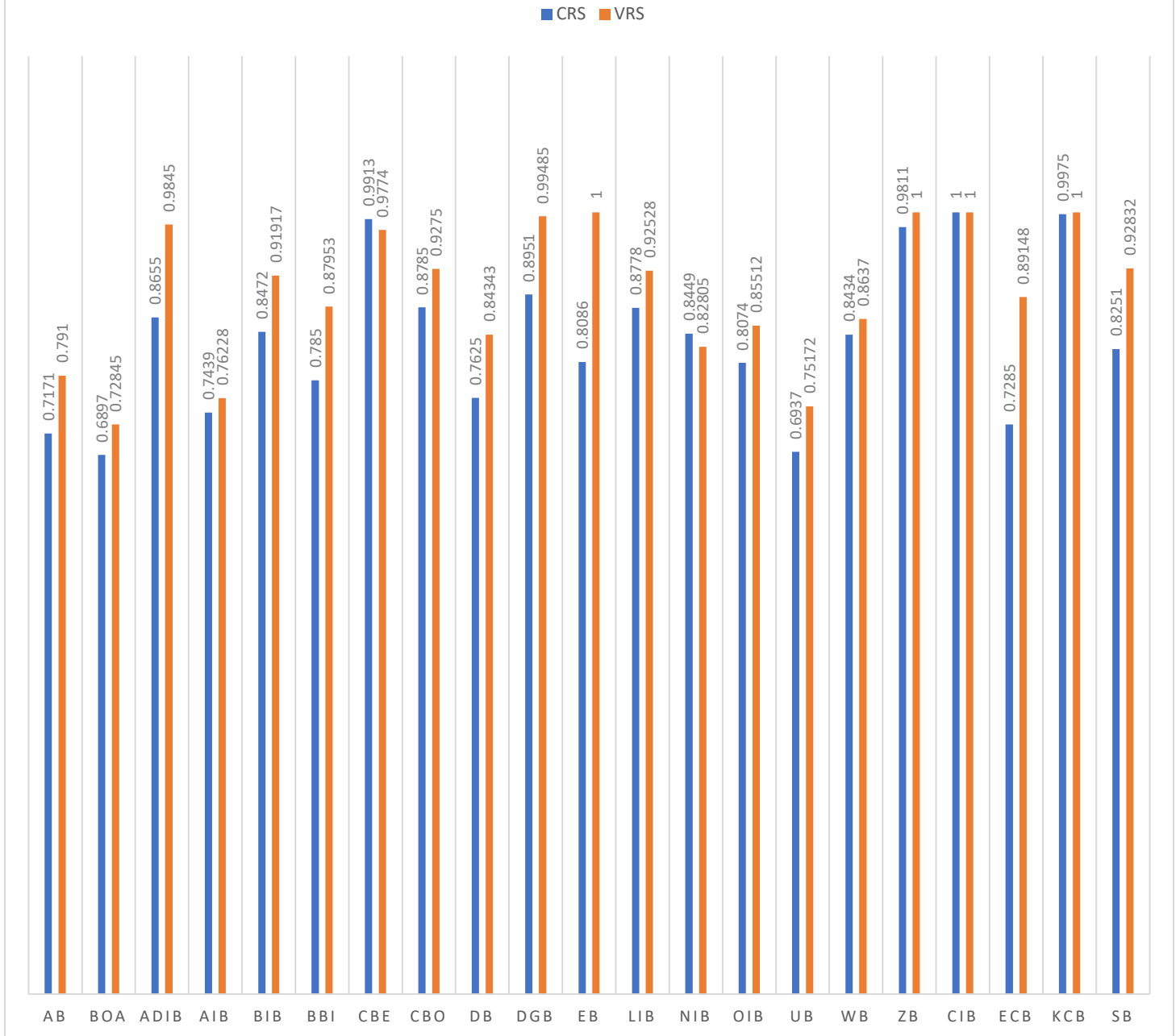


Figure 4.8: Average DEA Efficiency Scores using CRS and VRS

The DEA results show using the VRS assumption yield higher results than using the CRS assumption which is in line with (Ofori-Sasu, Abor, & Mensah, Funding Structure and technical efficiency: A data envelopment analysis (DEA) approach for banks in Ghana., 2019). Under the CRS assumption, the average Ethiopian Banks Efficiency is 0.84 (84%) while the average foreign banks' efficiency is 0.888

(88.8%) and under the VRS assumption, the average Ethiopian banks' efficiency is 0.9 (90%) while the average Foreign banks' efficiency is 0.963 (96.4%).

#### **4.4.3. Merger Analysis**

In most real applications of bank mergers only two banks are merged (Shi, Li, Emrouznejad, Xie, & Liang, 2017). Therefore, for this research, the merger is set between two banks. All local banks (State-owned banks, Large, Medium, and Small Sized banks) are have been merged between themselves and foreign banks while the foreign banks are only merged with local banks. In total there are 1204 hypothetical DMUs under CRS and 1103 hypothetical DMUs under VRS.

The distribution of hypothetical DMU's merger efficiency scores under the CRS and VRS assumptions is shown in Table 8. It could be noted that the majority of hypothetical DMU's merger efficiency scores are less than one therefore there exists considerable potential merger gains for the majority of the hypothetical DMU under both CRS and VRS assumptions. Under the CRS assumption, pure merger efficiency gains of hypothetical DMUs with a score of one are 440 which shows that pure merger efficiency gains are low and are consistent with (Boetoft & Wang, 2005). Under the VRS assumption, pure merger efficiency gains are very low of even negative which is in line with (Shi, Li, Emrouznejad, Xie, & Liang, 2017) and (Bogetoft & Wang, 2005).

Efficiency Interval in %	CRS		VRS	
	Overall	Pure	Overall	Pure
<b>0-9.99</b>	0	0	0	0
<b>10-19.99</b>	0	0	0	0
<b>20-29.99</b>	0	0	0	0
<b>30-39.99</b>	0	0	0	0
<b>40-49.99</b>	2	1	1	0
<b>50-59.99</b>	69	0	14	0
<b>60-69.99</b>	176	1	115	1
<b>70-79.99</b>	244	5	194	5
<b>80-89.99</b>	264	27	227	68
<b>90-99.99</b>	405	730	176	522
<b>100</b>	44	440	0	0
<b>&gt;100</b>	0	0	376	507

*Table 4.8: Distribution of hypothetical DMU's merger efficiency score under CRS and VRS*

To further explain the findings, the hypothetical DMUs overall merger efficiency, pure merger efficiency, technical efficiency, harmony efficiency, and scale efficiency score for both the CRS and VRS assumptions are plotted below.

### 4.4.3.1 Overall Merger Efficiency

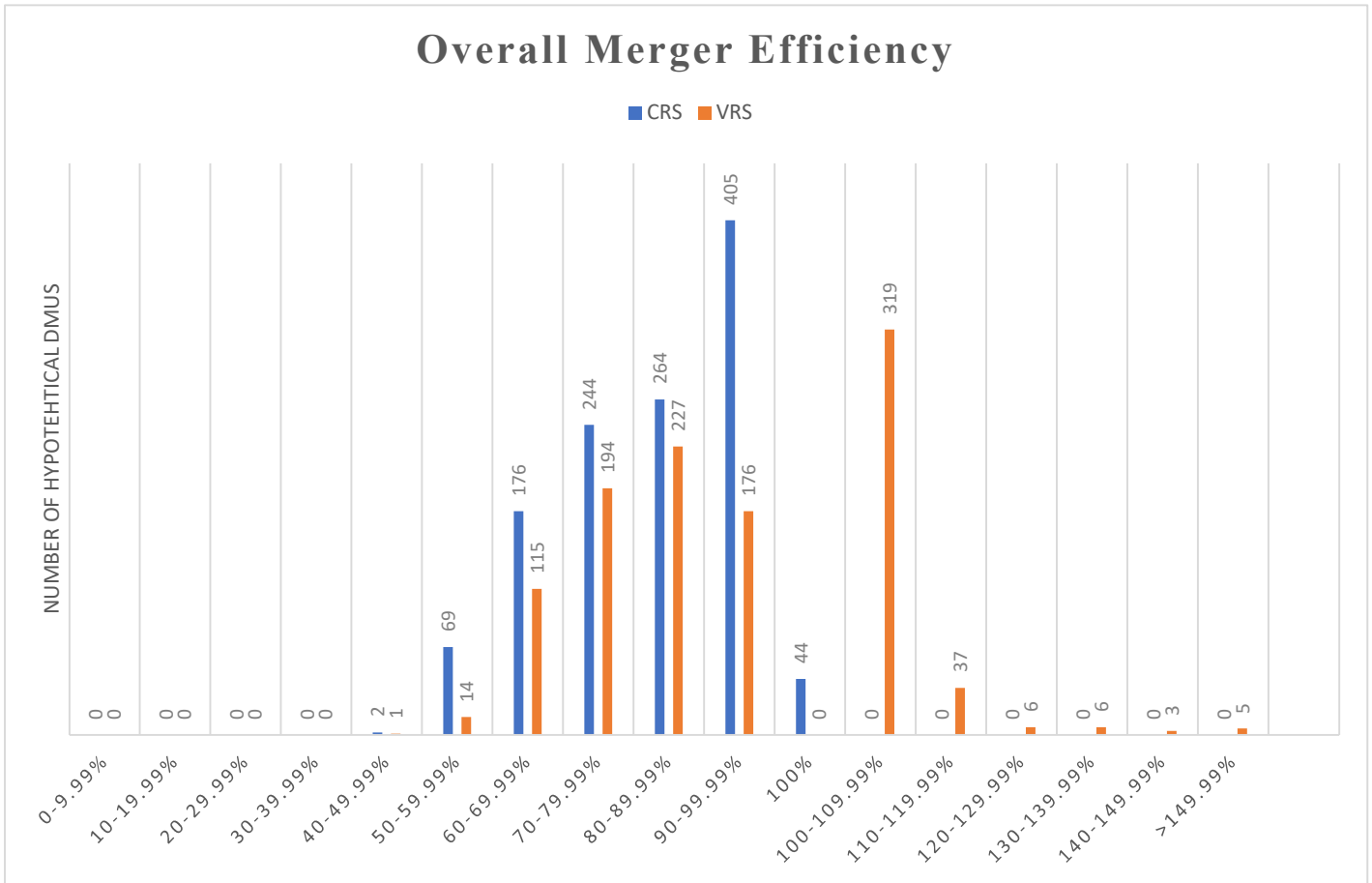


Figure 4.9: Overall Merger Efficiency Under CRS and VRS assumption

The majority of the efficiency scores under the CRS assumption 1160 (96.34%) are less than one which shows that there are gains from mergers. Under the VRS assumption, 727 (65.91%) hypothetical DMUs merger efficiency scores are less than one which shows that there are gains from mergers. This is in line with (Said, Zouari-Hadiji, & Bouri, 2017).

#### 4.4.3.2. Pure Merger Efficiency

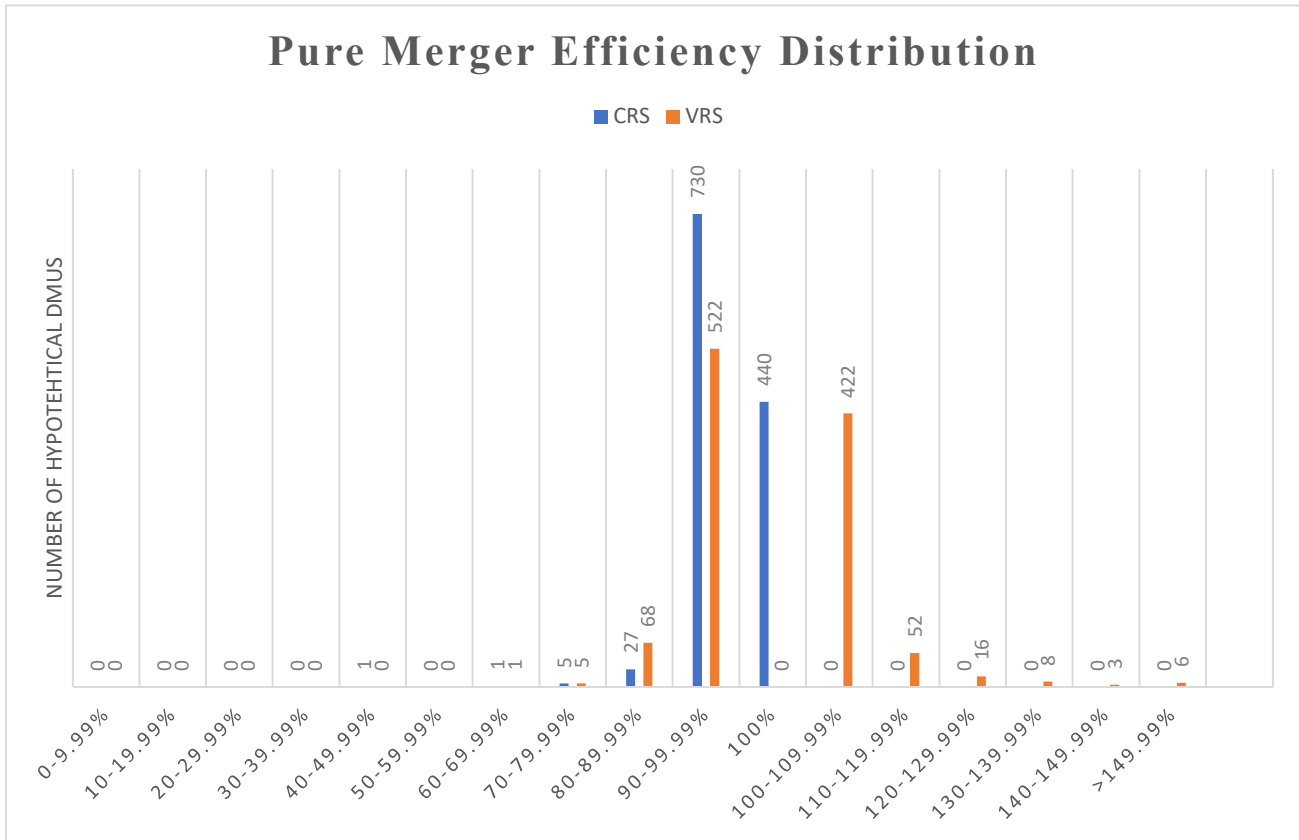


Figure 4.10: Pure Merger Efficiency under CRS and VRS assumption

Under the CRS assumption, pure merger efficiency gains of hypothetical DMUs with a score of one soars to 440 from 44 which shows that pure merger efficiency gains are low and is consistent with (Boetoft & Wang, 2005). Under the VRS assumption, pure merger efficiency gains are very low, some even show inefficiencies of merging which is in line with (Shi, Li, Emrouznejad, Xie, & Liang, 2017) and (Bogetoft & Wang, 2005).

#### 4.4.3.3. Technical (Learning) Efficiency

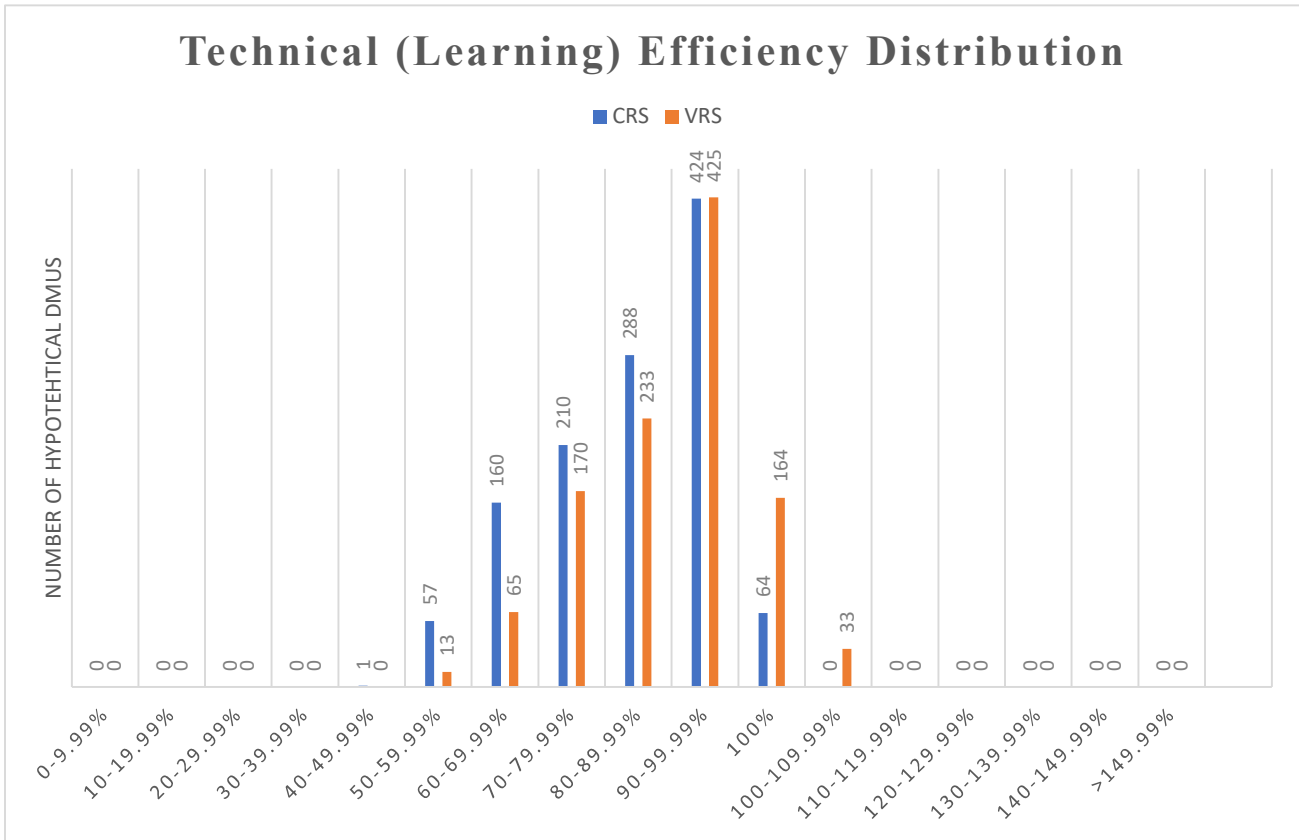


Figure 4.11: Learning or Technical Efficiency under CRS and VRS assumption

As shown in figure 16, most of the hypothetical DMU’s technical efficiency scores are less than one. Therefore, potential technical improvements exist for the merged entities which are in line with (Shi, Li, Emrouznejad, Xie, & Liang, 2017) and (Bogetoft & Wang, 2005).

#### 4.4.3.4. Harmony (Scope) Efficiency

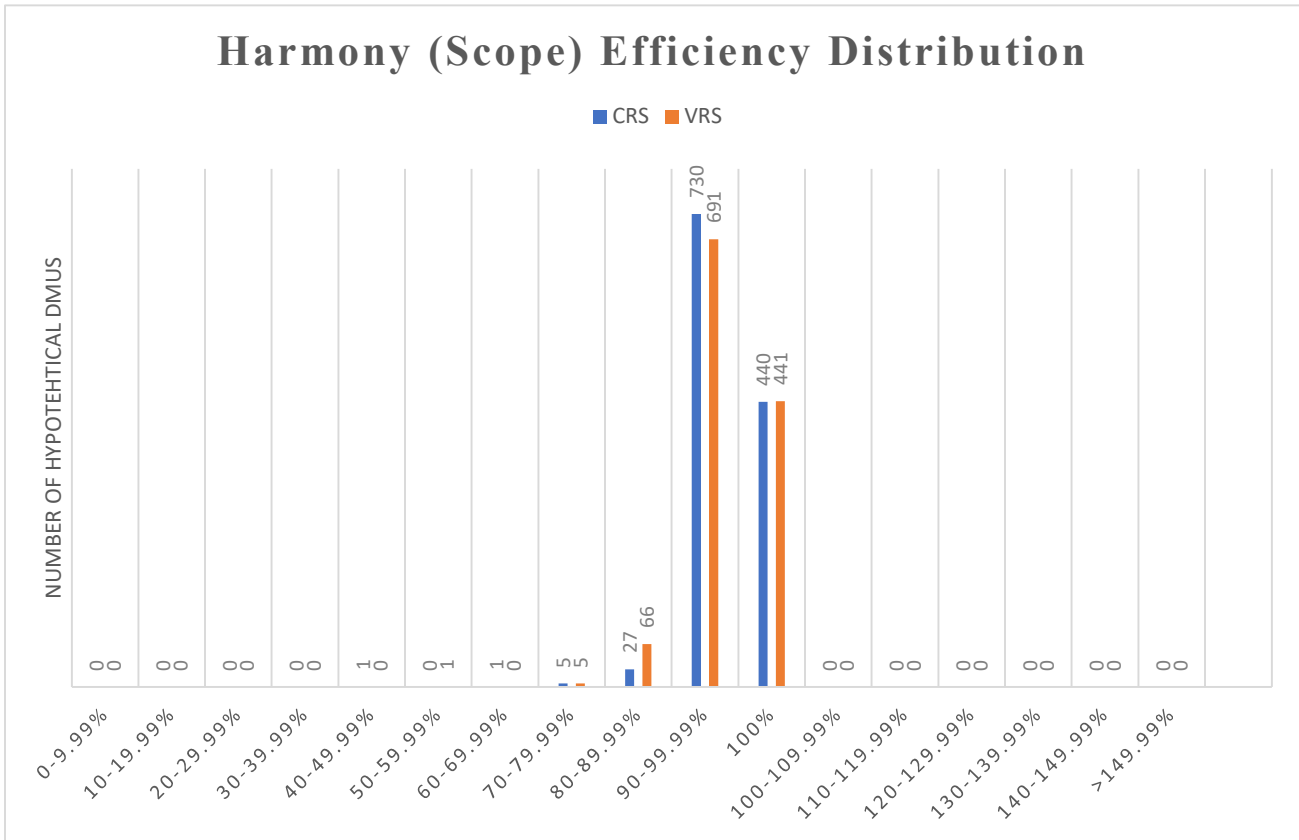


Figure 4.12: Harmony or Scope Efficiency under CRS and VRS assumptions

Figure 17 shows that the harmony efficiency favors mergers as most of the hypothetical mergers' efficiency scores are less than one which is in line with (Shi, Li, Emrouznejad, Xie, & Liang, 2017) and (Bogetoft & Wang, 2005).

#### 4.4.3.5. Size (Scale) Efficiency

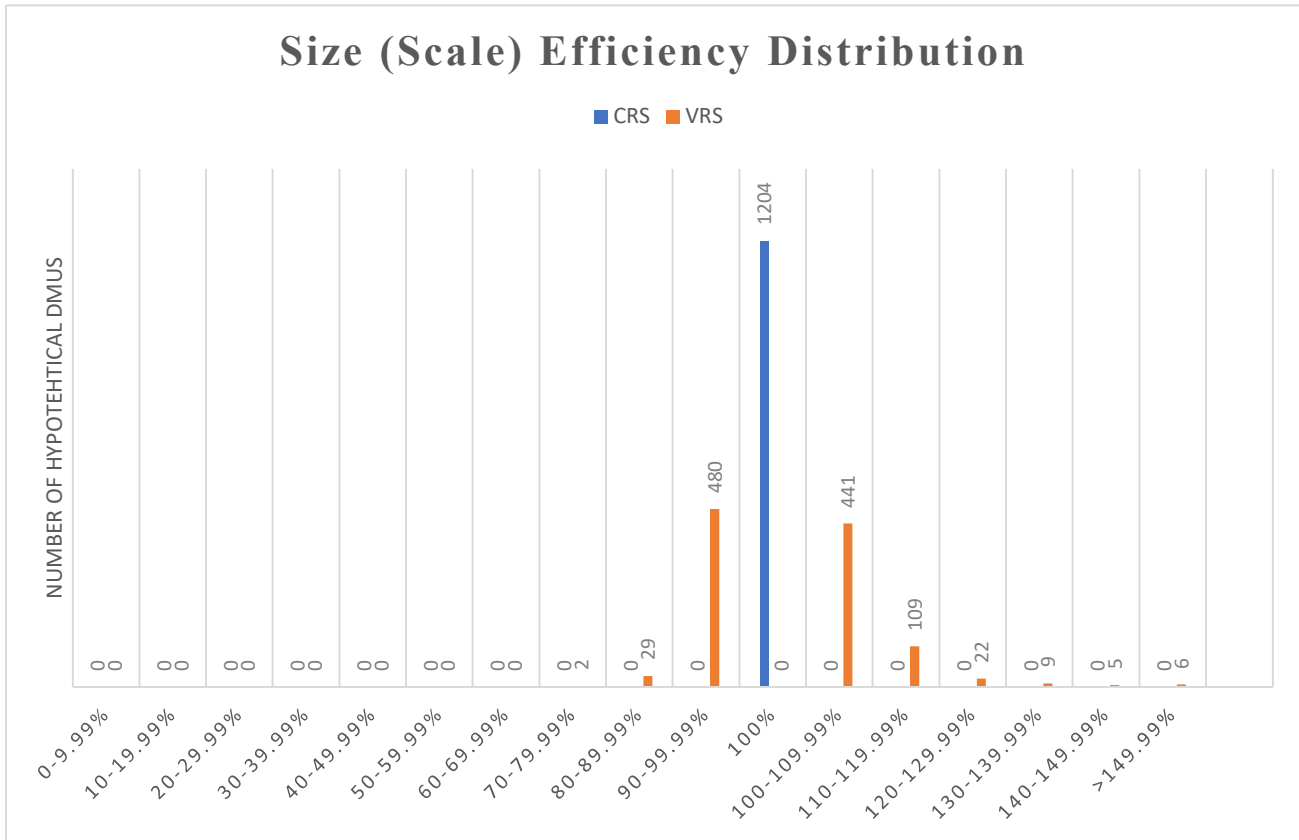


Figure 4.13: Scale or Size Effect under CRS and VRS assumption

Though the technical effect and harmony efficiency favor mergers, the scale effect show mixed effects using the VRS assumption. As shown in Figure 25, 511(46.33%) potential mergers scale effect favors mergers while 592 (56.67%) potential mergers' scale effect doesn't favor mergers. Compared to previous studies, scale effect works against mergers (Boetoft & Wang, 2005) and (Reda, 2013) but in this research, almost half (46.33%) of potential mergers scale effect favors merges.

## 4.5. Bootstrapped Tobit Regression Analysis

### 4.5.1. Small Private Banks

#### 4.5.1.1. CRS assumption

$$OME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$PME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$LE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$HE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

Where

- $OME_{it}$ : Overall Merger Efficiency for Small Private Banks under CRS
- $PME_{it}$ : Pure Merger Efficiency for Small Private Banks under CRS
- $LE_{it}$ : Learning or Technical Efficiency for Small Private Banks under CRS
- $HE_{it}$ : Harmony or Scope Efficiency for Small Private Banks under CRS
- Small: Dummy variable indicating the other merged bank as Small Private Bank
- Medium: Dummy variable indicating the other merged bank as Medium Private Bank
- Large: Dummy Variable indicating the other merged bank Large Private Bank
- State: Dummy variable indicating the other merged bank State-Owned Bank
- Foreign: Dummy variable indicating the other merged bank Foreign Bank

### Bootstrapped Tobit Regression Results

	(1)	(2)	(3)	(4)
	$OME_{it}$	$PME_{it}$	$LE_{it}$	$HE_{it}$
<b>Small</b>	0.764*** (41.07)	0.982*** (136.29)	0.779*** (30.54)	0.980*** (156.25)
<b>Medium</b>	0.821*** (61.24)	0.972*** (285.84)	0.842*** (65.34)	0.979*** (340.84)
<b>Large</b>	0.761*** (52.51)	0.971*** (163.26)	0.771*** (50.74)	0.997*** (338.8)
<b>State</b>	0.993*** (536.98)	0.997*** (148.55)	1.001*** (126.8)	1.007*** (202.18)
<b>Foreign</b>	0.894*** (34.86)	1.016*** (250.93)	0.896*** (32.27)	1.011*** (362.61)
<b>sigma_u</b>				
<b>_cons</b>	0.0586*** (6.41)	0.0100 (1.52)	0.0620*** (7.59)	8.90e-16 (0.00)
<b>sigma_e</b>				
<b>_cons</b>	0.112*** (21.64)	0.0454*** (11.95)	0.107*** (17.63)	0.0349*** (8.39)
<b>N</b>	424	424	424	424

Table 4.9: Bootstrapped Tobit Regression Results for Small Private Banks with CRS assumption

*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Under the constant returns to scale assumption, results from the Bootstrapped Tobit regression show that the strategic fit for mergers for small banks is to merge with large banks as there are more gains

in pure merger efficiency as compared to the rest banks. There is also more learning or technical efficiency gain to be had from this merger. This suggests that the best merger scenario for both improvements by learning and strategic fit for small banks is to merge with large banks.

#### 4.5.1.2. VRS assumption

$$OME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$PME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$LE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$HE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$SE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

Where

- $OME_{it}$ : Overall Merger Efficiency for Small Private Banks under VRS
- $PME_{it}$ : Pure Merger Efficiency for Small Private Banks under VRS
- $LE_{it}$ : Learning or Technical Efficiency for Small Private Banks under VRS
- $HE_{it}$ : Harmony or Scope Efficiency for Small Private Banks under VRS
- $SE_{it}$ : Size Effect for Small Private Banks under VRS
- Small: Dummy variable indicating the other merged bank as Small Private Bank
- Medium: Dummy variable indicating the other merged bank as Medium Private Bank
- Large: Dummy Variable indicating the other merged bank as Large Private Bank
- State: Dummy variable indicating the other merged bank as State-Owned Bank
- Foreign: Dummy variable indicating the other merged bank as Foreign Bank

### Bootstrapped Tobit Regression Results

	(1)	(2)	(3)	(4)	(5)
	$OME_{it}$	$PME_{it}$	$LE_{it}$	$HE_{it}$	$SE_{it}$
<b>Small</b>	0.816*** (31.56)	0.900*** (90.23)	0.905*** (23.11)	1.018*** (73.46)	0.907*** (78.05)
<b>Medium</b>	0.850*** (72.03)	0.942*** (176.18)	0.904*** (65.91)	0.986*** (202.24)	0.966*** (217.30)
<b>Large</b>	0.764*** (78.93)	0.970*** (173.39)	0.794*** (77.74)	0.979*** (161.29)	0.988*** (256.23)
<b>State</b>	1.070*** (79.18)	1.032*** (122.61)	1.052*** (10.45)	1.010*** (116.29)	1.039 (0.60)
<b>Foreign</b>	1.058*** (66.68)	1.043*** (131.51)	1.027*** (57.61)	0.998*** (116.31)	1.069*** (110.51)
<b>sigma_u</b>					
<b>_cons</b>	0.0381*** (3.33)	0.0196*** (5.42)	0.0559*** (5.39)	0.0191*** (5.90)	0.0163*** (3.85)
<b>sigma_e</b>					
<b>_cons</b>	0.108*** (19.27)	0.0428*** (15.95)	0.0934*** (18.43)	0.0446*** (13.72)	0.0417*** (12.60)
<b>N</b>	401	401	401	401	401

Table 4.10: Bootstrapped Tobit Regression Results for Small Private Banks with VRS assumption  
*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Under the variable returns to scale assumption, results from the Bootstrapped Tobit regression show that the overall efficiency gains have the most improvement when small banks are merged with large banks but the pure merger efficiency gain to be had from that merger is less than the pure merger gains from mergers with other small banks and medium banks suggesting that a look into other merges for strategic fit. When the gains from pure merger efficiency were decomposed, in the case of mergers with small banks all of the gains of mergers come from the size or scale effect suggesting that there are economies of scale to be had from the mergers but there are no Harmony or Scope gains to be had from the merger suggesting that service offerings of small banks are similar to each other. On the other hand, mergers with large followed by medium and foreign banks offer better gains in harmony or scope efficiency while mergers with the state-owned banks offer no benefits in both harmony and size. This suggests that the best strategic fit for small banks are other small banks.

## 4.5.2. Medium Private Banks

### 4.5.2.1. CRS assumption

$$OME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$PME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$LE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$HE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

Where

- $OME_{it}$ : Overall Merger Efficiency for Medium Private Banks under CRS
- $PME_{it}$ : Pure Merger Efficiency for Medium Private Banks under CRS
- $LE_{it}$ : Learning or Technical Efficiency for Medium Private Banks under CRS
- $HE_{it}$ : Harmony or Scope Efficiency for Medium Private Banks under CRS
- Small: Dummy variable indicating the other merged bank as Small Private Bank
- Medium: Dummy variable indicating the other merged bank as Medium Private Bank
- Large: Dummy Variable indicating the other merged bank as Large Private Bank
- State: Dummy variable indicating the other merged bank as State-Owned Bank
- Foreign: Dummy variable indicating the other merged bank as Foreign Bank

### Bootstrapped Tobit Regression Results

	(1) <i>OME<sub>it</sub></i>	(2) <i>PME<sub>it</sub></i>	(3) <i>LE<sub>it</sub></i>	(4) <i>HE<sub>it</sub></i>
<b>Small</b>	0.798*** (80.86)	0.978*** (233.26)	0.820*** (75.72)	0.978*** (220.81)
<b>Medium</b>	0.824*** (75.44)	0.993*** (170.60)	0.842*** (58.86)	0.993*** (152.95)
<b>Large</b>	0.743*** (165.58)	0.993*** (208.72)	0.764*** (141.24)	0.993*** (168.58)
<b>State</b>	0.988*** (87.14)	1.031*** (60.50)	0.999*** (96.09)	1.031*** (68.61)
<b>Foreign</b>	0.882*** (54.75)	1.016*** (250.69)	0.891*** (42.95)	1.016*** (246.76)
<b>sigma_u</b>				
<b>_cons</b>	0.0554*** (9.23)	0.0129** (2.53)	0.0620*** (11.34)	0.0129** (2.56)
<b>sigma_e</b>				
<b>_cons</b>	0.106*** (27.14)	0.0550*** (8.75)	0.0996*** (25.70)	0.0550*** (7.67)
<i>N</i>	758	758	758	758

Table 4.11: Bootstrapped Tobit Regression Results for Medium Private Banks with CRS assumption

*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Under the constant returns to scale assumption, results from the Bootstrapped Tobit regression show that the strategic fit for mergers for medium banks is to merge with small banks as there are more

gains in pure merger efficiency as compared to the rest banks. There is more learning or technical efficiency gain to be had from the merger with large banks but this doesn't necessitate full mergers as the banks can learn from each other without merging.

#### 4.5.2.2. VRS assumption

$$OME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$PME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$LE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$HE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$SE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

Where

- $OME_{it}$ : Overall Merger Efficiency for Medium Private Banks under VRS
- $PME_{it}$ : Pure Merger Efficiency for Medium Private Banks under VRS
- $LE_{it}$ : Learning or Technical Efficiency for Medium Private Banks under VRS
- $HE_{it}$ : Harmony or Scope Efficiency for Medium Private Banks under VRS
- $SE_{it}$ : Size Efficiency for Medium Private Banks under VRS
- Small: Dummy variable indicating the other merged bank as Small Private Bank
- Medium: Dummy variable indicating the other merged bank as Medium Private Bank
- Large: Dummy Variable indicating the other merged bank as Large Private Bank
- State: Dummy variable indicating the other merged bank as State-Owned Bank
- Foreign: Dummy variable indicating the other merged bank as Foreign Bank

### Bootstrapped Tobit Regression Results

	(1)	(2)	(3)	(4)	(5)
	<i>OME<sub>it</sub></i>	<i>PME<sub>it</sub></i>	<i>LE<sub>it</sub></i>	<i>HE<sub>it</sub></i>	<i>SE<sub>it</sub></i>
<b>Small</b>	0.838*** (71.06)	0.937*** (174.97)	0.893*** (74.46)	0.990*** (171.28)	0.961*** (223.99)
<b>Medium</b>	0.861*** (77.38)	0.963*** (244.38)	0.889*** (81.26)	0.993*** (198.48)	0.984*** (275.93)
<b>Large</b>	0.784*** (96.72)	0.978*** (360.54)	0.795*** (154.15)	0.982*** (169.01)	0.995*** (316.98)
<b>State</b>	1.132*** (110.36)	1.079*** (23.66)	1.015*** (154.16)	1.021*** (76.85)	1.060*** (119.85)
<b>Foreign</b>	1.119*** (63.93)	1.083*** (104.13)	0.996*** (137.39)	1.006*** (129.27)	1.085*** (22.24)
<b>sigma_u</b>					
<b>_cons</b>	0.0321*** (3.10)	0.0141*** (3.13)	0.0326*** (4.18)	0.0207*** (6.75)	0.0140*** (6.65)
<b>sigma_e</b>					
<b>_cons</b>	0.118*** (24.71)	0.0478*** (13.10)	0.0892*** (24.36)	0.0567*** (12.16)	0.0351*** (12.43)
<b>N</b>	711	711	711	711	711

Table 4.12: Bootstrapped Tobit Regression Results for Medium Private Banks with VRS assumption

*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Under the variable returns to scale assumption, results from the Bootstrapped Tobit regression show that the overall efficiency gains have the most improvement when medium banks are merged with

large banks but the pure merger efficiency gain to be had from that merger is less than the pure merger gains from mergers with small banks and medium banks suggesting that a look into other merges for strategic fit. When gains from pure merger efficiency are decomposed into harmony and size efficiency, different results are found. More gains in harmony efficiency are realized when medium banks are merged with large banks while more gains in size efficiency are realized when medium banks are merged with small banks. This suggests that for more service diversification, merging with large banks is preferred while to realize economies of scale merger with small banks is preferred but more pure efficiency gains come from the merger medium banks with small banks. This suggests that the best strategic fit for medium banks are small banks.

### 4.5.3. Large Private Banks

#### 4.5.3.1. CRS assumption

$$OME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$PME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$LE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$HE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

Where

- $OME_{it}$ : Overall Merger Efficiency for Large Private Banks under CRS
- $PME_{it}$ : Pure Merger Efficiency for Large Private Banks under CRS
- $LE_{it}$ : Learning or Technical Efficiency for Large Private Banks under CRS
- $HE_{it}$ : Harmony or Scope Efficiency for Large Private Banks under CRS
- Small: Dummy variable indicating the other merged bank as Small Private Bank
- Medium: Dummy variable indicating the other merged bank as Medium Private Bank
- Large: Dummy Variable indicating the other merged bank as Large Private Bank
- State: Dummy variable indicating the other merged bank as State-Owned Bank
- Foreign: Dummy variable indicating the other merged bank as Foreign Bank

### Bootstrapped Tobit Regression Results

	(1) <i>OME<sub>it</sub></i>	(2) <i>PME<sub>it</sub></i>	(3) <i>LE<sub>it</sub></i>	(4) <i>HE<sub>it</sub></i>
<b>Small</b>	0.751*** (70.99)	0.989*** (381.95)	0.763*** (68.01)	0.989*** (362.37)
<b>Medium</b>	0.751*** (122.26)	0.986*** (364.20)	0.768*** (109.96)	0.986*** (303.21)
<b>Large</b>	0.723*** (60.28)	0.991*** (131.82)	0.734*** (49.97)	0.991*** (126.64)
<b>State</b>	0.959*** (245.26)	1.023*** (148.35)	0.961*** (205.10)	1.023*** (46.69)
<b>Foreign</b>	0.869*** (37.07)	1.007*** (256.35)	0.873*** (34.11)	1.007*** (308.45)
<b>sigma_u</b>				
<b>_cons</b>	0.0293* (1.91)	0.0108*** (2.68)	0.0308* (1.80)	0.0108** (2.29)
<b>sigma_e</b>				
<b>_cons</b>	0.107*** (21.50)	0.0307*** (8.55)	0.106*** (23.54)	0.0307*** (12.00)
<b>N</b>	401	401	401	401

Table 4.13: Bootstrapped Tobit Regression Results for Large Private Banks with CRS assumption

*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Under the constant returns to scale assumption, results from the Bootstrapped Tobit regression suggest that the strategic fit for mergers for large banks is to merge with medium banks as there are more gains in pure merger efficiency as compared to the rest banks. There is more learning or technical efficiency gain to be had from the merger with large banks but this doesn't necessitate full mergers as the banks can learn from each other without merging.

#### 4.5.3.2. VRS assumption

$$OME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$PME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$LE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$HE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

$$SE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it} + \beta_5 Foreign_{it}$$

Where

- $OME_{it}$ : Overall Merger Efficiency for Large Private Banks under VRS
- $PME_{it}$ : Pure Merger Efficiency for Large Private Banks under VRS
- $LE_{it}$ : Learning or Technical Efficiency for Large Private Banks under VRS
- $HE_{it}$ : Harmony or Scope Efficiency for Large Private Banks under VRS
- $SE_{it}$ : Size Efficiency for Large Private Banks under VRS
- Small: Dummy variable indicating the other merged bank as Small Private Bank
- Medium: Dummy variable indicating the other merged bank as Medium Private Bank
- Large: Dummy Variable indicating the other merged bank as Large Private Bank
- State: Dummy variable indicating the other merged bank as State-Owned Bank
- Foreign: Dummy variable indicating the other merged bank as Foreign Bank

### Bootstrapped Tobit Regression Results

	(1)	(2)	(3)	(4)	(5)
	$OME_{it}$	$PME_{it}$	$LE_{it}$	$HE_{it}$	$SE_{it}$
<b>Small</b>	0.784*** (65.47)	0.975*** (171.48)	0.801*** (67.88)	0.976*** (145.95)	0.988*** (245.78)
<b>Medium</b>	0.798*** (84.58)	0.979*** (334.55)	0.802*** (131.40)	0.978*** (184.73)	0.993*** (413.91)
<b>Large</b>	0.775*** (54.23)	0.992*** (119.41)	0.767*** (57.43)	0.982*** (104.44)	0.995*** (232.47)
<b>State</b>	1.111*** (17.45)	1.060*** (4.29)	0.975*** (490.05)	1.021*** (85.46)	1.037 (0.26)
<b>Foreign</b>	1.070*** (77.58)	1.062*** (3.60)	0.960*** (153.05)	1.000*** (132.20)	5.616 (0.94)
<b>sigma_u</b>					
<b>_cons</b>	1.23e-16 (0.00)	0.0134** (3.99)	1.31e-20 (0.00)	0.0142** (2.43)	0.0112*** (2.83)
<b>sigma_e</b>					
<b>_cons</b>	0.112*** (22.10)	0.0325*** (16.71)	0.0929*** (27.42)	0.0551*** (19.45)	0.0189*** (13.43)
<b>N</b>	376	376	376	376	376

Table 4.14: Bootstrapped Tobit Regression Results for Large Private Banks with VRS assumption

*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Under the variable returns to scale assumption, results from the Bootstrapped Tobit regression show that the overall efficiency gains have the most improvement when large banks are merged with other

large banks but the pure merger efficiency gain to be had from that merger is less than the pure merger gains from mergers with small banks and medium banks suggesting that a look into other merges for strategic fit. When gains from pure merger efficiency are decomposed into harmony and size efficiency, more gains in both harmony efficiency and size efficiency are realized when large banks are merged with small banks. This suggests that the best strategic fit for large banks are small banks.

#### 4.5.4. State-Owned Bank

##### 4.5.4.1. CRS assumption

$$OME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 Foreign_{it}$$

$$PME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 Foreign_{it}$$

$$LE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 Foreign_{it}$$

$$HE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 Foreign_{it}$$

Where

- $OME_{it}$ : Overall Merger Efficiency for State-Owned Bank under CRS
- $PME_{it}$ : Pure Merger Efficiency for State-Owned Bank under CRS
- $LE_{it}$ : Learning or Technical Efficiency for State-Owned Bank under CRS
- $HE_{it}$ : Harmony or Scope Efficiency for State-Owned Bank under CRS
- Small: Dummy variable indicating the other merged bank as Small Private Bank
- Medium: Dummy variable indicating the other merged bank as Medium Private Bank
- Large: Dummy Variable indicating the other merged bank as Large Private Bank
- State: Dummy variable indicating the other merged bank as State-Owned Bank
- Foreign: Dummy variable indicating the other merged bank as Foreign Bank

### Bootstrapped Tobit Regression Results

	(1) <i>OME<sub>it</sub></i>	(2) <i>PME<sub>it</sub></i>	(3) <i>LE<sub>it</sub></i>	(4) <i>HE<sub>it</sub></i>
<b>Small</b>	0.986*** (462.40)	1.006*** (199.31)	0.991*** (288.41)	1.006*** (175.18)
<b>Medium</b>	0.963*** (112.14)	1.022*** (115.67)	0.975*** (93.54)	1.022*** (81.72)
<b>Large</b>	0.972*** (123.63)	1.048** (2.49)	0.972*** (111.65)	1.048*** (20.02)
<b>Foreign</b>	0.891*** (22.50)	1.021*** (28.67)	0.900*** (25.09)	1.021*** (20.05)
<hr/>				
<b>sigma_u</b>				
<b>_cons</b>	2.63e-16 (0.00)	0.0111* (1.65)	4.70e-17 (0.00)	0.0111* (1.84)
<hr/>				
<b>sigma_e</b>				
<b>_cons</b>	0.0930*** (5.58)	0.0463*** (2.72)	0.0908*** (6.26)	0.0463* (1.93)
<hr/>				
<b>N</b>	119	119	119	119

Table 4.15: Bootstrapped Tobit Regression Results for State-owned Bank with CRS assumption

*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Under the constant returns to scale assumption, results from the Bootstrapped Tobit regression suggest that there is no strategic fit for mergers for the state-owned bank as there are no pure efficiency gains to be had from the mergers. There is more learning or technical efficiency gain to be had from the merger with foreign banks but this doesn't necessitate full mergers as the banks can learn from each other without merging.

#### 4.5.4.2. VRS assumption

$$OME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 Foreign_{it}$$

$$PME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 Foreign_{it}$$

$$LE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 Foreign_{it}$$

$$HE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 Foreign_{it}$$

$$SE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 Foreign_{it}$$

Where

- $OME_{it}$ : Overall Merger Efficiency for State-Owned Bank under VRS
- $PME_{it}$ : Pure Merger Efficiency for State-Owned Bank under VRS
- $LE_{it}$ : Learning or Technical Efficiency for State-Owned Bank under VRS
- $HE_{it}$ : Harmony or Scope Efficiency for State-Owned Bank under VRS
- $SE_{it}$ : Size Efficiency for State-Owned Bank under VRS
- Small: Dummy variable indicating the other merged bank as Small Private Bank
- Medium: Dummy variable indicating the other merged bank as Medium Private Bank
- Large: Dummy Variable indicating the other merged bank as Large Private Bank
- State: Dummy variable indicating the other merged bank as State-Owned Bank
- Foreign: Dummy variable indicating the other merged bank as Foreign Bank

### Bootstrapped Tobit Regression Results

	(1)	(2)	(3)	(4)	(5)
	$OME_{it}$	$PME_{it}$	$LE_{it}$	$HE_{it}$	$SE_{it}$
<b>Small</b>	1.065*** (36.84)	1.002*** (105.02)	1.034*** (84.18)	1.022*** (55.28)	1.002*** (1291.17)
<b>Medium</b>	1.074*** (35.41)	1.006*** (46.79)	0.987*** (152.44)	1.024*** (87.40)	1.005*** (51.90)
<b>Large</b>	1.087*** (30.19)	1.006* (1.79)	0.982*** (132.74)	1.047*** (22.50)	1.005*** (13.72)
<b>Foreign</b>	1.099*** (5.36)	1.005*** (4.33)	0.998*** (14.66)	1.072*** (9.80)	1.507 (7.83)
<hr/>					
<b>sigma_u</b>					
<b>_cons</b>	2.65e-15 (0.00)	3.18e-13 (0.00)	9.63e-17 (0.00)	4.00e-16 (0.00)	1.18e-17 (0.00)
<hr/>					
<b>sigma_e</b>					
<b>_cons</b>	0.0905*** (3.00)	0.00367*** (5.23)	0.0658*** (5.56)	0.0723*** (3.71)	0.00311*** (5.72)
<hr/>					
<b>N</b>	113	113	113	113	113

Table 4.16: Bootstrapped Tobit Regression Results for State-owned Bank with VRS assumption

*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Under the variable returns to scale assumption, results from the Bootstrapped Tobit regression show that there are no strategic fits for mergers for the state-owned bank as there are no pure merger efficiency gains to be had from the mergers. There is learning or technical efficiency gain to be had

from the merger with large banks but this doesn't necessitate full mergers as the banks can learn from each other without merging.

#### 4.5.5. Foreign Bank

##### 4.5.5.1. CRS assumption

$$OME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it}$$

$$PME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it}$$

$$LE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it}$$

$$HE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it}$$

Where

- $OME_{it}$ : Overall Merger Efficiency for Foreign Banks under CRS
- $PME_{it}$ : Pure Merger Efficiency for Foreign Banks under CRS
- $LE_{it}$ : Learning or Technical Efficiency for Foreign Banks under CRS
- $HE_{it}$ : Harmony or Scope Efficiency for Foreign Banks under CRS
- Small: Dummy variable indicating the other merged bank as Small Private Bank
- Medium: Dummy variable indicating the other merged bank as Medium Private Bank
- Large: Dummy Variable indicating the other merged bank as Large Private Bank
- State: Dummy variable indicating the other merged bank as State-Owned Bank
- Foreign: Dummy variable indicating the other merged bank as Foreign Bank

### Bootstrapped Tobit Regression Results

	(1) <i>OME<sub>it</sub></i>	(2) <i>PME<sub>it</sub></i>	(3) <i>LE<sub>it</sub></i>	(4) <i>HE<sub>it</sub></i>
<b>Small</b>	0.888*** (42.03)	1.016*** (149.60)	0.891*** (45.93)	1.016*** (124.93)
<b>Medium</b>	0.885*** (51.64)	1.013*** (210.83)	0.894*** (50.41)	1.013*** (189.65)
<b>Large</b>	0.871*** (48.72)	1.012*** (146.70)	0.878*** (48.26)	1.012*** (106.99)
<b>State</b>	0.942*** (10.49)	1.022*** (43.59)	0.951*** (10.28)	1.022*** (32.63)
<hr/>				
<b>sigma_u</b>				
<b>_cons</b>	0.106*** (16.31)	0.0128** (2.54)	0.109*** (16.51)	0.0128** (2.28)
<hr/>				
<b>sigma_e</b>				
<b>_cons</b>	0.116*** (13.80)	0.0468*** (3.04)	0.114*** (17.00)	0.0468** (2.52)
<hr/>				
<b>N</b>	404	404	404	404

*Table 4.17: Bootstrapped Tobit Regression Results for Foreign Banks with CRS assumption*

*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Under the constant returns to scale assumption, results from the Bootstrapped Tobit regression suggest that there is no strategic fit for mergers for foreign banks as there are no pure efficiency gains to be had from the mergers. There is more learning or technical efficiency gain to be had from the merger

with large banks but this doesn't necessitate full mergers as the banks can learn from each other without merging.

#### 4.5.5.2. VRS assumption

$$OME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it}$$

$$PME_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it}$$

$$LE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it}$$

$$HE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it}$$

$$SE_{it} = \beta_1 Small_{it} + \beta_2 Medium_{it} + \beta_3 Large_{it} + \beta_4 State_{it}$$

Where

- $OME_{it}$ : Overall Merger Efficiency for Foreign Banks under VRS
- $PME_{it}$ : Pure Merger Efficiency for Foreign Banks under VRS
- $LE_{it}$ : Learning or Technical Efficiency for Foreign Banks under VRS
- $HE_{it}$ : Harmony or Scope Efficiency for Foreign Banks under VRS
- $SE_{it}$ : Size Effect for Foreign Banks under VRS
- Small: Dummy variable indicating the other merged bank as Small Private Bank
- Medium: Dummy variable indicating the other merged bank as Medium Private Bank
- Large: Dummy Variable indicating the other merged bank as Large Private Bank
- State: Dummy variable indicating the other merged bank as State-Owned Bank
- Foreign: Dummy variable indicating the other merged bank as Foreign Bank

### Bootstrapped Tobit Regression Results

	(1) <i>OME<sub>it</sub></i>	(2) <i>PME<sub>it</sub></i>	(3) <i>LE<sub>it</sub></i>	(4) <i>HE<sub>it</sub></i>
<b>Small</b>	1.151*** (31.02)	1.074*** (20.51)	1.019*** (80.56)	1.001*** (106.00)
<b>Medium</b>	1.266*** (31.30)	1.136*** (13.20)	0.995*** (140.24)	1.007*** (151.62)
<b>Large</b>	1.179*** (29.44)	1.141*** (5.97)	0.960*** (158.03)	1.001*** (117.13)
<b>State</b>	2.238*** (11.09)	1.499*** (4.39)	1.030*** (30.26)	1.097 (0.16)
<b>sigma_u</b>				
<b>_cons</b>	0.0000410** (2.12)	0.0319 (1.42)	1.31e-18 (0.00)	0.0238*** (3.33)
<b>sigma_e</b>				
<b>_cons</b>	0.229*** (6.95)	0.0718 (1.45)	0.0861*** (8.98)	0.0567*** (5.26)
<b>N</b>	303	303	303	303

Table 4.18: Bootstrapped Tobit Regression Results for Foreign Banks with VRS assumption

*t* statistics in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Under the Variable Returns to Scale assumption, results from the bootstrapped Tobit regression indicate that there are no merger gains to be had suggesting that full merger with Foreign banks are not advisable. Yet, Learning or Technical Efficiency gains can be attained with Mergers of Foreign

Banks with Medium and Large Private Banks. There was no size (scale) efficiency analysis because there was not a single merger that was below the upper limit of the Tobit regression analysis.

## **4.6 Discussion**

To achieve the general objective, the research needs to answer the research questions. To answer these research questions, seven hypotheses have been put forward. Based on the outputs and analysis presented in the previous section, this section will answer the research hypothesis and the research questions. The first section answers the research hypothesis:

### **H1: Foreign Banks are more efficient than Ethiopian Banks**

Under the CRS assumption, the average Ethiopian Banks Efficiency is 0.84 (84%) while the average foreign banks' efficiency is 0.888 (88.8%) and under the VRS assumption, the average Ethiopian banks' efficiency is 0.9 (90%) while the average Foreign banks' efficiency is 0.963 (96.4%). Therefore, Foreign banks are more efficient than Ethiopian banks which makes sense as foreign banks have been in more competitive markets thereby forcing them to increase their efficiency. This is in line with (Ofori-Sasu, Mensah, Akuma, & Doku, 2019), (Wezel, 2010), (Detragiache, Tressel, & Gupta, 2008)

### **H2: There are potential efficiency gains in M&As**

To answer this research hypothesis five sub-hypotheses have been put forward:

#### **H2a: There are potential overall efficiency gains in M&As**

The majority of the efficiency scores under the CRS assumption 1160 (96.34%) are less than one which shows that there are gains from mergers. Under the VRS assumption, 727 (65.91%) hypothetical DMUs merger efficiency scores are less than one which shows that there are gains from mergers. This is consistent with (Du & Sim, 2016) and (Said, Zouari-Hadiji, & Bouri, 2017).

#### **H2b: There are potential technical efficiency gains in M&As**

Most of the hypothetical DMU's technical efficiency scores are less than one. Therefore, potential technical improvements exist for the merged entities which are in line with (Shi, Li, Emrouznejad, Xie, & Liang, 2017) and (Bogetoft & Wang, 2005).

#### **H2c: There are potential pure merger efficiency gains in M&As**

Under the CRS assumption, pure merger efficiency gains of hypothetical DMUs with a score of one soars to 440 from 44 which shows that pure merger efficiency gains are low and is consistent with (Boetoft & Wang, 2005). Under the VRS assumption, pure merger efficiency gains are very low of

even negative which is consistent with (Shi, Li, Emrouznejad, Xie, & Liang, 2017) and (Bogetoft & Wang, 2005).

#### **H2d: There are potential Scope efficiency gains in M&As**

The harmony efficiency favors mergers as most of the hypothetical mergers' efficiency scores are less than one which is in line with (Shi, Li, Emrouznejad, Xie, & Liang, 2017) and (Bogetoft & Wang, 2005).

#### **H2e: There are no potential Scale efficiency gains in M&As**

The scale efficiency shows mixed effects. Using the VRS assumption, 511 (46.33%) potential mergers scale effect favors mergers. Compared to previous studies, scale effect usually works against mergers (Boetoft & Wang, 2005), (Reda, 2013) and (Wang & Zhang, 2018) but in this research, 46.33% of potential mergers scale effect favors merges. The difference in size between the Ethiopian private banks (small, medium and large) and the state-owned bank and Foreign banks is the reason behind this even when two Ethiopian private banks merge, they will not be as large as the state-owned bank or the foreign banks.

#### **H3: The strategic fit for Small private banks are Foreign banks**

The results contradicted the hypothesis in both assumptions. Under the CRS assumption, the largest gain in efficiency 22.9% is formed in technical efficiency but this doesn't necessitate full merger. The gain from a pure merger is 2.9% which is small as compared to the technical efficiency gain. Both technical efficiency gains and pure merger efficiency gains are formed when Small private banks merge with Large private banks. This suggests that the strategic fit for Small private banks are Large private banks. Under the VRS assumption, there are a 23.6% technical efficiency gain and 2.1% scope efficiency gains from mergers with Large Private banks but there is a 9.3% scale efficiency gain with a merger between Small private banks and an overall 10% Pure merger efficiency gain with mergers between Small Private banks, greater than any other merger. This suggests that the strategic fit for Small private banks are other Small private banks. This is in line with efficiency theory (Leepsa & Mishra, 2016) and economic theory where mergers should form between two businesses with different strengths and weaknesses and (Le T. D., 2015) where potential benefits are gained from scope and scale economies. This is also in line with (Wanke, Maredza, & Gupta, 2017) where the focus should be on merging banks with local origins

#### **H4: The strategic fit for Medium Private banks are Foreign banks**

The results contradicted the hypothesis in both assumptions. Under the CRS assumption, the largest gain in efficiency is 23.6% from technical efficiency gains from mergers with Large private banks but this doesn't necessitate full mergers. The largest gain from pure merger efficiency is 2.2% from a merger with Small private banks which is small as compared to the technical efficiency gain. This suggests that the strategic fit for Medium private banks are Small private banks. Under the VRS assumption, there is a 20.5% technical efficiency gain from mergers with and 1.8% scope efficiency gains from mergers with Large Private banks but there is a 3.9% scale efficiency gain with a merger with Small private banks and an overall 6.3% Pure merger efficiency gain with mergers with Small Private banks, greater than any other mergers. This suggests that the strategic fit for Medium private banks are Small private banks in both assumptions. This is in line with efficiency theory (Leepsa & Mishra, 2016) and economic theory where mergers should form between two businesses with different strengths and weaknesses and (Le T. D., 2015) where potential benefits are gained from scope and scale economies. This is also in line with (Wanke, Maredza, & Gupta, 2017) where the focus should be on merging banks with local origins.

#### **H5: The strategic fit for Large Private banks are Foreign banks**

The results contradicted the hypothesis in both assumptions. Under the CRS assumption, the largest gain in efficiency is 26.6% from technical efficiency gains from mergers with Large private banks but this doesn't necessitate full mergers. The largest gain from pure merger efficiency is 1.4% from a merger with Medium private banks which is small as compared to the technical efficiency gain. This suggests that the strategic fit for Large private banks are Medium private banks. Under the VRS assumption, there is a 23.3% technical efficiency gain from mergers with Large private banks, A 2.4% scope efficiency gains from mergers with Small Private banks but there is a 0.7% scale efficiency gain with a merger with Medium private banks and an overall 2.5% Pure merger efficiency gain with mergers with Small Private banks, greater than any other mergers. This suggests that the strategic fit for Large private banks are Small private banks. This is in line with efficiency theory (Leepsa & Mishra, 2016) and economic theory where mergers should form between two businesses with different strengths and weaknesses and (Le T. D., 2015) where potential benefits are gained from scope and scale economies. This is also in line with (Wanke, Maredza, & Gupta, 2017) where the focus should be on merging banks with local origins.

## **H6: The strategic fit for State-owned bank are Foreign banks**

The results contradicted the hypothesis in both assumptions as per the definition of strategic fit which means gains in economies of scale or gains in economies of scope or both. Under the CRS assumption, the largest gain in efficiency is 10% from technical efficiency gains from mergers with Foreign banks and under the VRS assumption, the largest 1.8% technical efficiency gains from mergers with Large private banks but this doesn't necessitate full mergers. Pure merger efficiency results are all greater than one which means that all mergers will be costly, meaning that there is no strategic fit for state-owned banks. This is against the findings of (Wanke, Barros, Azad, & Constantino, 2016) which claimed efficient M&As emerge when foreign and state-owned banks are merged.

## **H7: The strategic fit for Foreign banks is State-owned bank**

The results contradicted the hypothesis in both assumptions. Under the CRS assumption, the largest gain in efficiency is 12.2% from technical efficiency gains from mergers with Large private banks and under the VRS assumption, the largest 4% technical efficiency gains from mergers with Large private banks but this doesn't necessitate full mergers. Pure merger efficiency results are all greater than one which means that all mergers will be costly, meaning that there is no strategic fit for Foreign banks. This is in line with the findings of (Wanke, Maredza, & Gupta, 2017) greater emphasis should be given to mergers between local banks. This is also in line with (Wang & Zhang, 2018) which state that as the banks become larger it will inhibit the development of firms resulting in inefficiencies. This is against the findings of (Wanke, Barros, Azad, & Constantino, 2016) which claimed efficient M&As emerge when foreign and state-owned banks are merged.

After answering the research hypotheses, the next section answers the research questions:

### **1. What types of efficiency gains are formed with mergers and acquisitions in emerging markets?**

The largest efficiency gains from mergers are technical (learning) efficiency gain. This is obvious when the definition of learning or technical efficiency is taken into account but learning efficiency gains do not necessitate full-scale mergers. If the banks can learn best practices, they can manage to become more efficient which leaves pure merger efficiency, a combination of size or scale efficiency, and harmony or scope efficiency. Here the pure merger efficiency gains are smaller as compared to technical efficiency gains, raising the question are mergers necessary? This question is also asked by other researchers and some have even advised against full-scale mergers (Reda, 2013). But since the

best practices are not easy to discover and adopt, a merger might be necessary, this is in line with the Q-theory in which M&As leads to effective reallocation of resources as the result of being run by better management (Ching, 2018). It is also in line with findings from (Shi, Li, Emrouznejad, Xie, & Liang, 2017) (Said, Zouari-Hadiji, & Bouri, 2017).

## **2. What types of mergers and acquisitions yield strategic fits?**

M&As with Strategic fits are mergers that provide either harmony (scope) efficiency gains and Size (scale) efficiency gains. These efficiency gains are combined to form pure merger efficiency gains. Pure merger efficiency gain has been used to measure if there are strategic fits for mergers. To gauge the strategic fit of mergers hypotheses three to seven have been put forward. Results clearly show that there is a strategic fit when only Ethiopian private banks merge between themselves. This finding is in line with (Wanke, Maredza, & Gupta, 2017) which states that merging banks focusing on their local origin should be given greater emphasis.

When the asset size of the banks increase there are lower gains in pure merger efficiency, which gives support to the (Reda, 2013), (Wang & Zhang, 2018) and (Boetoft & Wang, 2005) that bank size works against mergers. This is further elaborated by (Asongu & Odhiambo, 2019) that beyond a certain threshold there will be diseconomies of scale, this inhibits the development of the bank and will result in inefficiencies.

## **3. Does bank size matter in the strategic fit of mergers and acquisitions?**

Bank size does matter when it comes to gains in pure merger efficiency i.e strategic fit. As shown in the previous section and the hypotheses as the bank size increased, the gain in pure merger efficiency decreased, completely becoming inefficient once a state-owned bank and foreign banks were analyzed. This view is supported by (Asongu & Odhiambo, 2019), (Reda, 2013), (Wang & Zhang, 2018) and (Boetoft & Wang, 2005).

## **4. Does bank ownership structure matter in the strategic fit of mergers and acquisitions?**

There are three types of banks based on ownership in this research, State-owned banks, local private banks, and foreign banks. Based on the research, bank ownership structure does matter in the strategic fit of mergers and acquisitions. The State-owned bank and foreign banks are far larger than local private banks which might be the reason that size scale efficiency gains are found in mergers between

the local private banks. There have also been more scope (harmony) gains from mergers within the local private banks which shows that these banks also have different strengths and weaknesses which make them the right candidate for mergers according to the efficiency gain theory (Leepsa & Mishra, 2016).

It's also has been difficult to capture size or scale efficiency gains from mergers with foreign banks as in line with (Wanke, Maredza, & Gupta, 2017) which means that more emphasis is needed in merging the local private banks.

## **Chapter Five: Conclusion, Recommendation and Future Research Direction**

In this research, Potential gains and strategic fit from M&As in Ethiopian banking were assessed. Input Oriented DEA with both CRS and VRS assumptions were used in the analysis. Three things can be concluded from this research. First, most of the gains in efficiency come from learning or technical efficiency gains which don't necessitate full mergers. Second, only the local private banks (Small, Medium, and Large) banks have pure merger efficiency gains, gains that occur due to full mergers. Third, there are no strategic-fit to start M&A in state-owned and foreign banks. Consequently, focus on future M&As should be between the local private banks as economies of scope and economies of scales are attained from M&As between them. This should also be the focus of the regulatory authority in the National Bank of Ethiopia as the efficiency gain and increase in asset size might make the local commercial banks more competitive before the potential entry of foreign banks.

There are other approaches to select inputs and outputs and environmental factors can also be added to the second stage to analyze the determinants of M&A efficiency gains. Hence, this can be a future research direction. Another future research direction is applying what has been quantitatively found from this research and applying qualitative research to find the reasons why M&As in Ethiopian Banking sector have not been occurring. Another future research direction is to study how differences in organizational identity might affect Mergers and Acquisitions.

## Appendix

### Exchange rate data

Date	ETB/USD
<b>June 30, 2013</b>	0.05317
<b>June 30, 2014</b>	0.05095
<b>June 30, 2015</b>	0.04820
<b>June 30, 2016</b>	0.04567
<b>June 30, 2017</b>	0.04305
<b>June 30, 2018</b>	0.03626

Date	ZAR/USD
<b>December 31, 2013</b>	0.09528
<b>December 31, 2014</b>	0.08661
<b>December 31, 2015</b>	0.06467
<b>December 31, 2016</b>	0.07302
<b>December 31, 2017</b>	0.08106
<b>December 31, 2018</b>	0.06898

Date	KES/USD
<b>December 31, 2013</b>	0.01157
<b>December 31, 2014</b>	0.01104
<b>December 31, 2015</b>	0.009722
<b>December 31, 2016</b>	0.009766
<b>December 31, 2017</b>	0.009692
<b>December 31, 2018</b>	0.009814

Date	EGP/USD
<b>December 31, 2013</b>	0.14391
<b>December 31, 2014</b>	0.13986
<b>December 31, 2015</b>	0.12732
<b>December 31, 2016</b>	0.05517
<b>December 31, 2017</b>	0.05628
<b>December 31, 2018</b>	0.05597

*Table 6.19: Exchange rate data sourced from exchange-rates.org*

## **Left-censored, Right Censored and Uncensored Observations**

### **1. Small CRS**

- For Overall Efficiency from 425 observations, there are 0 left-censored observations, 11 right-censored observations, and 414 uncensored observations
- For Pure Merger Efficiency from 425 observations, there are 0 left-censored observations, 102 right-censored observations, and 323 uncensored observations
- For Learning (technical efficiency), there are 0 left-censored observations, 18 right-censored observations, and 407 uncensored observations.
- For Harmony efficiency, there are 0 left-censored observations, 130 right-censored observations, and 294 uncensored observations.

### **2. Small VRS**

- For overall efficiency, there are 0 left-censored observations, 85 right-censored observations, and 316 uncensored observations
- For Pure merger efficiency, there are 0 left-censored observations, 118 right-censored observations, and 283 uncensored observations
- For learning efficiency, there are 0 left-censored observations, 87 right-censored observations, and 314 uncensored observations
- For Harmony efficiency, there are 0 left-censored observations, 140 right-censored observations, and 261 uncensored observations.

- For Size efficiency, there are 0 left-censored observations, 153 right-censored observations, and 248 uncensored observations.

### **3. Medium CRS**

- For Overall Efficiency, there are 0 left-censored observations, 26 right-censored observations, and 732 uncensored observations
- For Pure merger Efficiency, there are 0 left-censored observations, 285 right-censored observations, and 473 uncensored observations.
- For Learning Efficiency, there are 0 left-censored observations, 38 right-censored observations, and 720 uncensored observations
- For Harmony Efficiency, there are 0 left-censored observations, 285 right-censored observations, and 473 uncensored observations

### **4. Medium VRS**

- For Overall Efficiency, 0 left-censored observations, 215 right-censored observations and 496 uncensored observations
- For Pure Merger Efficiency, 0 left-censored observations, 283 right-censored observations and 428 uncensored observations
- For Learning Efficiency, 0 left-censored observations, 100 right-censored observations, and 611 uncensored observations.
- For Harmony Efficiency, 0 left-censored observations, 270 right-censored observations and 441 uncensored observations
- For Size Efficiency, 0 left-censored observations, 338 right-censored observations, and 373 uncensored observations.

### **5. Large CRS**

- For Overall Efficiency, there are 0 left-censored observations, 0 right-censored observations, and 401 uncensored observations
- For Pure Merger Efficiency, there are 0 left-censored observations, 135 right-censored observations, and 266 uncensored observations
- For Learning Efficiency, there are 0 left-censored observations, 0 right-censored observations and 401 uncensored observations

- For Harmony Efficiency, there are 0 left-censored observations, 135 right-censored observations, and 266 uncensored observations

## **6. Large VRS**

- For Overall Efficiency, there are 0 left-censored observations, 76 right-censored observations, and 300 uncensored observations
- For Pure Merger Efficiency, there are 0 left-censored observations, 167 right-censored observations, and 209 uncensored observations
- For Learning Efficiency, there are 0 left-censored observations, 0 right-censored observations, and 376 uncensored observations
- For Harmony Efficiency, there are 0 left-censored observations, 110 right-censored observations, and 266 uncensored observations
- For Size Efficiency, there are 0 left-censored observations, 204 right-censored observations, and 172 uncensored observations

## **7. State CRS**

- For Overall Efficiency, there are 0 left-censored observations, 16 right-censored observations, and 103 uncensored observations
- For Pure Merger Efficiency, there are 0 left-censored observations, 69 right-censored observations, and 50 uncensored observations
- For Learning Efficiency, there are 0 left-censored observations, 20 right-censored observations, and 99 uncensored observations
- For Harmony Efficiency, there are 0 left-censored observations, 69 right-censored observations, and 50 uncensored observations

## **8. State VRS**

- For Overall Efficiency, there are 0 left-censored observations, 88 right-censored observations, and 25 uncensored observations
- For Pure Merger Efficiency, there are 0 left-censored observations, 101 right-censored observations, and 12 uncensored observations
- For Learning Efficiency, there are 0 left-censored observations, 35 right-censored observations, and 78 uncensored observations

- For Harmony Efficiency, there are 0 left-censored observations, 73 right-censored observations, and 40 uncensored observations.
- For Size Efficiency, there are 0 left-censored observations, 104 right-censored observations, and 9 uncensored observations.

### **9. Foreign CRS**

- For Overall Efficiency, there are 0 left-censored observations, 27 right-censored observations, and 377 uncensored observations
- For Pure Merger Efficiency, there are 0 left-censored observations, 174 right-censored observations, and 230 uncensored observations
- For Learning Efficiency, there are 0 left-censored observations, 36 right-censored observations, and 368 uncensored observations
- For Harmony Efficiency, there are 0 left-censored observations, 174 right-censored observations, and 230 uncensored observations

### **10. Foreign VRS**

- For Overall Efficiency, there are 0 left-censored observations, 248 right-censored observations, and 55 uncensored observations.
- For Pure Merger Efficiency, there are 0 left-censored observations, 278 right-censored observations, and 25 uncensored observations.
- For Learning Efficiency, there are 0 left-censored observations, 83 right-censored observations, and 220 uncensored observations.
- For Harmony Efficiency, there are 0 left-censored observations, 120 right-censored observations, and 183 uncensored observations.

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