DETERMINANTS OF COMMERCIAL BANKS COST EFFICIENCY*:* *EVIDENCE FROM COMMERCIAL BANKS IN ETHIOPIA*

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF JIMMA UNIVERSITY IN PARTIAL FULLFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN ACCOUNTING AND FINANCE

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CERTIFICATE

This is to certify that the thesis entitled "***DETERMINANTS OF COMMERCIAL BANKS COST EFFICIENCY: EVIDENCE FROM COMMERCIAL BANKS IN ETHIOPIA***" submitted to Jimma University, College of Business and Economics for the award of the Degree of Master of Science in Accounting and Finance is a record of genuine research work carried out by Muliye Teklu, under our guidance and supervision. Therefore, we hereby declare that no part of this thesis has been submitted to any other university or institution for the award of any degree or diploma; and all the sources of materials referred in the process have been duly acknowledged.

Principal Advisor's Name	Date	Signature
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DECLARATION

I, the undersigned, hereby declare that, this thesis entitled "***DETERMINANTS OF COMMERCIAL BANKS COST EFFICIENCY: EVIDENCE FROM COMMERCIAL BANKS IN ETHIOPIA***", has been carried out by me under the guidance and supervision of DR. AREGA SEYOUM (Associate Professor) and Mr. ZEWUDE TARIKU (MSc).

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

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abstract

This study attempted to identify the factors which determine commercial banks cost efficiency: evidence from commercial banks of Ethiopia. Thus, the study will help through informing the determinants of commercial bank's cost efficiency which could assist the managers to give attention to these factors in attaining the desired efficiency. From the target population, among the 31 commercial banks thirteen banks were selected as a sample size. To select the sample banks purposive sampling techniques was used. The time coverage of the study was twelve years from 2011 to 2022. This study deployed descriptive and explanatory research design. The study was conducted based on secondary source of data. The data were collected from the National Bank of Ethiopia (NBE) and from the individual commercial banks. The study was adopted descriptive statistics like mean, standard deviation, minimum and maximum to describe variables in the Stochastic Cost Frontier Model. Statistical analyses was carried out using econometric analysis which is Stochastic Cost Frontier Model was used to test the relationships among variables. The result shows that there is a positive insignificant relationship between bank size and cost efficiency. On the other hand, the capital adequacy ratio (CAR), & the real GDP with positive and significant coefficient, shows a positive relationship between these variables and total cost, which contributes to lower the banking efficiency. Thus, banks can improve their cost efficiency by way of improving their ROA, ROE, the method of advances. In addition they have to increase the share of capital by boosting banking investment operation.

Keywords: bank efficiency, determinants of cost efficiency, technical efficiency, allocate efficiency

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ACRONYMS & ABBREVIATIONS

AIB: - Awash International Bank S.C

BOA: -Bank of Abyssinia S.C

CBE: -Commercial bank of Ethiopia

CBO: Cooperative Bank of Oromia

DB: - Dashen Bank S.C

NBE: - National Bank of Ethiopia

NIB: - Nib International Bank S.C

OIB: - Oromia International Bank S.C

UB: - United Bank

WB: - Wegagen Bank

ZB: - Zemen Bank

OB: - Oromia Bank

BIB: - Birhan International Bank

AIB: - Anbessa International Bank

DEA: -Data Envelopment Analysis

ROA: - Return on Asset

ROE: - Return On Equity

CAR: - Capital Adequacy Ratio

IR: - Intermediation Ratio

GDP: - Gross Domestic Product

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CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

In developing countries, the banking sector plays a critical part in fiscal intermediation, in addition to helping the government achieve social pretensions. This necessary link between profitable growth and banking has led to the development of the entire frugality and is linked to the health of the banking sector. Adding technology and competition emphasize the significance of a largely effective banking sector. This underscores the significance of monitoring and assessing the performance of banks, as this can affect their overall effectiveness and accordingly profitability. At the transnational position, performing means in the banking sector are constantly adding, and advanced means affect the price of credit and the interest rate, which in turn affects shareholders, investor stations, creditors, and depositors (Hassan et al., 2022). Fiscal reform has led to colorful policy developments, technological change, advanced situations of deregulation, multitudinous privatizations of fiscal institutions, and the active participation of foreign banks in the fiscal sector (Sáez- Fernández et al, 2015). In addition, some Latin American husbandry has achieved significant profitable development and deeper indigenous integration during these times. All this has increased effectiveness and productivity in the Latin American banking sector, helping banks to reach the most effective product frontier- as assumed in former literature- and has led to adding request attention in the region. On this content, Carvallo(2017) provides a comprehensive analysis of effectiveness in the Latin American banking sector using a panel of banks from 19 countries over the period 1999- 2013; the results show that effectiveness in the region has bettered, especially in terms of cost effectiveness.

After the banking sector crushed the extremity COVID-19, its stability was tested again with the outbreak of the war in Ukraine. So far, the banks have fared well. In direct terms, the impact of the war appears to have been manageable, indeed for those banks with large direct exposures to Russia. Laterally, the macroeconomic shock touched off by the war, which is still ongoing, has not yet had a perceptible impact on banks' balance wastes. Overall, capital and liquidity rates declined slightly between end- 2021 and the alternate quarter of 2022. Still, they were still robust and in

both cases above pre-pandemic situations and near their literal highs. Over the same period, the overall nonperforming loan rate at banks supervised by ECB fell further to an each- time low of1.9. Bank profitability, as measured by return on equity, was formerly rebounding as profitable exertion originally recovered in the final stages of the epidemic. It was further supported by the positive impact on net interest perimeters associated with the turn in the interest rate cycle. As a result, utmost banks have posted gains above request prospects in recent diggings. Overall, the return on equity of banks supervised by ECB increased to7.6 in the alternate quarter of 2022, reaching the loftiest position since the functional launch of ECB banking supervision (ECB, 2022).

The banking system is veritably important to the ultramodern frugality. As fiscal interposers, banks pool saviors ' finances and distribute them to implicit investors, allocate coffers, and give liquidity and payment services. Considering this important part, it's veritably important to develop a sound banking system in which banks operate with good performance. To measure the performance of the banking sector, two types of measures are frequently used, videlicet rates and effectiveness measures (Suzuki & Sastrosuwito, 2012).

Effectiveness measures for the banking system lead to further invention, bettered profitability, and lesser safety and soundness when productivity advancements are conducted into strengthening capital buffers that absorb threat. In recent times, still, the banking sector has come under competitive pressure encyclopedically as the global fiscal structure has changed fleetly due to the deregulation of fiscal services and the adding use of information technology. Bank effectiveness and its impact on profitability have been studied from two perspectives counting and economics (Olson and Zoubi, 2011; Blatter &Fuster, 2022).

With respect to Ethiopian marketable banks, Muluneh (2006) examined the cost effeciency of six private banks through stochastic frontier analysis using daily data for the period 1994- 2001. Also, Eskindir (2013) applied the stochastic frontier approach to examine the cost efficiency of 10 marketable banks over the period 2007- 2012 and determine whether power has an impact on bank cost effectiveness. Tesfaye (2016) examined the determinants of commercial Banks efficiency in Ethiopia over the period 2003–2012 using Tobit model. The study results indicated that deposit liquidity is found to have positive and significant effect on bank efficiency, while bank size has negative and significant effect on bank efficiency. Although the data envelopment analysis (DEA) efficiency approaches is one of the popular approaches to measure banking efficiency (Boubaker et al, 2022).

Therefore, this study was conducted with the objective of examining determinants of cost efficiency of commercial banks as well as the factors that are associated with cost efficiency of commercial banks using stochastic frontier approach (SFA) to analyze the relative cost efficiency of commercial banks in Ethiopia based on an intermediation approach. The study used recent data from published and audited annual financial reports of commercial banks in Ethiopia during the period of 2011-2022 G.C.

1.2. Statement of the Problem

The relative cost efficiency of the median euro area bank fluctuated between 82% and 83% over the period from 2006 to 2015. These findings suggest that if the median bank operated on the efficiency frontier, it could produce the same level of output at only 82% to 83% of its current costs (Ivan Huljak, 2018).

Cost-inefficient banks may tend to have loan performance problems for a number of reasons. For example, banks with poor senior management may have problems in monitoring both their costs and their loan customers, with the losses of capital generated by both these phenomena potentially leading to failure. Alternatively, loan quality problems may be caused by events exogenous to the bank, such as regional economic downturns, in which case extra expenses associated with the nonperforming loans (e.g., monitoring, negotiating workout arrangements, seizing and disposing of collateral diverted senior managerial focus) can create the appearance, if not the reality, of low cost efficiency (ECB, 2022).

Despite its astonishing progress and significant contributions of the banks to the economy, the banking sector in Ethiopia is still performing below the economic need (Mekonnen, 2015). According to Keatinge (2014), the performance of the banking industry is less than its regional peers and the proportion of the population that has a deposit account is less than eight per cent (8%). As to Keatinge (2014), comparing the level of access to financial services in a neighboring country such as Kenya, it can be deduced that there was considerable room for expansion for these service in Ethiopia. Edward (2014) also indicated that the banking penetration in Ethiopia remained low when compared with the Kenyan economy. Nonetheless, it is a challenging job to expand the sector to the level of the economic need given limited resources. Thus, efficient allocation of the existing resources is advisable. The survey of the literature has pointed to a wide set of environmental variables that influence banking efficiency such as ownership of capital (Lin, 2009), origin of investors (Havrylchyk, 2006), banking regulations (Barth et al., 2013), size (Bonin

et al., 2005) or ownership structure (Becket al, 2013). From a geographical point of view, some studies have examined banking performance on a global scale (Bhimjee et al., 2016), while others have focused on emerging economies (Huang and Fu, 2013), transition economies (Yildirim, 2007), developed economies (Berger, 2007) or other particular economic areas.

Commercial banks accumulate deposits from savers and use the proceeds to provide credit to firms, individuals, and government agencies. Thus, they serve investors who wish to invest funds in the form of deposits. Commercial banks use the deposited funds to provide commercial loans to firms and personal loans to individuals and to purchase debt securities issued by firms or government agencies. Efficiency is a key concept for financial institutions. Efficiency is measured with respect to an organization's objective; it can be measured with respect to maximization of output, maximization of profits, or minimization of costs (Mester, 2003). According Berger et al. (1993) as cited in (Abdelkader Chachi, 2006), in case of financial institutions efficiency relates with growth in profitability, greater amounts of funds intermediated, better prices and service quality for consumers, and greater safety.

The approaches to bank efficiency analysis can be divided into two categories: parameter approach and non-parameter approach. Parametric approach has the virtue of allowing for noise in the measurement of inefficiency. This method requires assumptions about the particular form of the cost or profit function being estimated and the distribution of efficiency. Nevertheless, non-parametric linear programming approach requires no such specification of the functional form (Abdelkader Chachi, 2006). From the nonparametric approach, Data Envelopment Analysis (DEA) is widely used for measuring efficiency of banking (Charnes et al., 1978; Ray, 2011). DEA is a mathematical programming, which is introduced by Charnes, Cooper and Rhodes (CCR) in 1978 and they proposed a model of constant returns to scale (CRS). Later studies have considered alternative sets of assumptions and variable returns to scale (VRS) was introduced by Banker, Charnes and Cooper (1984).

The current Ethiopian economic policy liberalizes the investment scheme of commercial banks to domestic investors; as a result, many investors have been involved in the banking sector. Results revealed that banks had better profitability business organizations in Ethiopia (Kiyota et. al, 2007). Consequently, the number of commercial banks in the country is increasing from time to time. Thus, the intensity of competition among the commercial banks in Ethiopia has increased tremendously.

Investigating determinants of efficiency of the banking sector is essential for further improvement especially under the dominance of the globalization of the banking system. The efficiency performance study is essential due to the following reasons. Foremost reason, banks play an important role as financial intermediaries, (money transfer, foreign exchange, pooling deposits and lend to different client, facilitate the international trades etc.). Due to this reason, the banks efficiency indirectly affects the whole country's economy. Second, contribute empirical investigations on the determinants of Ethiopian commercial banks efficiency. In addition to this, the profitability of the banks attracted to potential investors but competition is still tough and therefore, only the efficient ones could keep on enjoying the benefits.

Despite the efforts made to examine the determinants of banks efficiency in different parts of the world studies regarding the commercial banks in Ethiopia is scanty. The study conducted by Tesfay (2016) fails to incorporate many relevant variables like level of capitalization, ownership structure and market concentration in efficiency/inefficiency model. On the other hand, the current study emphasized on the GTP II period and thus different from that of Tesfay (2016). Moreover, the government of Ethiopia is implementing the second GTP II and banks are supposed to play a vital role for the achievement of this plan. Thus, evaluating the determinants of the technical efficiency of commercial banks over the GTP II period and indicating solutions to improve efficiency is crucial to improve their role for the GTP III. Thus, using DEA and Tobit model, this study tried to examine the determinants of efficiency of commercial banks in Ethiopia over the period 2011 to 2022.

A cost function is used to estimate banks' relative ability to convert inputs into outputs while minimizing costs. The most efficient bank is the one that incurs the lowest cost to generate a given amount of output at predetermined input prices. An advantage of this technique is that the resulting measure of cost efficiency controls for the fact that banks produce different outputs (loans and investments) and pay different prices for inputs (financial capital, labor and fixed assets), thereby allowing a better comparison across banks of different size, ownership structure, specialization, etc. The bank on the frontier represents best practice in the banking sector and the remaining banks are measured against this benchmark. Importantly, the technique distinguishes persistent inefficiency from time-varying inefficiency (Cheng S, 2016).

However, most of the above previous studies limited their investigation only for cost efficiency and neglect the causes of cost efficiency; they cover a short period of time and compare efficiency

of banks based on their ownership. Thus, this study attempts to find out the determinants of commercial banking cost efficiency and fill the gap in the existing literature and by covering a longer time period. Therefore, this study was conducted through covering the last 12 years financial data obtained from the National Bank of Ethiopia (NBE). Therefore, this study is expected to fill the time, scope, conceptual & methodological gaps from the previous studies.

1.3. Basic research questions

This study was tried to find answer for the following basic research questions;

- Does CAR have a relationship with the cost efficiency of commercial banks in Ethiopia?
- Does IR have a relationship with the cost efficiency of commercial banks in Ethiopia?
- Does real GDP have a relationship with the cost efficiency of commercial banks in Ethiopia?
- Does ROA have a relationship with the cost efficiency of commercial banks in Ethiopia?
- Does loan quality have a relationship with the cost efficiency of commercial banks in Ethiopia?
- Does credit risk have a relationship with the cost efficiency of commercial banks in Ethiopia?

1.4. Objective of the study

1.4.1. General objective

The general objective of the study is to examine the determinants of commercial bank cost efficiency, in case of selected commercial banks of Ethiopia.

1.4.2. Specific objectives

- To identify the effect of CAR on the cost efficiency of commercial banks in Ethiopia
- To examine the effect of IR on the cost efficiency of commercial banks in Ethiopia
- To investigate the effect of real GDP on the cost efficiency of commercial banks in Ethiopia
- To determine the effect of ROA on the cost efficiency of commercial banks in Ethiopia
- To examine the effect of loan quality on the cost efficiency of commercial banks in Ethiopia
- To examine the effect of credit risk on the cost efficiency of commercial banks in Ethiopia

1.5. Significance of the study

One of the major reasons that forces banks to fail is inefficient knowledge about the determinants and their effect on the efficiency of commercial banks. The failure of a bank was adversely affect the country's economy widely. Thus, the study was help through informing the determinants of commercial bank's efficiency which could assist the managers to give attention to these factors in attaining the desired efficiency. This study was used as a reference for managers of commercial private banks, academic staff and regulatory bodies in order to give a theoretical insight and policy recommendation. It also gives a motivation to other researchers to conduct a research on the same and/or related topics.

1.6. Scope of the study

There are 31 commercial banks which presently operate in Ethiopia. From these thirty one commercial banks, 29 banks are privately owned and the other is government owned. This study selected 13 banks, Commercial bank of Ethiopia, Awash bank, Bank of Abyssinia, Dashen bank, Nib International bank, Oromia bank, Zemen bank, Bunna International Bank, Cooperative Bank of Oromia, United bank, Anbessa International bank, Birhan bank, and Wegagen bank for the research purpose. The time coverage of the study was twelve years from 2011 to 2022.

1.7. Limitation of the Study

There are different types of efficiency measures that can be used to identify the performance of commercial banks including cost efficiency, revenue efficiency, scale efficiency, profit efficiency, technical efficiency, and allocative efficiency. However, this study focuses only on the cost efficiency and factors affecting it because of time and financial problem. The study also does not include all commercial banks as a result of lack of data and shorter period of joining the banking industry.

1.8. Organization of the study

The study was organized in to five chapters. Chapter-one presented the introductory part of the study that comprises, among others, the background of the study, statement of the problem along with the objectives and hypothesis of the proposed study, significance, scope, organization & Limitation of the study. Chapter-two would deal with the review of the existent literature related to the topic of inquiry; whereas chapter-three would give detail account of the design and methodological aspects that was employed. The analysis of the study data, presentation of the results and corresponding discussions was comprised under chapter-four. Chapter-five was culminates the thesis by providing brief conclusions and relevant suggestions on the basis of the findings of the study.

CHAPTER TWO

2. LITERATURE REVIEW

2.1.Theoretical literature review

As observed by Varadi et al, (2006), public sector banks (PSB) have shown higher efficiency according to income, asset and finance management, and productivity compared to private sector banks. However, foreign banks during the research period have shown more efficiency than private banks. The major benefits in improving efficiency have been taken by public sector units (PSU) from the government reforms and policies. As per the research conducted by Joshi and Bhalerao (2011), both public and private banks in India are equally efficient but the private sector is marginally on the better side compared to public sector banks. Some of the private banks have low efficiency, but in the last few years, they made remarkable improvements in their efficiency leading to higher productivity and profitability.

The nationalized bank OTE (Overall Technical Efficiency) reported a considerable decline, and the identified prime reason for inefficiency was an inappropriate allocation size. However, the allocation of bank resources was the prime concern for all kinds of banks operating in the bank in the research period. In the last decade, the Indian banking system has shown enormous transformation through its performance and financial perseverance that led to steady growth. The research study reveals that government policies, geographic locations, illiteracy, and technological talent have a tremendous impact on the overall efficiency of the banking system (Phanse et al., 2018).

Sangeetha(2020) observed in her research study that in the last decade, public sector banks have performed very hard to utilize their complete resources. Public sector banks are under the control of the government and preferred by Indian citizens for business operations. They allow better predictability to maintain higher efficiency. In his research study, Maity(2020) stated that the banking sector plays a crucial role in the economic growth of the country. In his research, he concluded that private sector banks are more efficient than public sector banks in profitability because of different levels of resource utilization by banks. The major identified reason for the variation is the operational scale, inappropriate use of IRS, and resource miss-utilization.

As concluded by Maity & Sahu(2021), the prime reason for low efficiency in the case of public sector banks is the scale rather than managerial failure due to high presence in rural areas compared to other sector banks in the market. They further added that there is a requirement of better resource utilization and growth at scale level followed by technological reformation.

According to Ataullah and Le (2006), the presence of foreign banks in India does not have any impact on the efficiency of the other banks in the market. However, the growing competition between banks in the market has a direct impact on the bank efficiency that directly affects the bank profitability. As concluded by Kalluru and Bhat (2008) in his research the Indian banking profit is not affected only through their efficiency but through external factors such as political disturbance, the trend of industry, and microeconomic factors. It can be concluded that the efficiency of the bank to a great extent is affected by external factors such as political presence. Singh and Kaur (2016), comparing private and public sector bank efficiency, concluded that PSB is not capable enough to achieve full efficiency while private banks easily achieved 100% efficiency in all the ten years of research. He concluded that the service cost, customer benefits, and overall satisfaction are the key to attaining 100% efficiency.

2.1.1. Concept of Efficiency

Efficiency is a relative term which shows the ratio of achieved results to the means used. It is the ability of individuals or organizations effort to produce the desired result with minimum use of efforts and expenses. Therefore, in most of the situations, efficiency is a relative concept and must involve comparisons. It is the way of producing maximum value of output with a given value of inputs; or equivalently, by using minimum value of inputs to produce a given value of output (Bhat, 2001). According to Cooper (2004) a firm is said to be efficient on the basis of available evidence if and only if the performance of other firms do not show improvement in inputs or outputs without worsening some of its other inputs or outputs.

According to Chen (2001) efficiency can be classified as scale efficiency, scope efficiency, technical efficiency, and allocative efficiency. A bank has the scale efficiency when it operates in the range of constant returns to scale. Scope efficiency occurs when a bank operates in different diversified locations. When a bank maximizes output from the given level of inputs technical efficiency occurs and when a bank chooses maximizing revenue, allocative efficiency occurs.

Erkoc (2013) define efficiency as the ability of firms to produce output using a given level of inputs with minimum cost. This definition indicates that banks should allocate inputs and outputs properly with the aim of obtaining maximum result with minimum cost.

"Efficiency represents the degree of success in which producers achieve in allocating the available inputs and outputs they produce in order to achieve their goals" (Kumbhakar and Lovell, 2000). Hoyo et al. (2004) define efficiency as the relationship between what an organizations produces and what it could be feasibly produced under the assumption of full utilization of the available resources. Hughes and Mester (2001) define efficiency as the microeconomic concept which indicates the minimum inputs required to produce any given level of output. It is the measure of the difference between the desired performance and actual performance of firms. Generally, the above definitions relate the concept of efficiency as the relationship between inputs and outputs.

2.1.1.1.*Efficiency Concepts in Banking*

When measuring efficiency of financial institutions, a fundamental decision to be made is which efficiency concept to use. There are three most important economic efficiency concepts currently being used namely cost, profit and alternative profit efficiency. These are well documented by Berger & Mester (1997). The choice on the appropriate concept to use is informed by the problem being addressed.

2.1.2. Cost Efficiency

A concept which can be used to measure financial institutions€ efficiency is a fundamental question to be addressed. With regards to banks, cost efficiency is the most commonly used concept in the literature of efficiency. The concept has the economic foundation for analyzing the efficiency of financial institutions because it is based on economic optimization in relation to market prices and competition, rather than being based solely on the use of technology (Berger and Mester, 2008).

The concept of cost efficiency is rooted in the neoclassical microeconomic theory, which focuses on resource allocation and utilization. It advocates non-wastage of resources by emphasizing cost reduction while producing the maximum possible level of output for a given technology and available inputs. Thus, a firm that is economically efficient may possess competitive advantage

over other rival firms€ which produces less efficiently in the same industry. The main driving force behind cost efficiency is value creation.

Accordingly, in the process of transforming inputs into some output value, a change that increases value is an efficient change and one that decreases value is an inefficient change (Musonda, 2008).

Berger and Mester (2008) argue that while dealing with banking efficiency analyses, regulators, customers, managers, and stakeholders are concerned about the relative efficiency of banks. From the regulators perspective, inefficient banks are riskier and have a higher likelihood of failure. In addition, the efficiency of banks is directly linked to the productivity of the economy. Without a sound functioning of banking system, the economy cannot function well and efficiently. When banking system fails, the whole of a nation's payment system is in trouble. From the point of view of customers, only efficient banks can offer better services at reasonable prices. The stakeholders view is that only efficient banks can produce reasonable returns. The perspective of bank managers is that in a dynamic and competitive market environment, only efficient banks will survive and maintain their market share, and inefficient ones will exit from the market. The efficient banks are better able to compete because of their lower operational costs and can take away business from less efficient banks. In developing countries like Ethiopia, where propensity to consume is high and as a result savings of the people are low, banks play a significant role in attracting more deposits from the people and then distribute these saving as loans for various sectors of the economy (Rangarajan, 1997).

2.1.3. Types of efficiency of banks

I. Cost efficiency

Cost Efficiency denotes comparing a bank's cost to the firm's best practices for producing the same output in the same conditions. A bank is cost-efficient if it utilizes given input at the lowest cost and produces the maximum output in a shorter period under the same conditions. According to (Sardar, et.al, 2013), cost-efficiency refers to a minimum cost and maximum output production with limited resources. Cost Efficiency is divided into Allocative Efficiency and Technical Efficiency.

II. Allocative efficiency

The Allocative Efficiency denotes the use of the best level of input. According to Qayyum A., & Khan S. (2010) Allocative Efficiency refers to the choice of optimal input proportion at the given input prices. While according to Burki A. A., & Ahmad S. (2011) the Allocative Efficiency Change (AEC) becomes important mostly when some governance changes and state control moderates the de-regulation process. Othman F. M., et.al. (2016) claimed that Allocative Efficiency measures the optimal mix of inputs to increase Efficiency and production or services, such as introducing Automatic Teller Machines (ATM) by banks and internet banking for capital-labor tradeoffs.

III. Technical efficiency

Technical Efficiency refers to the maximum output production with limited time and resources. The concept of Technical Efficiency, introduced by Koopmans, T. C. (1951) is commonly used to assess organizations. Technical Efficiency is helpful when multiple inputs and outputs are considered. Technical Efficiency is also closely related to managerial efforts. According to the production theory, Technical Efficiency is the assessment of the resources (inputs) vector used to obtain the vector of outputs. Hayat S. J. (2011) Claimed that Technical Efficiency indicates a good deal about the quality of managerial decisions. Othman F. M., et.al. (2016) stated that Technical Efficiency is also known as Global Efficiency. They claimed that Technical Efficiency measures the ability of banks to produce actual outputs with fewer inputs or resources used by indicating higher Efficiency. Rogova, E. & Blinova, A. (2018) Focused on Technical Efficiency analysis and reported that it could indicate the quality of the management in the Russian market.

Scale efficiency Farrell, M.J. (1957) stated that production at a maximum level by utilizing the best maximum input level refers to Scale Efficiency. The overall technical efficiency ratio to pure Efficiency refers to scale efficiency (Khan F. U., &Khattak B. K., 2016). In recent times, Othman F. M., et al. (2016) have defined Scale Efficiency as "the optimal activity volume level" whereby inefficiency may arise if goods or services are produced above or below the optimal level, resulting in added fixed cost.

Price efficiency efficient banks can offer better services at reasonable prices in the view of customers. At the same time, other stakeholders think that only efficient banks can ensure consistent returns. Moreover, only efficient banks can survive and maintain their market share, while in managers' view, inefficient banks would ultimately be eliminated in changing and completive market conditions (Khan F. U., &Khattak B. K., 2016).

2.2. Empirical literatures review

2.2.1. Studies Made Outside Ethiopia

The evaluation of Cost Efficiency of banks came in vogue amongst researchers in early 2000s. Isik and Hassan (2002) estimated Cost Efficiency of Turkish Banks for a period 1988–1996. The study found that the Cost Efficiency of Turkish Banking Sector decreased from 78% in 1988, to 71% in 1992 and to 68% in 1996. The dominant source of Cost Inefficiency was Technical Inefficiency which emerged because the Turkish banks did not operate at a correct scale. The study also evaluated the trends in Return to Scale. The results of Return to Scale showed that majority of Turkish Banks were facing diseconomies of scale as 47% of banks in 1988, 48% of banks in 1992 and 53% of banks in 1996 were operating at Decreasing Return to Scale (DRS).

Niazi (2003) calculated Cost Efficiency of Pakistan Commercial Banks from 1991-2000. The study revealed that Cost Efficiency varied from 46.6% to 97.4% for all banks during the entire study period. The Cost Efficiency score of Foreign Banks, Private Banks and State-Owned Banks was 79.7%, 75.1% and 60.5% respectively suggesting that Foreign Banks were the most Cost Efficient Banks. Allocative Inefficiency was the main reason of Cost Inefficiency. The results of Return to Scale depicted that majority of Pakistani Banks were functioning on the correct scale i.e. Constant Return to Scale (CRS).

Weill (2004) measured the Cost Efficiency of banks belonging to five European countries namely France, Germany, Italy, Spain and Switzerland for the period 1992-1998. The results of Bank Specialization showed that Co-operative Banks were most efficient followed by the Commercial and then Savings Banks. Girardoneet al. (2004) examined Italian banks' Cost Efficiency for the years 1993 to 1996. The study reported that Credit Co-operative Banks had the highest Cost Efficiency followed by Popular, Savings and Commercial Banks.

Burki and Niazi (2006) compared Cost Efficiency of Domestic and Foreign Banks of Pakistan for the period 1991 to 2000. The study found that the Cost Efficiency of all Pakistan Banks was 74.5%. Foreign Banks were much better as compared to Domestic Banks in the first reform period, but in the second-reform period, the Cost Efficiency of Foreign Banks chopped down. The results of Return to Scale showed that 43.7% of all CommercialBanks operating in Pakistan were operating on Constant Return to Scale (CRS).

Chatterjee and Sinha (2006) evaluated the Cost Efficiency of 20 Public Sector Banks and 10 Private Sector Banks in India from 1996-97 to 2002-03. The results of the study depicted that overall Indian Scheduled Commercial Banks had Cost Efficiency of 0.713 in 1996-97 which declined significantly to 0.662 in 2002-03. Private Sector Banks had higher Cost, Technical, Allocative and Scale Efficiency as compared to Public Sector

Banks. Sahooet al. (2007) examined the Cost Efficiency of 81 Indian Commercial Banks across ownership for the period 1997-98 to 2004-05. The study revealed that there were significant differences in the Cost Efficiency scores among Nationalized and Private Banks, Nationalized and Foreign Banks, Private Banks and Foreign Banks.

Ioanniset al. (2008) analyzed Allocative, Technical and Cost Efficiency of all banks operating in Greek Banking System from 1994 to 2006. The results revealed that average efficiency of Greek Banking System showed enhancement over time as it augmented from 0.74 in 1994 to 0.82 in 2006. Kalluru and Bhat (2009) examined the Cost Efficiency of Indian Commercial Banks for the period 1992- 2006. The results of the study showed that the Cost Efficiency of all Indian Commercial Banks had decreased for the time period of the study. The ownership-wise results showed that Foreign Sector Banks were relatively more Cost Efficient followed by Private and Public Sector Banks in India.

Brack and Jimborean (2009) compared the Cost Efficiency of European and American Banks over the period 1994-2006. The study found an enhancement in the Cost Efficiency scores for banks working in France and Spain while a decline for banks in Germany, Italy, United Kingdom and United States. Staubet al. (2010) investigated the Cost, Technical and Allocative Efficiency of Brazilian Banks for the period 2000-2007. The study found that the average Cost, Allocative and Technical Efficiency (inefficiency) was 44.7% (55.3%), 66.9% (51.40%) and 63.3% (57.98%) respectively. The results of the study depicted thatthe main source of Cost Inefficiency was Technical Inefficiency till 2002, but Allocative Inefficiency became the major cause thereafter. Public Banks were the most efficient followed by Private Domestic Banks and there was relatively higher inefficiency among Foreign Banks.

Kumar and Gulati (2010) analysed the Cost Efficiency of 27 Indian Public Sector Banks (PSBs) from 1992-93 to 2007-08. The study reported that on average PSBs had Cost, Technical and Allocative Efficiency Score of 0.796, 0.844 and 0.944 respectively. The study also reported that

the Cost Efficiency of PSBs improved significantly in the second phase of reforms as compared to first phase of reforms. Kaur and Kaur (2010) examined the impact of merger on the Cost Efficiency of selected merged banks over the period 1990-91 to 2007-08. The results showed that the impact of merger on efficiency depicted that 6 out of 11 banks had positive impact of merger as these banks showed better efficiency after merger.

Gulati (2011) checked the impact of inclusion of non-interest income in the banks' output on the Cost Efficiency of Indian Banks from 1992-93 to 2007-08. The results of the study highlighted that dropping noninterest income understated true efficiency of the banks. Foreign Banks always ranked at top position in Model A, which included non-interest income but, according to Model B which dropped non-interest income, Public Sector Banks were more efficient than their counterparts. Private Sector Banks were consistently least Cost Efficient in both the sub periods according to Model A. Cost Inefficiency among Indian Scheduled Commercial Banks was due to Allocative Inefficiency. Further, Technical Inefficiency was due to Pure Technical Inefficiency. Most of Indian Scheduled Commercial Banks experienced Increasing Return to Scale (IRS).

Uddin and Suzuki (2011) studied the performance of Commercial Banks in Bangladesh after the execution of financial reforms from 2001- 2008. The study observed that overall the average of Cost and Income Efficiency score was 0.793 and 0.449 respectively. Abu-Alkheil (2012) used DEA-approach to calculate Cost Efficiency (CE), Allocative Efficiency (AE), Technical Efficiency (TE), Pure Technical Efficiency (PTE), and Scale Efficiency (SE) of Islamic and Conventional Banks over the period 2008-2009 operating in European countries i.e. UK and Switzerland. The results showed that the average Cost Efficiency (CE) of Conventional Banks was 69.7% which was better than that of Islamic Banks which had the efficiency score of 49.3%. The results of Return to Scale reported that most of the Conventional Banks were operating on the Decreasing Return to Scale (DRS) while Islamic Banks were operating on either Constant or Increasing Return to Scale.

Kumar (2013) analyzed the Cost Efficiency of Indian Public Sector Banks (PSBs) during 1992-1993 to 2007-2008. The results of the study showed that the average Cost Efficiency (inefficiency) of Indian Public Sector Banks was 79.6% (25.6%). The average Cost Inefficiency for Public Sector Banks was primarily due to Technical Inefficiency. Raina and Sharma (2013) examined the Cost Efficiency (CE) of 64 Indian Commercial Banks for the period 2005-06 to 2010-11. The results found that the average CE was 72.4%, Technical Efficiency (TE) 94.5% and Allocative Efficiency

(AE) 76.7%. The results highlighted that TE was consistently higher than AE which suggested that Allocative Inefficiency was the main reason for Cost inefficiency.

Review of Literature suggests that Cost efficiency evaluation has gained prime significance across the globe especially since past two decades amongst researchers. A lot of empirical work has been undertaken in several countries to assess the cost efficiency performance of banking industry. With specific reference to India only handful of studies are available that evaluated the cost efficiency performance of the banks. Majority of these studies as Chatterjee and Sinha (2006), Sahooet al. (2007), Kalluru and Bhat (2009), Kumar and Gulati (2010), Kaur and Kaur (2010), Gulati (2011) and Kumar (2013) cater to cost efficiency evaluation of an old period of time having diluted significance in the current years. A very critical time period of recession aftermath has not been considered by these studies. Raina and Sharma (2013) evaluated the Cost Efficiency during 2005-06 to 2010-11 and cover the recession time period but an evaluation over just 5 years seems to be less comprehensive.

2.2.2. Studies Made in Ethiopia

Tesfay (2016) examined the determinants of commercial Banks efficiency in Ethiopia over the period 2003–2012 using Tobit model. The study results revealed that deposit liquidity is found to have positive and significant effect on bank efficiency, while bank size has negative and significant effect on bank efficiency. The remaining covariates which include Profitability, loan quality, expenses, bank size and diversification did not have significant effect on bank efficiency.

A study conducted on Determinants of banks' cost efficiency: a case study of selected commercial banks, Ethiopia. Furthermore, five banks specific and one macroeconomic variable are included to examine their effect on cost efficiency. So as to examine the effect of determinant variables which are associated with banks efficiency, a single stage maximum likelihood estimation method is applied to stochastic frontier cost function. The empirical estimations were accomplished by Appling a single stage maximum likelihood function assimilated into Stata software. The estimation is based on conditional mean model concepts. The finding shows that from bank specific factors, return on assets (ROA), and intermediation ratio have positive and significant for intermediation (IR) and insignificant for ROA with cost inefficiency. On the other hand, Bank size (lnTA), Credit risk (CR) and capital adequacy ratio (CAR) have a significant negative coefficient with cost inefficiency. GDP also has negative but insignificant with inefficiency. Therefore, banks

are recommended to improve and sustain their efficiency by maintaining available proportion of capital adequacy ratio and attract high value, low interest-bearing demand deposits (Ereta, B. et. Al., 2020).

A breakthrough in such front was the study of Rao and Lakew (2012) who examined the cost efficiency and ownership structure of commercial banks in Ethiopia using data envelopment analysis (DEA) and Tobit models. The study found that the average cost efficiency of state-owned commercial banks over the period 2000-2009 is 0.69 while that of the private commercial banks is 0.74. The aggregate cost efficiency of Ethiopian commercial banks is found to be 0.73. In addition, the study found little statistical evidence to conclude that the state-owned commercial banks are less cost efficient than the private commercial banks. Thus, ownership structure has no significant influence on the cost efficiency of commercial banks in Ethiopia. Similarly, Lelissa (2014) explored the efficiency level of Ethiopian Banks for the period 2008-2012 using the DEA model and finds a notable variation among banks in terms of level of efficiency.

1.9. Summary and Research Gaps

Commercial banks collect deposits from depositors and use the proceeds to provide credit to businesses, individuals, as well as government agencies. Hence, they support investors who demand to invest their surplus funds in the form of deposits. Commercial banks use the deposited moneys to bid commercial loans to businesses and personal loans to individuals. Correspondingly, commercial banks make invest in debt securities issued by firms as well as government agencies. As banks are financial intermediaries, they should have to do in economically or efficiently so as to facilitate economic development of a country through of transfer of economic resources Efficiency is a crucial notion for financial institutions, and it is measured in respect to an organization's objective and goals. It can be measured regarding maximization of output, maximization of profits, or minimization of costs (Mester & Allen, 2003). The efficiency of commercial banks is usually measured in terms of minimization of inputs to produce a specific level of outputs or in terms of maximization of outputs given a specific level of inputs (Wang, 2008).

Banks are the primary sources of external funds for businesses throughout the world. So the data suggests that banks have the most important role in financing business activities in both industrialized and under developing countries. Although banks are even more important in developed countries, they play the more important role in the financial system of under industrialized countries (Frederic, 2004). Therefore, commercial banks are the primary financial intermediaries in Ethiopia as Ethiopia is one of the developing sub-Sahara African countries. They constitute a significant part of the financial sector.

According to (Beck, 2006), global financial background has been changing rapidly in the last two decades as a result of regulatory changes and technological development. Therefore, in a dynamic and reasonable banking system, only strong, technically efficient and profitable banks can promise a realistic return to their stakeholders and reduce the probability of bankruptcy (Adusei, 2016).

There are numerous studies which considered the determinants of the banking sector by using both parametric and non-parametric approaches in different parts of the world. For example, Tecles & Tabak (2010) studied the determinants of bank efficiency in Brazil by using stochastic frontier analysis. Fries & Taci (2005), studied the efficiency of banks across 15 East European countries

2.4. Conceptual Framework

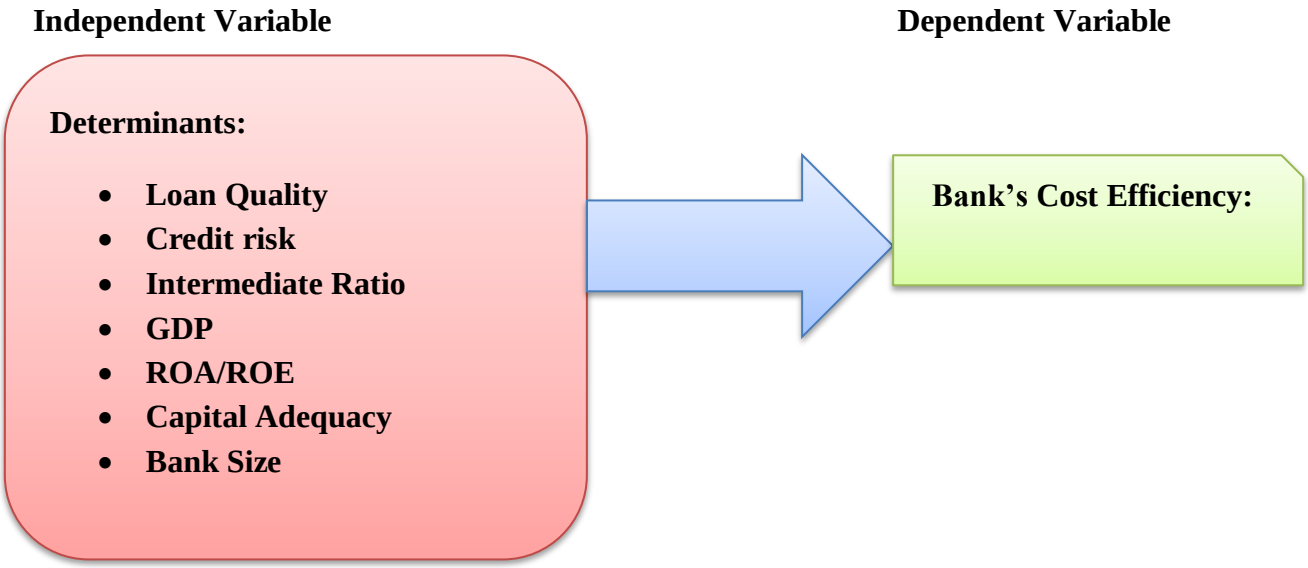

Figure 1 **Conceptual framework of the study(Adopted from; Hussein (2003))**

CHAPTER THREE

3. RESEARCH DESIGN AND METHODOLOGY

In this study the research design and methodology section was discussed about the research design, target population, data source & data collection, method of data analysis and data analysis tools, Operationalization of the research topic and indicates the model specify for the purpose of this study.

3.1. **Research design**

This study deployed both descriptive and explanatory research design. Based on the purpose of this research, among other research designs the researcher believed descriptive and explanatory survey design are the most suitable to address the objectives of the study and to answer its questions.

The main intention of this study was to find out the determinants of commercial banks efficiency and to examine the relationship between determinants and the banks cost efficiency. Therefore, the study was used explanatory research design to indicate the identified relationship.

3.2. **Study Approach**

Furthermore, the researcher examined the quantitative data collected from annual reports of the study's population to get sufficient empirical evidences. Thus, this study was used quantitative study approach.

3.3. Target population

Currently there are thirty one commercial banks operating in Ethiopian banking industry in which twenty nine are privately owned banks and the other two are government owned banks. The target population of this study was 31 commercial banks which are include the newly started commercial banks. As a result the researcher was considered all private commercial banks in Ethiopia that have operated in the industry between 2011 to 2022 G.C to identify the updated current data in order to determine the current cost efficiency of private commercial banks in Ethiopia.

3.4. **Sample size & Sampling technique**

From the target population, among the 31 commercial banks which 13 banks were selected as a sample for the purpose of this study. To select the sample purposive sampling techniques was used based on the year of establishment and availability of data. These are Commercial bank of Ethiopia, Awash bank, Bank of Abyssinia, Dashen bank, Nib International bank, Oromia bank, Zemen bank, Bunna International Bank, Cooperative Bank of Oromia, United bank, Anbessa International bank, Birhan bank, and Wegagen bank for the research purpose. The rationale behind the selection of those banks are their year of operation and availability of data (i.e. from 2011 – 2022G.C.). The study used Panel/longitudinal data for the time period specified above. Longitudinal data, sometimes called panel data, is data that is collected through a series of repeated observations of the same subjects over some extended time frame. Financial analysts was typically compare the financial statements of two companies, a cross sectional analysis would be to compare two companies at the same point of time

3.5. **Data source and data collection**

The study is based on secondary source of data. Quantitative data were obtained from the published and audited financial statements of commercial banks in the period of 2011– 2022. The data were collected from the National Bank of Ethiopia (NBE) and from the individual commercial banks. The main incentive of using secondary data for the study is to explain the effect of the independent variables of the study on the dependent variable. The data for analysis were collected through the review of audited annual financial reports (i.e. Balance Sheet, Income Statement and financial report notes) of the banks and relevant previous literatures.

3.6. **Method of data analysis**

This study adopted descriptive statistics like mean, standard deviation, minimum and maximum to describe variables in the Stochastic Cost Frontier Model. Statistical analyses was carried out using econometric analysis which is Stochastic Cost Frontier Model was used to test the relationships among variables. Each model is estimated and evaluated vis-à-vis a priori expectations and relevant statistics. The method of estimation employed is the stochastic model.

3.7. Description and operational definition of variables

Dependent variable

Cost Efficiency: A concept which can be used to measure financial institutions' efficiency is a fundamental question to be addressed. With regards to banks, cost efficiency is the most commonly used concept in the literature of efficiency. The concept has the economic foundation for analyzing the efficiency of financial institutions because it is based on economic optimization in relation to market prices and competition, rather than being based solely on the use of technology (Berger and Mester, 2008).

Independent Variables

Determinants of Efficiency

- **Bank Size**: measured by the Natural logarithm of total assets
- **Capital Adequacy Ratio**: measured by dividing capital by total assets (Capital/total Assets
- **Cost efficiencies:** are business strategies that strive to reduce the cost of creating a product or performing an activity without compromising quality. Determining cost efficiencies requires comparing the benefits of the output to the costs of the input.
- **Intermediation ratio**: measured by dividing total loans by total deposits (Total loans/total deposits)
- **Return on Asset**: measured by dividing gross profit by total assets (Gross profit/total assets)
- **Return on Equity**: measured by dividing gross profit by total equity (Gross profit / equity)
- **GDP:** GDP measures the monetary value of final goods and services—that is, those that are bought by the final user—produced in a country in a given period of time (say a quarter or a year). It counts all of the output generated within the borders of a country.
- **Credit Risk**: Credit risk is the probability of a financial loss resulting from a borrower's failure to repay a loan. Essentially, credit risk refers to the risk that a lender may not receive the owed principal and interest, which results in an interruption of cash flows and increased costs for collection.
- **Loan Quality:** The loan quality of banks as an independent variable is captured by the ratio of non-performing loans to total gross loans. Economic growth, inflation rate, lending rates, the ratio of net open position in foreign exchange to capital, return on assets and capital adequacy ratio are all utilized as explanatory variables.

3.8. **Stochastic cost frontier model specification**

This study used the stochastic frontier approach. According to Battese and Coelli, (1995) stochastic frontier approach estimates a border function by taking into account the distributional assumptions for both components of random error and inefficiencies. The stochastic frontier approach assumes that bank inefficiency components have a truncated normal distribution which is independently and identically distributed across different banks, an assumption which is violated in the second step of the estimation procedure. This procedure permits cost efficiencies and their determinants to be estimated using a one-step maximum likelihood estimates (MLE) procedure (Fries &Taci, 2004).

According to Shen & Jones (2008), cost efficiency provides a measure of how close a bank's actual cost is to what a best practice institution's cost would be for producing the same output bundles under the same conditions. The measure is derived from a cost function in which total cost depends on the prices of inputs (W), the output quantities (Y), bank specific variables (Z) and an error term (ε). Thus the general form for the stochastic cost frontier function specified as follows:

$C_it = f(W_it, Y_it, Z_it; +\beta) + \mathscr{E}_it$……..…….. (1)

Where C measures the total cost, W is a vector of the input prices, Y is a vector of the output quantities, Z is a bank specific efficiency determinants, β's are parameters and to be estimated, ε is preserved as a composite error term which is given in the form of εit= μit+vit, vit symbolize the random component or error term which follows a normal symmetric distribution around the border, N (0, σ2v) and integrates measurement error and break that could consequences for high or low costs for banks. The other component, μit, arrests the inefficiency term which follows a truncated normal asymmetric distribution or a half-normal distribution. Additionally, μit and vitare should be independently and identically distributed. Therefore, the inefficiency component, (μit) is assumed to be the function of a set of bank specific variables (Zit) that may affect performance, a vector of coefficients to be estimated (∂) and random error (Wit).

$\mu_it = Z_it\ \partial + W_it$ … (2)

Where, the random variable Wit has a half normal distribution with zero mean and variance σμ2

To make things easier the measurement of efficiency, a functional form has to be chosen given the multiplicity of bank functions. Thus, to estimate the cost frontier function the trans-logarithmic functional form is looks to be best adapted compared to other functional forms because it takes

into account the various complementarities between explanatory variables and it does not impose any restriction on the functional form. Moreover, panel data is used because observing banks at several points in time allows for possibly better estimates. For instance, assumptions relating to the stochastic frontier analysis can be relaxed, allowing for more flexibility in the handling of the model.

Consequently, according to Kumbhakar & Lovell (2000) the estimation of banks relative efficiency using panel data is obtained by estimating a Tran's log cost function of the general form as follows:

$\ln C_{it} = \ln C_{it}(Y_{it}, W_{it}, Z_{it}; \beta) + \varepsilon_{it}$ … … … … … … … … …… … … … … … … … … … … … (3)

Where $\varepsilon it = vit + \mu it$ for every bank i = 1,.., N; Cit is total cost of bank i, Yit is outputs' vector of bank i, Wit is inputs' vector of bank i, Zit is bank specific variables, β is vectors of parameters to be estimated, μit is the measure of inefficiency of bank i and is determined by a set of bank specific variables. Staikouras & Schmiedel (2007), estimate the specific cost efficiency frontier using the specification of Tran slog as follows:

$\ln C_{it} = \alpha 0 + \sum \alpha jljn Wj_{it} + \sum \boldsymbol{\beta} k^{k} \ln Yk_{it} + 0.5 \sum\sum \alpha hjh \; j \ln Wh_{it} \ln Wj_{it} + 0.5 \sum\sum \beta k1 \ln Yk_{it} \ln Y1_{it} + 1$

$\sum\sum \delta hk hk lnWh_{it} lnY k_{it}^{k} + \sum \varphi mlnZm_{it} + V_{it} + \mu_{it}$ … . .[m]… … …… … … . … . . … … … … … (4)

Where i = (1,…….,13) refers to number of banks ,t = years of study (2011-2022),h and j= (1,….,3) are parameters of input prices, k and l = (1,2) are outputs, m refers to number of bank specific variables; β, δ and φ are parameters to be estimated. To decrease the number of parameters and consequently, to win in terms of degrees of freedom, the following limitations must be imposed:

$\alpha hj = \alpha jh$ and $\beta k1 = \beta 1k$ … … … … … … …. . ($Symmetricconstraints$)

Furthermore, any function of cost must be homogeneous of degree 1 in input prices. So, a proportional increase in input prices increases the total cost in the same proportion without affecting the factors request. The linear homogeneity conditions were imposed during the estimation by normalizing the cost and inputs prices by the input price of capital. This condition of homogeneity is translated by the following limitations:

$\sum \alpha j = 1; \sum \alpha hj = 0; j \sum \delta hk = 0$ … … … … … ($Homogenietyconstraints$)

These constraints of symmetry and homogeneity reduce significantly the number of parameters to be estimated.

CHAPTER FOUR

4. RESULTS AND DISCUSSIONS

4.1. Introduction

Empirical data were computed for twelve consecutive years (2011 - 2022) using audited financial statements of the selected thirteen commercial banks which were collected from the National Bank of Ethiopia (NBE) and from the individual banks. Therefore, panel data were computed by Stochastic Cost Frontier Analysis to provide a comprehensive analysis about the determinants of private banks' cost efficiency in Ethiopia. STATA application version 14 was used here to run the regressions.

4.2. Descriptive Statistics

As mentioned in prior chapter, three input prices, two output variables, and five efficiency correlated variables are used to determine the efficiency level of commercial banks included in the study. The identification and selection of inputs and outputs variables is based on the intermediation approach which is briefly explained in chapter three. Accordingly the input price measurement lies on the following three variables. The first is price of labor (W1) which is calculated by the ratio of personnel expenses to number of employees. The second variable is price of capital (W2) which is measured by the ratio of other operating expenses to fixed assets. The third one is the price of deposits (W3) which is calculated by the ratio of interest expenses to total deposits. Expenditures on these inputs consist of the majority of all banking costs. The outputs(Y), are specified as total loans (Y1) which includes short term loans, medium term loans, long term loans, and other loans, excludes the loan loss reserves; other earning assets (Y2) such as short and long term investments, deposits with national bank and other banks, non-interest income which comes from net fee and commission and other operating income.

Thus table 4.1 summarizes averages, standard deviations, as well as the minimum and maximum values of basic and bank specific variables of commercial banks held within the sample. These descriptive values of the inputs, outputs, the dependent variables, and the environmental variables show differences and variations between the various banks.

Table 4.1: ***Descriptive statistics of the variables used in the estimation of cost efficiency***

Variable Name	Observation	Mean	SD	Min	Max
Total Cost (in million Birr)	156	1557.36	1673.2377	594	22311.4
Input Prices					
Price of labor (W1)	156	0.0921	0.1742	0.0193	0.4234
Price of capital (W2)	156	3.6543	3.8934	0.4748	29.34
Price of deposit (W3)	156	0.2634	0.7584	0.0213	9.3874
Outputs (in millions' Birr)					
Loans(Y1)	156	5239.374	9986.784	193.72	93476
Deposits (Y2)	156	19354.72	65326.73	87.335	674161.1
Determinants of Efficiency					
LnTA	156	8.9354	1.6893	7.4346	14.0835
CAR	156	0.2647	0.1864	0.1591	2.3843
IR	156	1.7682	6.6425	0.0734	67.1436
Real GDP growth	156	6.837	34.61	3.9	14.7
ROE	156	0.5693	0.5174	-0.5438	3.9483
ROA	156	0.0673	0.0528	-0.0294	0.4352

Source: Researcher's Computation from Annual Reports of National Bank of Ethiopia, 2022

Table 4.1 indicated that the annual total cost of the Ethiopian commercial banks attained, on average, 1,557.36 million ETB over the last twelve years with maximum of 22,311.4million ETB and minimum of 594 million ETB. On the other hand, the standard deviation statistics for total cost was also 1,673.238 million ETB which indicated that the cost variation between the selected banks was very high too. Regarding the explanatory variables of the model there are some interesting statistics that have to be mentioned. On average, the labor price of Ethiopia commercial banks for the last twelve consecutive years was approximately equals 9.2% with a maximum of 42.3 % and minimum 1.9%. The standard deviation statistics for labor prices was 17.4 % that reveals high variation in the labor price of Ethiopian commercial banks. A possible explanation can be the existence of high salary variation on employee salary fee, training and motivating staff among banks. In the same fashion the standard deviation statistics for the price of capital was also (38.3%) which shows the existence of very high variation of branch expansion between the selected Ethiopian Commercial banks. This may be due to the fact that some commercial banks

made few branch expansions and installation cost while others opened many branches which lead to very high variation cost associated with branch expansion. The SD for the price of deposit which was 75.84% which shows the existence of very high variation among branches. This would be due to the variation of customer and deposit size among the branches.

4.3 Correlation Analysis

Correlation is a way to index the degree to which two or more variables are associated with or related to each other (Brooks, 2008). The most widely used bi-variant correlation statistics is the Pearson product-movement coefficient, commonly called the Pearson correlation which was used in this study.

	TC	W1	W2	W3	Y1	Y2	LnTA	CAR	IR	Real GDP	ROE	ROA
TC	1											
W1	.464	1										
W2	.564	.188	1									
W3	0.209	.087	.238	1								
Y1	.358	.724	.369	.498	1							
Y2	.624	.397	.489	.665		1						
LnTA	.425	.547	.687	.741	.347	.554	1					
CAR	-.152*	.347	.348	.622	.689	.574	.337	1				
IR	.247	.647	.489	.543	.387	.429	.723	.578	1			
Real GDP gth	-.262*	.687	.548	.328	.426	.654	.369	.649	.832	1		
ROE	.387	.542	.367	.297	.369	.483	.597	.354	.764	.493	1	
ROA	.549	.489	.674	.347	.478	.598	.459	.358	.543	.387	.487	1

Table 4.2: Correlation Matrix

Source: Researcher's Own Computation from Stata-14

Table 4.2, shows the correlation of dependent and independent variables used in this research. The result of this study reveals that prices of labor, price of capital, prices of deposit, IR, lnTA, ROA, and ROE have positive association with the total cost of commercial banks. This indicates that in commercial banks of Ethiopia the increase in the above listed variables was lead to increase in

total cost to the banks. On the other hand, prices of capital, management performances, real GDP growth and capital adequacy were found to be negatively correlated with total cost of Ethiopian commercial banks.

4.4 Econometric Analysis

The researcher conducted diagnostic tests to guard against the possibility of obtaining and interpreting spurious egression results. The results of the tests are presented in the following sections.

4.4.1 Diagnostic Tests

This section presents and discusses the result of diagnostic test on the assumptions of classical linear regression models were done to ensure that the quality of quantitative assessment was valid. This includes heteroscedasticity, multicollinarity, autocorrelation and the normality test.

Multi-co-linearity

Before conducting the regression, it is pertinent to test Multi-co-linearity. Multi-co-linearity is the situation when some or all of the explanatory variables having a high degree of relation with each other and making it difficult to tell which of them is influencing the dependent variable (Gujarati, (2004). It is observed from appendix 1 and appendix 2, the result of the correlation matrix lays between the ranges of -0.152 and 0.764.The higher the correlation between the predictor variables the higher the Multi-co-linearity. Specifically, the correlation above 0.77 considered as Multi-co-linearity and the above correlation among the variables is below 0.77.Thus, our panel data are free from Multi-co-linearity problem as Variance inflation factor test show below.

Sample characteristics of Multi-co linearity

Table 4.3: Multi-co-linearity test

Variables	Tolerance	VIF	1/VIF
W1	.491	2.035	0.4914
W2	.577	1.732	0.5774
W3	.647	1.545	0.6472
Y1	.800	1.250	.8000
Y2	.321	6.54	0.153
LnTA	.425	3.48	0.287
CAR	.433	7.23	0.138
IR	.578	4.86	0.206
Real GDP gth	.634	4.78	0.209
ROE	.236	8.36	0.120
ROA	.478	6.48	0.154
Mean of VIF		4.39	

Source: Researcher's own Computation from Stata-14

We can use the variance inflation factor (VIF) command after the regression to check for Multicollinarity. As a rule of thumb, a variable whose VIF values are greater than 10 may merit further investigation. Thus, the mean VIF was 4.39 which indicate that there is no problem of Multicollinearity among the independent variables.

Heteroscedasticity Test

The heteroscedasticity problems arise when the variance of the error term is not constant. If the errors do not have a constant variance, there would be heteroscedastic problem. As noted in Gujarati, (2004) the variance of the errors is constant, this is known as the assumption of homoscedacticity. Thereby, the researcher study would be employed the popular white test to detect heteroscedasticity. This test involves testing the null hypothesis that the variance of the errors is constant (homoscedacticity) or no heteroscedasticity against the alternative that the errors do not have a constant variance.

As shown the result, the histogram is bell-shaped and from the Bera-Jarque statistic we can see that the p-value is 0.4263 which is greater than 0.05, this implies that with a p-value 0.4263 which is greater than 0.05 this study failed to reject the Null hypothesis that there was normal distribution of the residuals of the error terms. On top of this a requirement of kurtosis close to 3.04 and skewness close to 0 was satisfied by the output of Table 4.4 which indicates a Kurtosis and skewness of 3.287 and -0.0946 respectively. Therefore, this study concludes that the residuals of the error terms were normally distributed around the mean, and there was no the problem of normality on ROE Model.

Table 1Table 4.4: Test for Heteroscedasticity

asdocxttest3	
Modified Wald test for group wise	Heteroskedasticity
In fixed effect regression model	Kurtosis=3.287
H0:sigma(i)^2=sigma^2forall	Skewness=-0.0946
chi2(14)=1642.84	
Prob>chi2=0.4263	

Source: Researcher's own Computation from Stata-14

Test for Autocorrelation

This is an assumption that the errors term in one-time period is correlated with the error term in any other time period. The study employed the popular Woodridge test for autocorrelation to detect the existence of serial correlation. Accordingly, the test statistics fails to reject the null hypothesis which says there is no serial autocorrelation. This implies that our model does not have the problem of serial autocorrelation. Wooldridge test for autocorrelation in panel data H0: no first order autocorrelation

F(1, 13) =2.684

Prob> F = 0.1337

Normality Test

The other tests were carried out on the model which includes test of Normality. In order to conduct the normality assumption required a single or joint hypothesis tests about the model parameters. The popular Bera–Jarque test would be employed to check normality. According to (Gujarati, 2004,p 476)a normal distribution is defined to have a coefficient

of kurtosis of 3.04. In the same token, if the residuals are normally distributed, the Bera-Jarque statistic would be significant at 5% significant level. So that, the null hypothesis is that the distribution of the residuals is normal. As shown in figure 4.1below, the graphic bell-shaped and with 5 % significance level, we failed to reject the null hypothesis. Therefore, the residuals are normally distributed in this study and there is no the problem of normality in the models. The kernel value 0.0262 is less than 5% level of significance means the residual is normally distributed.

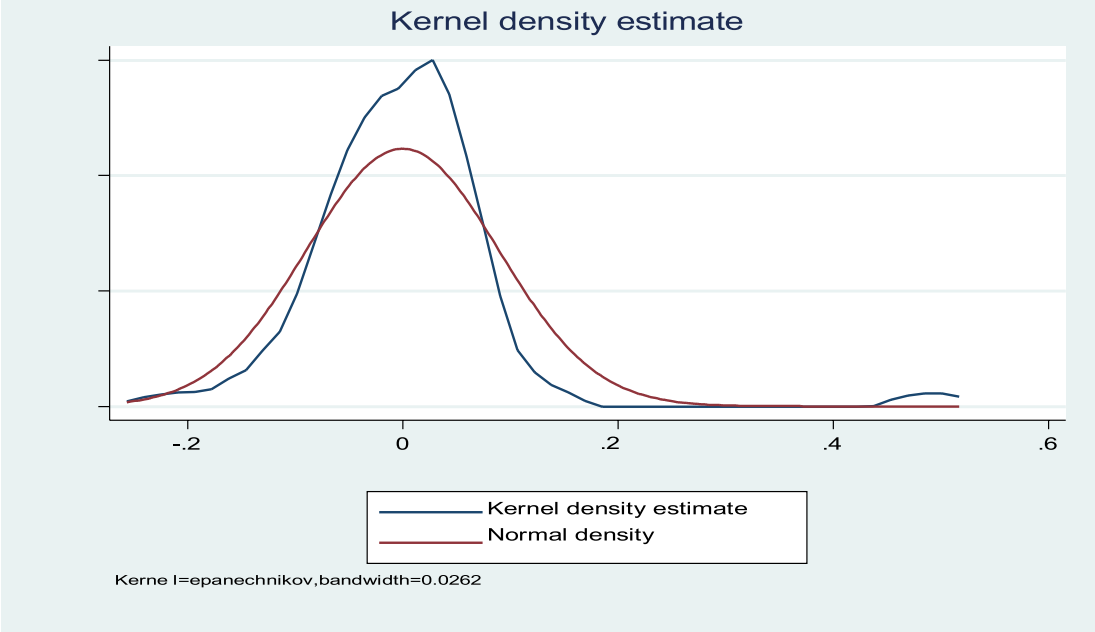

Figure4.1: Normality test for residuals

Source: Researcher's own Computation from Stata-14

4.4.2. Model Selection Test: Random Model versus Fixed Effect Model

Panel modelling enables to identify a common group of characteristics whilst, at the same time, considering the heterogeneity that is present among individual units (Baltagi, 2005). Prior to conducting the panel regression analysis, it is pertinent to select between fixed or random effect models. To this effect, the Hausman test was performed to select the appropriate model between fixed and random model. The null hypothesis is that the preferred model is random effects and the alternative hypothesis states that the fixed effects are preferred. The result of the Hausman test is presented in Table 4.5.,

accordingly, the Hausman specification test fails to accept the null hypothesis which says random effect model is appropriate and accepted the alternative hypothesis which says fixed effect is appropriate at 5% significance level. For further see regression result from appendix.

Table 4.5: Hausman Specification Test

	Coef.
Chi-square test value	26.632
P-value	0.025

Source: Researcher's own Computation from Stata-14

4.5 Estimation of Stochastic Cost Frontier Analysis

The empirical results of the cost frontier estimations were performed by maximum likelihood function incorporated into Stata 14. Alternative specifications and assumptions about the distribution of the one-sided error term were also tried. Specifically, a more restrictive half-normal distribution of the inefficiency effects and a specification assuming heteroscedasticity (Bottasso and Sembenelli, 2004; Hadri, 1999) were estimated but results were unreliable due to model instability arising from non-convergence even at a higher number of iterations. Accordingly, results of these estimations are not reported. On the other hand, convergence of the single stage frontier estimation and cost inefficiency model assuming a truncated normal distribution is achieved only after a small number of iterations. Consequently, the reported results are based on the chosen specification taking into account the assumptions made about the inefficiency error component. In this vein, a more general unrestrictive truncated normal distribution is assumed. The advantage of the truncated normal distribution is that it allows for a simultaneous estimation of the stochastic frontier function and analysis of the determinants of the inefficiency effects under very general conditions (Fujii, 2001).

The subsequent discussion reports the results obtained from the Trans log stochastic cost frontier function and the accompanying inefficiency model. The estimation result of the Trans log function is based on the conditional mean model approach of SFA method, using Stata 14 statistics software. The conditional mean model approach allows the single step estimation of maximum likelihood estimates (MLE) of the parameters of the stochastic cost frontier function and the inefficiency model. All summary statistics and regression reports in this paper were generated using the same software Stata 14. The linear homogeneity conditions were imposed during the

estimation by normalizing the cost and inputs prices by the input price of capital. The empirical results of the stochastic cost frontier model obtained by MLE are presented in Table 4.6 as follows

Table 4.6: Empirical results of the stochastic cost frontier model

Variables	Parameter	Coefficient	Std. Error
Constant	α_0	2.6441***	0.3235
$\ln w_1$	α_1	0.1896	0.1453
$\ln w_3$	α_2	0.8347***	0.0437
$\ln Y_1$	β_1	-0.6747**	0.2839
$\ln Y_2$	β_2	1.8473***	0.2479
$\ln w_1 \ln w_1$	α_{11}	-0.0492**	0.0342
$\ln w_1 \ln w_3$	α_{12}	0.0848**	0.1022
$\ln w_1 \ln Y_1$	δ_{11}	0.1384**	0.0586
$\ln w_1 \ln Y_2$	δ_{12}	-0.1656**	0.0796
$\ln w_3 \ln w_3$	α_{22}	-0.1427**	0.0789
$\ln w_3 \ln Y_1$	δ_{21}	-0.4875***	0.1784
$\ln w_3 \ln Y_2$	δ_{22}	0.4967***	0.0845
$\ln Y_1 \ln Y_1$	β_{11}	0.4379***	0.0963
$\ln Y_1 \ln Y_2$	β_{12}	-0.8393***	0.2147
$\ln Y_2 \ln Y_2$	β_{22}	0.4533***	1.4235

Source: own computation based on National Bank of Ethiopia (NBE) annually data

Log likelihood function=59.3435 and the notations ***, **, * shows level of significance at 1%, 5% and 10% respectively.

The result shows that the price of deposits is significant with positive sign. This sign is expected since the increase in interest payment raises the costs of banks and consequently their levels of inefficiency. However, the price of labor indicates a positive insignificant sign which indicates the low payment level of wages and salaries paid for the employees. The coefficients of outputs (loans and other earning assets) are significant with negative sign for first and positive for the second. The negative sign of loans indicates that the collected funds from customers and lend afterward, serve to decrease the costs of financial intermediation and consequently increases the efficiency level of banks. The parameters β_{11}, β_{12} and β_{22} which represent the impact of the joint production of two outputs on total costs, are statistically significant. On the other hand, the α_{12} parameter which represents the interaction between price of labor and price of deposits is significant and positive sign of independence between labor and deposits in the costs of the banking industry and negatively affect the efficiency of banks. Finally, the parameters δ_{11}, δ_{12}, δ_{21}, and δ_{22} representing

the effects of inputs on banking products, are statistically significant and partially positive. For example the coefficient δ_{21} has a negative sign which indicates that the activity of lending is much assisted by the use of deposits than by banks staff.

4.6. Determinants of Banking Efficiency

The estimation results of determinants of bank efficiency are based on the conditional mean model approach of SFA method, using Stata 14 statistics software. The conditional mean model approach allows the single step estimation of maximum likelihood estimates (MLE) of the parameters of the stochastic cost frontier function and the inefficiency variables. The empirical results of determinants of bank efficiency obtained by MLE are presented in Table 4.7 as follows.

Table 4.7: Empirical results of determinants of bank efficiency

Table 4.7: Empirical results of determinants of bank efficiency

Determinants of Efficiency	Parameter	Coefficient	Std. Error
LnTA	Φ1	-4.6149	4.3456
CAR	Φ2	4.6042*	9.4567
IR	Φ3	-2.8147*	0.5347
Real GDP gth	Φ4	1.7465*	1.2342
ROE	Φ5	-14.9862*	23.8238
ROA	Φ6	-14.6473*	57.448
Loan Quality	Φ7	-0.6233805	0.169557
Credit Risk	Φ8	0.0158109	0.008148
Constant	Φ0	12.9731	17.2842
$lnsigma^2$		1.4639	2.4695
Llgtgamma		9.6473***	2.9531
$sigma^2$		4.5139	5.8628
Gamma(γ)		2.2954	0.0248
$sigma\_u^2$		4.2186	6.3947
$sigma\_v^2$		0.0273	0.0146

Source: own computation based on National Bank of Ethiopia (NBE) annually data.

The notations ***, **, * shows level of significance at 1%, 5% and 10% respectively.

The inefficiency variables are quite supposed to have an effect on the total cost since all the coefficients of these variables are significant except size of the bank. The result leads to predict an important effect of these variables on the costs of banks and consequently on their levels of efficiency. Both variables of profitability (ROA and ROE) indicators have a negative and significant coefficient affect negatively the total cost of banks and thus positively the banking efficiency. In fact, the more the bank tries to improve its economic and financial performance, the more it will be able to lower its costs and consequently improve efficiency. The result is in conformity with the studies of (Dietsch and Vivas, 2000; and Kauko, 2009). Bank size (lnTA) does not significantly affect cost efficiency which is in conformity with the view that large branch network results in higher costs and higher cost inefficiency. The capital adequacy ratio (CAR), with positive and significant coefficient, shows a positive relationship between this variable and total cost, which contributes to lower the banking efficiency. Indeed a high level of capital reduces the risk of insolvency and, after all, the cost of borrowed capital. However, the Ethiopian banks show weak capital average ratio and therefore lacking levels of own capital with regard to total assets, which increases the risk of insolvency, the cost of borrowed capital, total cost and consequently affects banking efficiency negatively.

The intermediation ratio (IR), with a coefficient of negative and significant sign, acts negatively on the total cost, thus positively on the cost efficiency. In fact, the more the ratio of intermediation is high, the lower are the banking costs, and the higher will be the efficiency of banks. Banking systems with a higher intermediation ratio (ratio of total loans to total deposits) have significantly lower costs. This may reflect the developments in the legal and regulatory framework which support both the financial intermediation process and lower costs to banks. These may include the development of effective secured transactions laws and bankruptcy procedures which are necessary to support lending to customers (Pancurova and Lyocsa, 2013).

According to these results, it is important to mention the crucial role of bank specific variables as determining factors of the Ethiopian banks cost efficiency. Moreover, the estimate of gamma (γ) for cost inefficiency is 0.9995 which is close to one, indicates that the inefficiency determinants are likely to be highly significant in the analysis of the value of cost function. In other words, the γ parameter associated with variances in the stochastic cost frontier is estimated to be close to 1 indicating that the inefficiency term dominates the random error term in the overall error variance. Thus, deviations from the frontier are largely driven by bank specific inefficiency effect.

4.6.1. Analysis of Average Bank Level Efficiency Scores

Table 4.8 below presents a ranking of average bank specific cost efficiency scores estimated from the Trans log frontier cost function. The efficiency estimates show that for the banking sector as a whole, banks operated below the frontier, with mean cost efficiency of 0.933. The implication is that Ethiopian commercial banks could improve their performance by saving up to 6.7 % in their costs per year if they were all utilizing the best practice technology over the sample period.

Table 4.8: Mean cost efficiency of banks

Bank	**Mean**	**SD**	**Rank**
Awash bank	0.937	0.013	9
Bank of Abyssinia	0.973	0.017	2
Dashen Bank	0.927	0.014	11
Nib International bank	0.942	0.0211	8
Oromia Bank	0.950	0.0018	6
Bunna International Bank	0.837	0.0014	12
Zemen Bank	0.986	0.0015	1
Cooperative Bank of Oromia	0.957	0.0018	4
United Bank	0.946	0.014	7
CBE	0.934	0.017	10
Anbessa International Bank	0.965	0.0016	3
Birhan Bank	0.824	0.0024	13
Wegagen Bank	0.953	0.0019	5

Source: Researcher's own Computation from Stata-14

Individually, the estimated cost efficiency indicators show that relative to the common frontier, the most efficient bank (ZB) has a score of 0.986, that is, approximately 5.3% more efficient than the average bank in the sample. This shows that ZB could cut its costs by 3.4 % to move to the best practice frontier. Put differently, the level of inefficiency for ZB is approximately 3%. This is due to the size of the bank which has only one branch and makes it easy to control costs. Conversely, the least performing bank Birhan bank with an efficiency score of 0.83 shows input wastage of up to 17%. This maybe because of the banks operational size due to its branch size and customers number. Other banks are generally in good position although none was operating

optimally. The overall result emerging from these efficiency indicators is that, although Ethiopian banks are inefficient on average, for most of them the scores are skewed closer to the frontier. This is shown by the trend in the cost efficiency estimates depicted by figure 1 and table 4.5 below. Figure 1 illustrates efficiency scores for the annually observations; table 4.5 reports annual efficiency score for each banks. Figure 1, shows, for most commercial banks there is a sustained upward trend in cost efficiency, depicting some reduction in inefficiency over the sample period.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

This study was conducted to identify the determinants of cost efficiency of commercial banks in Ethiopia. Doubts about the cost efficiency of commercial banks reflected in wide interest spreads continue to be a point of public policy debate. This study explores the area of bank efficiency, where it is important for banks to have better efficiency in terms of the usage of its cost in providing better services. This study has evaluated the cost efficiency of Ethiopian banks using the stochastic frontier approach by incorporating bank specific factors in the analysis. The intermediation approach is adopted to identify and define the inputs and outputs variables which are used in the analysis. The results show that Ethiopian banks are on average inefficient in the order of 6.7 %, indicating that mismanagement of resources remains a problem to better cost performance. However, over the years, there has been some improvement in the relative cost efficiency of banks, with new small banks displaying spectacular growth in performance.

With respect to the determinants being examined, the inefficiency variables are quite supposed to have an effect on the total cost since all the coefficients of these variables are significant except size of the bank. The result leads to predict an important effect of these variables on the costs of banks and consequently on their levels of efficiency. Both variables of profitability (ROA and ROE) indicators have a negative and significant coefficient affect negatively the total cost of banks and thus positively the banking efficiency. The capital adequacy ratio (CAR), with positive and significant coefficient, shows a positive relationship between this variable and total cost, which contributes to lower the banking efficiency. Indeed a high level of capital reduces the risk of insolvency and, after all, the cost of borrowed capital. The intermediation ratio (IR), with a coefficient of negative and significant sign, acts negatively on the total cost, thus positively on the cost efficiency. In fact, the more the ratio of intermediation is high, the lower are the banking costs, and the higher will be the efficiency of banks.

5.2. Recommendations

Based on the results, the importance of efficiency correlates was shown in the study which shows that banks tends to be more efficient in an economy characterized by high returns on assets (ROA) and returns on equities (ROE) as well as a high ratio of intermediation (IR). These factors suggest that there should be a stronger policy response to overcome the impediments which continue to affect banks cost performance.

The result of this analysis leads to important implication for management of the bank, policy makers, and bank regulators in Ethiopia. Thus, banks can improve their cost efficiency by way of improving the method of loans and advances, by increasing the share of capital relative to assets and by boosting banking investment operation; the less efficient banks can improve their resource utilization.

Moreover, Ethiopian authorities have committed to the privatization, modernization, and opening of the banking system to the foreign banks within as part of liberalization programs in order to have competitive, efficient and developed financial and banking systems.

5.3. Suggestions for future research

Future research can be extended by including more variables such as macroeconomic variables (for example, inflation rate) and also by including other new banks which are not included in this study with factors influencing the efficiency of Ethiopian commercial banks.

In addition, the methodology of stochastic frontier analysis could be compared with other parametric and non-parametric measures of efficiency such as Data Envelopment Analysis. Other than these, as the SFA model built in the study did not show complete variation of efficiency being explained by the selected determinants, there could be other significant variables such as institutional and regulatory factors which contribute to the changes of performance and efficiency in financial institutions. Therefore, researchers of future studies could also consider other factors that may affect the changes in cost efficiency of banks.

The scope of the study can be further increased and enriched to include other variables (other efficiency parameters) under the theoretical framework in future studies that might predict the overall efficiency of the commercial banks. Therefore, it proposes conducting further studies considering all private and governmental commercial banks.

The study only focused on the longitudinal time frame for 12 years. Therefore, future research should be conducted on a wider scale by considering additional decades and for all commercial banks in Ethiopia.

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