ADDIS ABABA UNIVERSTY
SCHOOL OF GRADUATE STUDIES

ANALYSING COST AND ALTERNATIVE PROFIT EFFICIENCY OF PRIVATE COMMERCIAL BANKS IN ETHIOPIA: A STOCHASTIC FRONTIER APPROACH

By
Misganaw Habte

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"Analyzing Cost and Alternative Profit Efficiency of Private Commercial Banks in Ethiopia: A Stochastic Frontier Approach."

By

Misganaw Habte Woldemedhin

Approved by the Board of Examiners:

Shail Singh
Advisor

Singh
Signature

J. MANOHAR RAO
Examiner

Signature

Mulat Demeke
Examiner

Mulat D
Signature

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Abstract

This paper attempts to examine the cost and alternative profit x-efficiency level and the factors that may influence the x-efficiency level of the private commercial banks in Ethiopia, by employing stochastic frontier approach. The data is obtained from audited financial statement of six private commercial banks between year 2000 and 2005, various NBE annual reports and interviewing different private bank officials.

The study employed stochastic frontier approach using translog functional form, which is commonly used in similar studies to represent the data. The study found that the mean level of cost and alternative profit x-efficiency of private commercial banks were 81 percent and 70 percent respectively. This indicates that private commercial banks incurred approximately 19 percent more cost than necessary and lost approximately 30 percent of their potential profits with in the sample period due to x-efficiency. This implies that there exists an immense room for improvement in cost and alternative profit x-inefficiency of private commercial banks with out employing additional resources.

The study also revealed that the effect of operational specific variables, market specific variables, macro variables and risk variable were plausible in explaining predicted cost and alternative profit x-inefficiency. Any policy implication designed by the banks management and policy makers to improve the efficiency level of the private commercial banks should consider the impact of those influencing factors.

ACRONYMS

AE	Allocative Efficiency
DEA	Data Envelopment analysis
DFA	Distributional Free Approach
FDH	Free Disposal Hull
GDP	Gross Domestic Product
NBE	National Bank of Ethiopia
NPA	Non Parametric Approach
NPL	Non Performing Loan
PA	Parametric Approach
ROE	Return on Equity
SFA	Stochastic Frontier Approach
SFA	Stochastic Frontier Approach
TE	Technical Efficiency
TFA	Thick Frontier Approach

CHAPTER ONE
INTRODUCTION

1.1. Background of the Study

The financial services sectors receive the attention of researchers in recent years. This is because, financial service sector has grown rapidly over the past war period and now represents a significant proportion of total economic activity in most developed economies (Anderton, 1995). Financial service institutions play a major role in the smooth operation of an economic system. Moreover, it is the most dynamic sector in developed western economies over the last 25years showing the amazing capacity for change, innovation and adoption.

The performance of any economy is closely and directly related to the performance of the financial sector. This is why, the role of financial sector for economic growth has been a major area of empirical research. At the centre of the financial sector of any economy is the process of financial intermediation. Financial institution notably banks act as a channel through which financial surplus of some groups in society are collected and then redistributed to other groups that have financial deficits. In other words, financial institutions have traditionally acted to mobilize the saving with in the economy and to direct them into productive investment (Aderson, 1995; Alemayehu, 1999)

The banking industry plays a key role as a means of credit and key source of future expansion and/or growth of the economy. Joseph Schumpeter (1911) argued that the granting of credit remain central to entrepreneurship and innovation, showing the pivotal role played by banks in attaining sustainable growth trajectory. The expansion and contraction of bank credit might not be the cause of economic role, but without banks these booms and slumps might not be what they are. This view signifies the significant degree of inter dependency between the financial sector (bank) and the real sector of the economy.

The solvency of banks on one hand and the strength and soundness of the banking system on the other hand remain germane to the performance of the entire economy. Without a sound and efficient banking system, the economy can't function well. When a bank fails, the whole of a nation's payment system is thrown in to jeopardy (Ikhide, 2000)

Thus, better functioning banks improve resource allocation and accelerate total productivity growth with positive repression for long run economic growth (Beck and levine 1999).

The history of commercial banking activities in Ethiopia took different forms in different economic systems (Alemayehu, 1999). This can be categorized in to three significant periods namely pre Derg era (pre-1974), the Derg era, (1974-1991) and post Derg era (1991 to date). Modern banking operation in Ethiopia was established in 1906 under the partnership of Ethiopia and the National Bank of Egypt. This was the first bank in the history of Ethiopia (Belay, 1990; Arnaldo, 2003). During pre- Derg era both private and state owned banks were operating in the market. Three foreign banks were also entered in the competition. However, such liberalized financial system was disrupted in 1974 immediately the Derg came to power. The military regime subsequently nationalized private commercial banks on January 1975. During the Derg regime, banks merely become instruments for channeling private sector resources for public use. After the downfall of the Derg in 1991, the EPRDF, with the aim of bringing competition in the financial market, allowed private commercial banks to operate (hundred percent owned by Ethiopians') and deregulated the interest rate that is put a minimum (interest rate) floor for deposit and liberalize (make free) lending rate. However, liberalization of the lending interest rate did not bring about a significant change in the rate structure due to lack of fierce competition in the banking industry. Low level of competition can cause relatively lower level of efficiency (Berger et al, 1993). The greater the efficiency, the higher would be competitiveness and vice versa (Ch. Spathis el. at., 2002). Though, the private banks have been showing remarkable performance in their years of operation, the Commercial Bank of Ethiopian still maintains a preeminent position in the commercial banking

activities. It remains the dominant commercial bank in terms of share in total deposit and total credit. This makes private banks to follow the leading bank. Therefore, lending interest rate does not reflect the true cost of money in the economy and higher costs can be passed on to consumers who do not understand the nature of the service offered or lack alternative sources of finance.

Moreover, commercial banks are more liquid and their non-performing loans grow persistently (see the annual reports of the National Bank of Ethiopia and commercial banks). This inefficiency of commercial banks is attributed to mismanagement of resources. The major factors leading to inefficiency of private commercial banks may be operational specific variable, market specific variable, macro specific variable, risk variable and other reasons. Thus, concept of efficiency study provides valuable information on the private commercial banks' efficiency level and factors that determine the cost and profit efficiency to policy maker and bank managements. Anchored in, this valuable information policy maker and bank managements can take corrective measures.

1.2. Statement of the problem

The performance review of banking industry is usually made based on audited financial statements (balance sheet, income and expense statements) using the technique called ratio decomposition. The technique allows breaking down some financial ratios in their component parts to find out particular areas that negatively or positively affect overall bank's performance. Most widely used ratios include return on equity and return on assets.

However, financial ratios have serious setbacks. First, difference in capital, structure, business mix and accounting standard across banks may affect these ratios and render comparability inadequate (Vitta 1991). Second, they relay on benchmark ratio. These bench marks could be arbitrary and may render misleading information i.e. it fails to provide satisfactory information to management as to how to improve resource allocation (budgetary) and achieve best performance level. Further more, the ratios don't capture the long term performance and aggregate many aspects of performances such as operations, marketing and financing (Sherman and Gold, 1985).

In recent period, academic researchers have developed alternative approaches to measure the performance of banks. Such methods are categorized in to parametric and non-parametric approach. Only Muluneh Ayalew (May 2006) studied cost efficiency of private commercial banks in Ethiopia, no other attempts were however, exerted in Ethiopia to assess the efficiency of banking sector by these two approaches. He found that, the cost efficiency level of private commercial banks was 86 percent between 1997 and 2005. He also identified capital, asset, branches number, and age as influencing factor.

The fact that commercial banks are highly liquid (Br.10,9 billion see NBE annual report) and their non-performing loans increase from year to year gives an indication of their inefficiency. The causes may either be management inability to utilize resources (labor, capital, and deposits) properly and effectively or bad luck (exogenous factors). The banks earn profit due to high spread, which is a symptom for lack of competition among banks, or high demand of bank service by the public suggesting the profit might not be the result of cost/profit efficiency or over all efficiency of the banks.

Ibrhim, 1997 indirectly tried to identify qualitatively the inefficiency of the banking sector in Ethiopia and pinpoint problems that negatively affect the performance of the banks. The problems he identified include the problem related with macro economic environment, lending operation, inadequate capital base, operational results, customer services quality, lack of competition, inadequate banking skills, in adequate legal and supervisory framework and monetary management.

This study, therefore, will employ a parametric (econometric) approach to assess the efficiency of private commercial banks. The paper will attempt to fill the gap by examining the cost and profit efficiency and inefficiency level of private commercial banks and to identify the factor that determine the efficiency level of private commercial banks and their root cause of inefficiency. The outcome of the study would serve as a guide to policy design and implementation.

1.3. Objective of the study

The general objective of the study is to assess the cost and profit efficiency level of private commercial banks in Ethiopia.

The specific objectives of the study are:

- Examining the private commercial banks cost and profit efficiency level,
- Identifying major drawbacks and cause for poor and unsatisfactory bank performance (i.e. x-inefficiency),
- To show the difference in x-inefficiency between private commercial banks.

1.4. Significant of the study

The result from the study gives a benchmark for policy makers and researchers to examine the effect of the financial liberalization per se. It also provides valuable and suggestive information to the researchers for their further study on the efficiency of private commercial banks. The result can also be used by the management of these banks in their endeavors towards improving their brank's performance. In a nut shell, the result may give adequate information for managers and policy makers to make informed decisions and employ resources more optimally.

1.5. Scope and limitation of the study

The paper focuses only on cost and profit efficiency of private commercial banks in Ethiopia using stochastic frontier approach for the last six years (2000-2005). It excludes Central Bank, Commercial Bank of Ethiopia, Construction and Business Bank and Development Bank.

Though, unavailability of source document such as books on efficiency from the library, lack of official data on non performing loans from banks and difficulty to obtain input prices are faced, alternative data like provision on loans and advances and estimated value for input prices will be used, which may reduce the problem of biasedness.

1.6. Hypotheses

The study hypothesized that:

- Private commercial banks are cost and profit inefficient.
- Predicted efficiency levels of private commercial banks are not constant in the sample period.
- Asset, Capital, ROE, Deposit ratio, and GDP have direct relation with cost and alternative profit x-efficiency, while NPL has direct relationship with cost x-inefficiency. The branch network has direct relationship with cost x-inefficiency and inverse relationship with profit x-inefficiency.

CHAPTER TWO

BANKING INDUSTRY OVERVIEW AND FINANCIAL STRUCTURE IN ETHIOPIA

2.1. Importance of Banking Industry

The role of financial sector development in economic growth has become a major topic in empirical research works. Most of them come to the conclusion that there is a positive interrelation between financial development and economic growth. Schumpter for instance, emphasized the importance of financial intermediation and financial markets in the process of economic development. Financial intermediaries and financial markets arise because of market frictions, which include information costs, cost of enforcing contracts and exchanging good and financial claims. The primary function of financial systems is to facilitate the allocation of resources. More specified financial systems might facilitate risk management; they help to diversify liquidity risks and idiosyncratic investment and demand risks.

As Joseph Schumpter (1911) argued among financial intermediaries' banks play a pivotal role in economic development, through providing various important services to public, government, and different sectors of a nation's economy. They also substantially enhance the welfare of people in both the developed and developing countries.

Banks provide liquidity and safe keeping for saving, which allows depositor to smooth consumption over time (Adongo, 2005). They also provide an efficient means of transferring claims over resources. On the other side, banks conduct credit analysis; disburse loans and monitors outstanding credits for borrowers. As Steuart viewed 'credit is a catalyst of economic development'. Banks have an ability to reduce the cost of acquiring of information about firms and managers and lower the cost of conducting transaction. Banks can enhance resource allocation by providing more accurate information about production technologies. Thus, banks have positive contribution on growth and sources of growth: capital accumulation, productive growth and private

saving. For centuries, banks have been a vital aspect of international trade. Through banks and cross-border correspondent banking, people who do not know or trust each other can effect trades.

Banks have strong relationships with monetary authorities. This is because monetary authorities have had several important concerns about banks and their operations. If major banks confront withdrawal risk, financial panic might be occurred. And also causes for financial sector bankruptcy and a multiple contraction of money supply. These would bring both direct and indirect adverse effects on the economy. Thus, managing monetary policy effectively calls for a well-established banking industry as a precondition.

In general, efficient financial intermediation mechanisms increase the expected return to investment, which can promote innovation resulting in further positive implications for economic growth (Covins, 2002 cited at Adongo, 2005). The efficiency of individual banks in providing the above services and conditions in the external environment determine the efficiency of the overall banking sector, which influences the effectiveness of the domestic financial intermediation mechanism (Adongo et al, 2005).

2.2. The History of Banking in Ethiopia: A Snapshot

The history of banking industry in Ethiopia took different forms in different economic systems (Alemayehu, 1999). This can be categorized in to three significant periods: pre Derg (up to 1974), Derg era (from 1974-1991) and post Derg (from 1991 to date).

The agreement that was reached in 1905 between Emperor Minilik II and Mr.Ma Gillivray, representative of the British owned National Bank of Egypt marked the introduction of modern banking in Ethiopia. Following the agreement, the first bank called Bank of Abyssinia was inaugurated in Feb.16, 1906 by the Emperor. The Bank was totally managed by the Egyptian National Bank and its shares were subscribed in a number of countries besides Ethiopia. The Bank of Abyssinia was given a 50 years concession and was engaged in issuing notes, collecting deposits and granting loans; but its clients were mostly foreign businessmen and wealthy Ethiopians.

Within the first fifteen years of its operation, Bank of Abyssinia opened branches in different areas of the country (Arnaldo Mauri, 2003). Despite its monopolistic position, the Bank earned no profit until 1914. Profits were recorded in fiscal years 1914, 1919, and 1920 and from 1924 onwards. Moreover, the Bank faced enormous pressure for being inefficient and purely profit motivated and reached an agreement to abandon its operation and be liquidated in order to disengage banking from foreign control and to make the institution responsible to Ethiopia's credit needs. Thus, by 1931 Bank of Abyssinia was legally replaced by Bank of Ethiopia shortly after Emperor Haile Selassie came to power.

Bank of Ethiopia was a purely Ethiopian owned institution and the first indigenous bank in Africa and established by an official decree on August 29, 1931 with capital of £750,000(Arnaldo Mauri, 2003; Belay Gedey, 1990 cited Alemayhu, 2002).

Bank of Ethiopia took over the commercial activities of the Bank of Abysinia 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 continued successfully until the Italian invasion in 1935. During the invasion, the Italians established branches of their main Banks namely Banca d'Italia, Banco di Roma, Banco di Napoli and Banca Nazionale del lavoro and started operation in the main towns of Ethiopia. However, they all ceased 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. Then on 15th April 1943, the State Bank of Ethiopia commenced full operation after 8 months of preparatory activities. It acted as the Central Bank of Ethiopia and had a power to issue bank notes and coins as 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 was also functioned as the principal commercial bank in the country and engaged in all commercial banking activities.

The State Bank of Ethiopia had established 21 branches including a branch in Khartoum, (Sudan) and a transit office in Djibouti until it eased to exist by bank proclamation issued on December 1963. Then, the Ethiopian Monetary and Banking law that came into force in 1963 separated the functions of commercial and central banking. Accordingly the National Bank of Ethiopia and Commercial Bank of Ethiopia were created. Moreover, it allowed foreign banks to operate in Ethiopia limiting their maximum ownership to be 49 percent while Ethiopians should own the remaining balance.

The National Bank of Ethiopia with more power and duties started its operation in January 1964. Following the incorporation as a share company on December 16, 1963 as per proclamation No.207/1955 of October 1963, Commercial Bank of Ethiopia took over the commercial banking activities of the former State Bank of Ethiopia. It started operation on January 1, 1964 with a capital of Birr 20 million.

There were two other banks in operation namely Banco di Roma S.C. and Banco di Napoli S.C. that later reapplied for license according to the new proclamation each having a paid up capital of Birr 2 million.

The first privately owned bank, Addis Ababa Bank Share Company, was established by Ethiopians initiative and started operation in 1964 with a capital of Birr 2 million in association with National and Grindlay Bank, London which had 40 percent of the total share. In 1968, the capital of the Bank rose to Birr 5.0 million and until it ceased operation, it had 300 staff at 26 branches.

There were other financial institutions operating in the country like the Imperial Savings and Home Ownership Public Association (ISHOPA), which specialized in providing loans for the construction of residential houses and to individuals under the guarantee of their savings. There was also the Saving and Mortgage Corporation of Ethiopia whose aims and duties were to accept savings and trust deposits account and provide loans for the construction, repair and improvement of residential houses, commercial and industrial buildings and carry out all activities related to mortgage operations.

Another bank called Agricultural Bank was established in 1945 with the role of extending credit facilities to agricultural and other development oriented projects. But in 1951 the Investment Bank of Ethiopia replaced it. In 1965, the name of the bank once again changed to Ethiopian Investment Corporation Share Company and the capital rose to Birr 20 million, which was fully paid up. However, proclamation No.55 / 1970 established the Agricultural and Industrial Development Bank Share Company by taking over the asset and liability of the former Development Bank and Investment Corporation of Ethiopia.

The fall of the imperial government in 1974 led to a major change in economic policy. The new military government declared Ethiopia to be a socialist state and steadily extended its control over the whole economy and nationalized all large corporations. Organizational setups were taken in order to create stronger institutions by merging those that perform similar functions. Accordingly, the three private owned banks, Addis Ababa

Bank, Banco di Roma and Banco di Napoli Merged in 1976 to form the second largest bank in Ethiopia called Addis Bank with a capital of Birr 20 million and had a staff of 480 and 34 branches. Before the merger, the foreign participation of these banks was first nationalized in early 1975. Then Addis Bank and Commercial Bank of Ethiopia S.C. were merged by proclamation No.184 of August 2, 1980 to form the sole commercial bank in the country till the establishment of private commercial banks in 1994. The Commercial Bank of Ethiopia commenced its operation with a capital of Birr 65 million, 128 branches and 3,633 employees. The Savings and Mortgage Corporation S.C. and Imperial Saving and Home Ownership Public Association were also merged to form the Housing and Saving Bank with working capital of Birr 6.0 million and all rights, privileges, assets and liabilities were transferred by proclamation No.60/ 1975 to the new bank.

Proclamation No.99 / 1976 brought into existence the Agricultural and Industrial Bank, which was formed in 1970 as a 100 percent state ownership, was brought under the umbrella of the National Bank of Ethiopia. Then it was reestablished by proclamation No. 158 / 1979 as a public finance agency possessing judicial personality and named Agricultural and Industrial Development Bank (AIDB). It was entrusted with the

financing of the economic development of the agricultural, industrial and other sectors of the economy by extending credits of medium and long-term nature as well as short-term agricultural production loans (Hervey, 1996 and Befkadu Degfe, 1995 cited at Alemayhu, 1999).

After the fall of the Derg regime in 1991, the EPRDF was undertaken package of reform measures at both the macro and sectoral levels. Monetary and Banking Proclamation of 1994 established the National Bank of Ethiopia as a judicial entity, separated from the government and outlined its main functions.

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. Shortly after the proclamation, the first privately owned commercial bank; Awash International Bank was established in 1994 by 486 shareholders and by 1998 the authorized capital of the Bank reached Birr 50.0 million. Dashen Bank was established on September 20, 1995 as a share company with an authorized and subscribed capital of Birr 50.0 million. Bank of Abyssinia, another private commercial bank was founded by 131 shareholders with subscribed and authorized capital of 25.0 million and 50 million in 1996, respectively. Wegagen Bank with an authorized capital of Birr 60.0 million started operation in 1997. The fifth private commercial bank, United Bank, was established on 10th September 1998 by 335 shareholders and the sixth private commercial bank, Nib International Bank started operation on May 26, 1999 with an authorized capital of Birr 150.0 million (see annex). The government's strategy for financial development is characterized by gradualism. The financial sector currently consists of a mix of private and public entities and strong emphasis on maintaining macro economic stability (Addison and Alemayehu, 2002).

2.3. Current structure of the Ethiopian banking industry

2.3.1. Development in Financial sector (Bank)

At the end of fiscal year 2005, the number of banks reached ten including the Cooperative Bank of Oromia; three among these are government owned banks. The total number of branches reached 389. The Commercial Bank of Ethiopia alone owned 174 (44percent) branches, which is the largest public bank in the country. Despite such a move in branch expansion, Ethiopia remains one of the under-banked economies even at Sub-Saharan African Countries standard. The bank branch to population ratio for Ethiopia stood at 1:185,000 in year 2004/2005.

Likewise, the total capital of the banking system reached Birr 3,486 million at the end of June, 2005, of which the government owned banks account for Birr 1,979 million (56.8 percent). The share of the Commercial Bank of Ethiopia was about 41 percent of the total capital of the banking system. However, it is worth noting that the share of private banks both in bank branches and capital has shown an increasing trend (NBE, 2005 annual report).

2.3.2. Development of Interest Rate

The interest rate structure of the banking system has not shown any significant change since 2001/2002. This was mainly due to the prevalence of excess liquidity in commercial banks. As a result, the simple average saving deposits rate remained at 3.08 percent per annum; just 0.08 percentage points above the 3 percents minimum rate set by NBE. Interest rate on fixed deposits, however, ranged between 3.47 percent for a maturity period of less than one year to 3.94 percent for those extending above two years. On average, banks paid 3.71 percent interest per annum on fixed deposits. Average interest rate on demand deposits remain at 0.05 percent as only three banks, namely Dashen, United and Wegagen banks paid interest. The minimum and maximum lending rates also remain 7 percent and 14 percent respectively; average rate is 10.5 percent. In general, both fixed and saving deposit rate were negative in real terms taking in to account the 6.8 percent average annual head line inflation and 5.2 percent core inflation. Lending interest rate, however, was positive at 3.7 percent in real term.

2.3.3. Resource Mobilization

Total resources mobilization by the banking system reached Birr 13.3 billion at the end of 2004/2005. Deposit liability of the banking system (including Development Bank and excluding Cooperative Bank of Oromia) reached Birr 38,515 million by end of June, 2005. Demand deposit constituted 49.1 percent of total deposit followed by saving deposits 44.5 percent. The deposit concentration in the Commercial Bank of Ethiopia reached to 70.1 percent by the end of 2004/2005. The three public banks held about 74.7 percent of the total deposits. The share of private banks in deposit mobilization has reached 25 percent in 2004/2005.

2.3.4. Outstanding Loans

Outstanding loans of the banking system reached at Birr 29.1 billion at the end of June 2004/05. Gross outstanding claims on central government declined during the year 2004/05 while public enterprises, private sector and cooperative increased in the same fiscal year. Though the lion share of outstanding loans (i.e. Birr 21.5 millions) is held by public banks, the portion of private banks tends to wind up from year to year.

2.4. Banking legislation and supervision

2.4.1. The Pre Reform Banking Sector Regulation

The National Bank of Ethiopia was granted substantial autonomy to oversee monetary policy using such instruments as reserve and liquidity requirements on commercial banks and to determine interest rate for various systems, which was disrupted in 1974, when the Derg came to power.

The monetary and banking proclamation of 1976 made the NBE to become the financial arm of the state required to provide loans and advances to the government. And the NBE had given power to control the operation of banks and other financial institutions and---- 'direct bank and other institutions to deny credit allocation to private enterprises' (Gebrehiwot, 1997). The controlling mechanisms include fixing both deposit and lending interest rates, controlling foreign exchange and credit allocation in discriminatory manner, and restricting new entry to the sector.

2.4.2. The Post Reform Banking Sector Regulation

The new banking law (proclamation no. 84/1994) was passed in January, 1994 and established the minimum capital requirement for starting new commercial bank to be Birr 10 million and a capital adequacy ratio of 8 percent of risk weighted assets. Any applicant complying with the proclamation's provision might be granted a license. Now, the minimum capital requirement rose to Birr 75 million. The NBE also put minimum requirements including educational background and work experience in banking sector that must be fulfilled by the applicants' directors and senior management to approve the license.

In 1996, NBE established a new division to undertake regulation and supervision. Its first task was to draw a set of guidelines. These codify what is expected of banks and of NBE itself. Among its tasks NBE license and employed external auditors to prepare regular accounts for financial institution; this is important since private sector capacity in auditing is itself a nascent and therefore inexperienced industry in Ethiopia. NBE supervision consists of both off-site surveillance and on-site examination.

Off-site surveillance mechanisms require banks to submit key financial data such as the composition of lending and the scale of non-performing loans on regular basis in order to identify all the risks to which banks are exposed. On the liability side, NBE's directive requires banks to maintain liquid assets of less than 15 percent of their total demand, saving and fixed deposits with less than one month to maturity. Banks must report their weekly liquidity position to NBE as to safe guard depositor.

NBE uses on-site examination to asses's the financial and managerial conditions of the banks using quantitative and qualitative measures. The quantitative measures focuses on analysis of the Bank's performance with respect to improving the quality of assets, maintaining capital at adequate level, profitability and liquidity position. The qualitative measures focuses on determination of the general health of Banks by assessing the adequacy of the operating policies and procedures, activities of the Board and executive management and internal control system.

In general, these help us to acquaint with that banking industry has vital role in the economy. As stated banking sector deposit mobilization and loan and advance have significant portion in gross domestic product of the country. Thus examining the efficient allocation of financial resources is very important.

CHAPTER THREE

LITERATURE REVIEW

3.1. Theoretical Literature Review

3.1.1. Conceptual Discussion

The core of any economic activity, whether it is consumption or production, is to strive for the maximum possible efficiency. Efficiency is a broad concept that can be applied to many dimensions of firms' activities. Let us take firms as a technical unit engaged in production of a commodity/service. Firms transform a set of given inputs in to given out put defined by the production function.

In this case, the emphasis will be on achieving maximum productive efficiency. If we define a firm as organizational unit, engaged in the production and disposal of a commodity for some desired purpose, then the emphasis will rest on achieving 'business' or 'Economic' 'Efficiency'. Efficiency is producing the right good/service of the right quality at the right cost. It is the success with which a firm uses its resources to produce output of a given quality.

The desirability of productivity efficiency cannot be questioned. However, it may be difficult to achieve it since the planning and forethoughts of the managers responsible for production may not be perfect, the coordination of the complex operations may be difficult and inadequate and the knowledge on the current practice as well as of the factor prices may not precise. All these are essential requirements for the achievement of the productive efficiency.

A broader concept that takes core of productive efficiency is the economic efficiency that may also be called business efficiency from a firm's point of views. The proportions on which the concept of economic efficiency depends on: i) resources at disposal of the firm are scarce, and ii) they can be put to alternative uses, human capital, machine, materials, finance and time are the scarce resources from which one can produce. Given the scarcity these of resources and their alternative uses, it is quite natural for a rational firm to obtain the best from them (Barthwal, 1984).

According to Farrell (1957), production units overall economic efficiency is composed of two components; technical efficiency and allocative efficiency. In other words, economic efficiency refers to the combination of technical and allocative efficiency (Coelli et al, 1998). Economic Efficiency incorporates efficient selection of goods to be produced, efficient allocation of resources in the production of these goods and efficient choice of the methods of production and efficient allotment of the goods produced among the consumers. Economists argue that correct applications of the economic principles will bring about optimal efficiency in the allocation and utilization of all resources, their products and in competition with all other desires of the community.

The main stream neoclassical paradigm assumes that producers in an economy always operate (internally) efficiently, that is, they are producing at their production frontier (allocative efficiency) with maximum output for given inputs (technical efficiency), and therefore, are cost minimizers (Frantz 1988 cited at Taylor 2003). The assumption of perfect internal organizational operations: no coordination failure, no prisoners dilemma and no market failure, can be considered to be dubious given the fact that performance indicators show inefficiency. This means, in reality, producers are not always efficient. Two identical firms may not produce the same output; cost and profit are not the same. This difference in output, cost and profit could be explained in terms of technical and allocative inefficiencies and same unforeseen exogenous shocks.

Technical Efficiency

A machine or appliance or organization is technically efficient if it is adequate to the demands made on it, or it lives up to the claims made for it; for example, reliability and quickness of bank service to customers. Technical efficiency may also be assessed on the basis of some quantitative standard of performance, such as degree to which a domestic heating appliance converts the potential heat contained in a unit of fuel in to unit of actual heat. In banking a standard time required serving a customer (loan processing, processing of transactions etc.) could be taken as performance measurement. Technical efficiency is doing a task in a cheapest possible way that is producing a given level of output from the

lowest possible combination of inputs or producing the maximum output given the level of inputs employed. It reflects the ability of firm or decision making unit to attain the maximum output from a given set of input. Thus, a technically efficient production could produce the same output with less of at least one input, or could use the same input to produce more output.

The level of technical efficiency of a particular firm is characterized by the relationship between observed production and some ideal or potential production (Green, 1993). The measurement of firm's specific technical efficiency is based up on deviations of observed output from the best production of efficient frontier. If a firm's actual production point lies on the frontier, it is perfectly efficient. If it lies below the frontiers, then it is technically inefficient (Cheer, 2002)

Allocative Efficiency

Allocative efficiency measures the skill in achieving the best combination of inputs by taking in to account their relative prices or produces the right mix of outputs given the set of prices (Kumhaker & Hevell 2000). It reflects the capability of a firm to utilize input in optimal proportion, given their respective prices and the production technology. In other words, allocative efficiency refers to whether inputs for a given level of output and set of input prices are chosen to minimize the cost of production; assuming that the firm being examined is already fully technically efficient. It operates on the least cost expansion path, i.e. the point where the marginal rate of technical substitution is equal to input price ratio. This is very important when one input can be substituted for another in the process of production.

The analysis of efficiency carried out by Farrel (1957) can be explained in terms of Figure 1.1

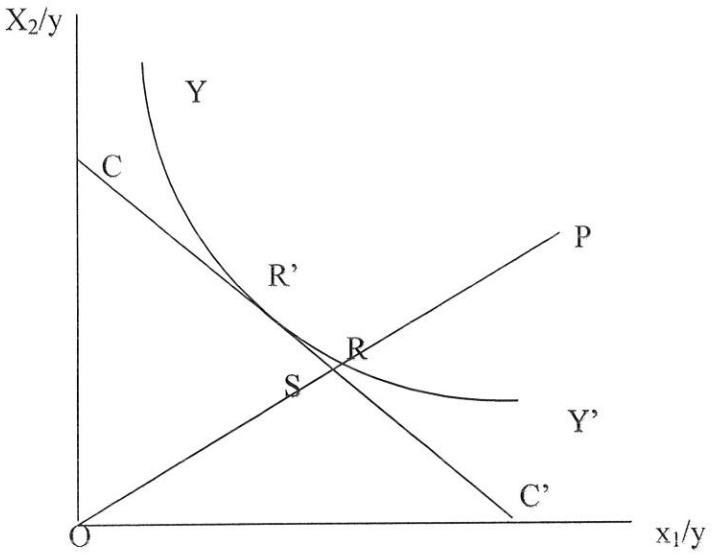


Figure 1.1 Technical and allocative efficiency measures

The technical set fully described by the unit Isoquant yy' that capture the minimum combination of inputs per unit of output needed to produce a unit of output. Thus, under this framework, every package of inputs along the unit Isoquant is considered as technically efficient while any point above and to the right of it, such as point P, defines a technically inefficient producer since the input package that is being used is more than enough to produce a unit of output. Hence, the distance RP along the ray OP measures the technical inefficiency of producing at point P. This distance represents the amount by which all inputs can be reduced without decreasing the amount of output. Geometrically, the technical inefficiency level associated to point P can be expressed by the ratio RP/OP, and therefore, the technical efficiency (TE) of the producer under analysis (1-RP/OP) would be given by the ratio OR/OP.

If information on market prices is available and a particular behavioral objective such as cost minimization is assumed in such a way that the input price ratio is reflected by the slope of the isocost-line CC', allocative inefficiency can also be desired from the unit isoquant plotted in figure 1.1. In this case, the line segment SR gives the relevant distance, which in relative terms would be the ratio SR/OR. With respect to least cost combination of inputs given by point R', the above ratio indicates the cost reduction that a producer would be able to reach if it moved from a technically and allocatively efficient one (R'). Therefore, the allocative efficiency (AE) that characterizes the producer at point P is given by the ratio OS/OR.

The product of technical and allocative efficiency measures gives economic Efficiency:

$$EE = TE \times AE = OR/OP \times OS/OR = OS/OP$$

Scale Efficiency

Scale Efficiency often arises from the ability of large firms to allocate fixed costs such as advertising expenses or cost of technology across a greater volume of output. It also shows whether the decision-making units (e.g. banks) operate at the minimum of their long run average cost curve. It focuses on technical efficiency, which is the ability of a bank to produce maximal output from a given set of inputs over a certain time period (Adongo et al, 2005). Scale economies are usually measured using data on all banks in the sample rather than just using the data on all of the banks. Scale Economies theoretically apply only to the production possibilities frontiers where firms are fully X-Efficient and minimize costs for every scale of output (Berger and Humphrey, 1994).

Scope Efficiency

Scope Efficiency may result from sharing information, such as knowledge of customer's habits, across products line. It refers to change in product mix related to cost. It occurs when it is more economical to produce two or more products jointly in a single production unit than to produce the products in separate specializing firms. Scope economies could emanate from two sources: i) spreading of fixed cost over an expanded product mixes and ii) cost complementarities in producing different products. Spreading

fixed cost occurs, for example when the fixed capital of a bank or its branches is more fully utilized by issuing many types of deposits to local residents than building separate offices to fulfill the separate demands for transactions accounts, saving accounts, consumer loans and business loans. Such economical spreading of costs occurs to the extent that the production of different types of services requires much the same type of computer, accounting system and other fixed inputs of a branch and there is insufficient local demand to justify a full specialized branch for each of the services. In contrast, cost complementary between deposits and loans occur for example, when the payment flow information developed in producing deposit services is used to reduce the costs of acquiring credit information and monitoring loans to the same customer. However, there is problem in applying the translog cost/profit function or other multiplicative specification to evaluate scope economies.

X-Efficiency

Professor Harvey Leibenstin (1966) was the first to introduce the concept of X-inefficiency. He defined it as the loss at which a bank is operating (deviation from the optimum). X-inefficiency is an intra-firm inefficiency or the deviation from the production efficient frontier, which depicts the maximum attainable output for a given level of input. This inefficiency can arise from management practice and the environment. X-inefficiency reflects the differences in managerial ability to control cost and/or maximize profits but not suboptimal economies of scale or scope. It has been linked to managerial quality. Empirical X-inefficiency is a measure of how banks utilize their inputs to produce a given level of output. Berger et al (1993) describe X-inefficiency, as a variance from the efficient frontiers set by the best practice or benchmark firm. It incorporates two components, those technical and allocative inefficiencies (Allen & Rai, 1996). According to Farrell (1957) technical inefficiency occurs due to sub optimal usage of input leading to waste, while allocative inefficiencies arise from inappropriate mix or composition of inputs using inefficient business process. Both inefficiencies are attributed to employee, management or environment factors.

Despite the lack of harmony across all methods, it seems clear that x-efficiency differences are much more important than scale and scope efficiencies in banking. Most of the studies find that average cost X-inefficiencies are on the order of 20% higher for virtually all size classes of banks, as apposed to scale inefficiencies. Scope inefficiencies are difficult to measure but also appear to account for 5% or less of costs (Berger and Humphrey, 1994, Berger et al, 1997).

Duality concepts have the best economic foundation for analyzing the efficiency of banks for they are based on economic optimization in reaction to market price and competition. The following sections will discuss cost and profit x-efficiency based on the duality concept.

Cost-Efficiency

Cost efficiency gives a measure of how close a bank's cost is to what a best practice bank's cost would be for producing the same output bundle under the same conditions (environment, rule and regulation). It is derived from a cost function in which variable cost depends on the prices of variable inputs, the quantities of variable outputs and any fixed inputs or outputs, environmental factors and random error, as well as efficiency. Such cost function may be written as:

$$C = c(w, y) + \mu_c + v_c \text{ ------(1)}$$

Where, C measures variable costs, w is the vector of price of variable inputs, y is the vector of quantities of variable outputs, μ_c denotes inefficiency factor that may raise costs above the best-practice level, and v_c denotes the random error that incorporates measurement error and luck that may temporarily give banks high or low costs. The inefficiency factor μ_c incorporates both allocative inefficiencies (from failing to react optimally to relative prices of inputs, w) and technical inefficiencies (from employing too much of inputs to produce y). To simplify the measurement of efficiency, the inefficiency and random terms μ_c and v_c are assumed to be multiplicatively separable from the rest of

the cost function, and both sides of equation 1 can be represented in natural logs as follows:

$$\ln C = \ln f(w, y) + \mu_c + v_c \text{ ----------(2)}$$

Where, f denote some functional form. The term, $\mu_c + v_c$ is treated as various X-inefficiency and composite error terms measurement.

We define the cost efficiency of bank 'b' as estimated cost needed to produce bank b's output vector if the bank were as efficienct as the best practice bank in the sample facing the same exogenous variable (w, y) divided by the actual cost of bank b, adjusted for random error. That is

$$\cos tEff^b = \frac{C^{\min}}{C^b} = \frac{\exp\left[f\left(w^b, y^b, z^b, v^b\right)\right]}{\exp\left[f\left(w^b, y^b, z^b, v^b\right)\right]} \frac{\exp\left[\ln u_c^{\min}\right]}{\exp\left[\ln u_c^b\right]} = \frac{u_c^{\min}}{u_c^b} \text{ ---------- (3)}$$

When $u_c^{\min}$ is the minimum u_c^b across all banks in the sample.

The cost efficiency ratio may be thought of as the proportion of cost or resources that are used efficiently. Cost efficiency ranges over (0, 1), and equals one for the best practice firm with in the observed data.

Standard Profit Efficiency

Standard profit efficiency measures how close a bank is to producing the maximum possible profit given a particular level of input prices and output prices (and other variables). In contrast to the cost function, the standard profit function specifies variable profits in place of variable costs and takes variable output prices as given rather than holding all output quantities statistically fixed at their observed possibly inefficient levels. That is, the profit dependent variable allows for consideration of revenues that can be earned by varying outputs as well as inputs. Output prices are taken as exogenous, allowing for inefficiencies in the choice of outputs when responding to these prices.

The standard profit function, in log form, is

$$\ln(\prod + \theta) = \ln f(w, p) + \mu_\pi + v_\pi \text{ -----(4)}$$

Where Π is the variable profit of the firm, which includes all the interest and non interest income earned on the variable output minus variable costs, C, used in the cost function; θ is a constant added to every firm's profit so that the natural log takes a positive number. It is defined as $\left|\prod^{\min}\right| + 1$; p is the vector of prices of the variable output; v_π represents random error; and μ_π represents inefficiency that reduces profits.

We define standard profit efficiency as the ratio of the predicted actual profits to the predicted maximum profit that could be earned if the considered bank was efficient as the best bank in the sample, net of random error, or the proportion of maximum profits that are actually earned.

$$Std \prod Eff^b = \frac{\prod^b}{\prod^{\max}} = \frac{\left\{\exp\left[f\left(w^b, p^b, z^b, v^b\right)\right]\right\}}{\left\{\exp\left[f\left(w^b, p^b, z^b, v^b\right)\right]\right\}} \frac{\exp\left[\ln u_\pi^b\right] - \theta}{\exp\left[\ln u_\pi^{\max}\right] - \theta} \text{ --------(5)}$$

Where, $u_\pi^{\max}$ is the maximum value of u_π^b in the sample

Standard profit efficiency is the proportion of maximum profits that are earned. The profit inefficiency is due to excessive costs or deficient revenues or both; the firm is losing the profit it could be earning. Similar to the cost efficiency ratio, the profit efficiency ratio equals one for a best-practice firm that maximizes profits for its given conditions within the observed data. Unlike cost efficiency, however, profit efficiency can be negative since firms can throw away more than 100% of their potential profits.

Profit efficiency concept is superior to cost efficiency concept for evaluating the overall performance of firms. This is because, profit efficiency accounts for errors on the output side as well as those on input side. Besides, profit efficiency is based on the more accepted economic goal of profit maximization, which requires that the same amount of managerial attention be paid to raising a marginal dollar of revenues as to reducing a marginal dollar of costs.

Moreover, profit efficiency is based on comparison with the best practice point of profit maximization within the data set, where as cost efficiency evaluates performance-holding output constant at its current level, which generally will not correspond to an optimum profit. A firm that is relatively cost efficient at its current output may or may not be cost efficient at its optimal output, which typically involves a different scale and mix of outputs.

Thus, standard profit efficiency may take better account of cost inefficiency than the cost efficiency measure itself, since standard profit efficiency embodies the cost inefficiency deviations from the optimal point.

Alternative Profit Efficiency

Alternative profit efficiency measures by how close a bank comes to earning maximum profits given its output levels rather than its output prices. It is helpful when some of the assumptions underlying cost and standard profit efficiency are not met. The alternative profit function employs the same dependent variable as the standard profit function and the same exogenous variable as the cost function. Thus, instead of counting deviations from optimal output as inefficiency, as in the standard profit function, variable output is constant as in the cost function while output prices are free to vary and affect profits. The alternative profit function in log form is:

$$\ln(\prod + \theta) = \ln f(w, y) + \mu_{a\pi} + v_{a\pi} \text{ -----(6)}$$

This is identical to the standard profit function eqn. (4) except that y replaces p in the function, f, yielding different values from the inefficiency and random error terms, $\mu_{a\pi}$ and $v_{a\pi}$ respectively.

As with standard profit efficiency, alternative profit efficiency is given by the ratio of predicted actual profit to the predicted maximum profits for a best practice bank.

$$Alt\prod Eff = \frac{\prod_a^b}{\prod_a^{\max}} = \frac{\left\{\exp\left[f\left(w^b, y^b\right)\right]\exp\left[\ln u_{a\pi}^b\right]\right\} - \theta}{\left\{\exp\left[f\left(w^b, y^b\right)\right]\exp\left[\ln u_{a\pi}^{\max}\right]\right\} - \theta} \text{ ---------- (7)}$$

Here, efficiency values are allowed to vary in an important way with output prices, but errors in choosing output quantities do not affect alternative profit except through the point of evaluation $f\left(w^b, y^b\right)$ to the extent that the best practice bank is not operating at the same (w, y) as bank b.

Standard profit efficiency and cost efficiency would appropriately measure how well the firm was producing outputs and employing inputs relative to best practice firms. However, alternative profit efficiency may provide useful information only when one or more of the following conditions hold:

a) Substantial unmeasured differences in the quality of banking services

The alternative profit function provides a way of controlling for unmeasured difference in output quality, since it considers the additional revenue that higher quality output can generate. If output markets are competitive and customers are willing to pay for the additional services provided by some banks, these banks should receive higher revenues that just compensate for their extra costs. Banks would be sorted in to market niches that differ by service quality or intensity, with customers who need or prefer higher quality or customers are willing to pay higher prices for services exceeding their needs. Since the higher interest rate or fees received by the higher quality providers just cover their extra production costs, these banks survive in competitive equilibrium. The alternative profit function essentially replicates the cost function except that it adds revenues to the dependent variable. It accounts for the additional revenue earned by higher- quality banks, allowing it to offset their additional costs of providing the higher service levels. So it does not penalize high-quality banks in terms of their efficiency measures, where as the cost function does.

b) Outputs are not completely variable, so that a bank cannot achieve a scale and product mix.

Alternative profit efficiency might also prove useful if the variable outputs are not completely variable. Banks differ in size even with in the same local markets. But the standard profit function essentially treats large and small banks as if they should have the same variable outputs when facing the same input and output prices, fixed outputs and environmental variables specified in the standard profit function. Thus, unless the (w,p,) variables give a strong prediction about the size of the bank, a scale bias may occur in the standard profit function, as larger banks have higher profit that are not explained by the exogenous variables. That is, larger banks may (arguably mistakenly) be labeled as having higher standard profit efficiency than smaller banks, by virtue of the fact that small banks cannot simply reach the same output level. This potential problem does not occur to the same degree for the alternative profit function, since outputs are held constant statistically. That is, alternative profit efficiency compares the ability of banks to generate profits for the same levels of output and therefore, reduces the scale bias that might present in the standard profit efficiency measure.

c) Firms exercise some market power in setting output prices

The standard profit function takes output prices as given and embodies the assumption that the considered bank can sell as much output as it wishes without having to lower its prices. This can lead to an understatement of standard profit efficiency for firms with output below efficient scale, since these firms might have to reduce their prices to increase output and, therefore, cannot earn as much maximum potential profits as we measure it.

Under conditions of market powers, it may be appropriate to consider output levels as relatively fixed in the short run and allow for efficiency differences in the setting of prices and service quality. Firms with market power may be able to increase revenue more than costs by increasing service quality because there may not be other competitors or potential competitors at that quality niche. It is also possible that optimizing choice

may help to economize on service quality and keep costs relatively low. Alternative profit efficiency measures the extent to which firms are able to optimize in their choices of prices and service quality, as well as their abilities to keep costs low for a given output level. Alternative profit efficiency will also incorporate differences across firms in market power and their abilities to exploit it, which is good for the owners of a bank, but is not good from the social point of view in the same way that the other efficiencies are. Alternative profit efficiency may be viewed as a robustness check on standard profit efficiency, which takes prices as fixed and allows outputs to be totally variable.

d) Inaccuracies in output price data

If the output price vector, p, is well measured, it should be strongly related to profits and explain a substantial portion of the variance of profits in the standard profit function. If prices are measured inaccurately as given the available banking data, the predicted part of the standard profit function would explain less of the variance of profits and yield more error in estimation of the efficiency term $\mu_{a\pi}$. In this event, it may be appropriate to try specifying other variables in profit function that might yield a better fit, such as the output quantity vector, 'y', as in the alternative profit function.

This study focuses on both cost and alternative profit efficiency concepts, concurrently for comparison.

3.1.2. Input-Output specifications

The concept of economic activity as an input-output process is perhaps the most basic concept of economics. Nevertheless it is vague, and various difficulties emerge when an effort is made to specify the inputs and outputs involved and to define the nature of transformation implied (Boulding, 1961 cited at Kwan, 1996).

Frich (1965) defined production as a process of transformation, directed by human beings, which is considered desirable by some individuals. Transformation implies that certain goods or services (inputs) enter a process where they lose their identity, i.e. cease to exist in the original form while other goods and services (outputs) are generated.

However, the production process in banking involves the use of deposits and other assets. It is therefore a stock concept, unlike the outputs of manufacturing firms can be measured in terms of quantity once the goal is clearly defined (Kwan, 1996)

The non-tangible nature of bank output and theoretical gap in the banking literature on multi-input-multi-output structure causes confusion in the definition of output measurement. There are two different methods of tackling this problem; production approach and asset /intermediation approach.

3.1.2.1. Production Approach

Banks are thought as primarily producing services for account holders; they are considered as firms, which employ capital and labour to produce different types of deposit and loan accounts. They perform transactions and process documents for customers, such as loan application, credit reports, and payment instruments. Under this approach outputs are measured by the number of deposit and loan accounts or number of transactions performed on each type of product, while total costs are the operating costs used to produce these products. Banks are viewed as producers of two types of services: deposits of funds and users of funds.

3.1.2.2. Intermediation approach

Banks are considering as primarily intermediating funds between savers and investors; they are intermediates of financial services rather than producing loan and deposits account services. Since service flow are not usually available, the flows are typically assumed to be proportional to the stock of financial value in the accounts, such as the number of dollars of loans, deposits (Berger and Humphery, 1991). Here, input of funds and their interest cost should be included in the analysis, since funds are the main 'row material' which is transformed in the financial intermediation process. This means, banks give intermediation services through the collection of deposits and other liabilities and the transfer of these funds to interest earning assets (Sealey and Hendly, 1997 cited at Isik and Hassen, 2002). Deposits are included as third input along with capital and labour. As

a result, Operating costs, as well as interest costs, are taken in to account in the production process.

Both approaches do not capture the dual roles of banks as

a) Providing transaction (document processing services), and
b) Being as financial intermediaries that transfer funds from savers to investors.

But each of the approaches has some advantages. The production approach may be some what better for evaluating the efficiencies of branches of banks because branches primarily process customer documents for the institution as a whole and branch managers typically have little influence over bank funding and investment decisions. The intermediation approach may be more appropriate for evaluating entire banks because this approach is inclusive of interest expenses, which often accounts for one half to two third of total cost.

As well, the intermediation approach may be superior for evaluating the importance of frontier efficiency to the profitability of the bank, since minimization of total costs, not just production costs is needed to maximize profits. Here, this paper follows intermediation approach.

3.2. Empirical literature review

The studies on economic efficiency are still having debating issues to researchers. The present theory provides only few guidelines for this. The bulk of the information on this aspect comes from the empirical analysis of the economic forces operating at industry level (banks) (R.R.Barthwal, 1984). Thus in the next part we will examine major empirical issues on bank efficiency.

Berger and Humphrey (1997) estimate the efficiency of financial institution using five different frontier approaches. This study surveys 130 studies that apply frontier efficiency analysis to financial institutions in 21 countries and found out an average efficiency of banking sectors around 77 percent.

Berger and Mester (1997) using panel data on US banks over the period 1990-95 estimate cost and profit efficiency by Fourier flexible frontier approach. They found that inefficiency are quite large, on the order of 20 percent or more of total banking industry costs and about half of the industry's potential profits.

Taylor and Franceis (1998) analyze Australian credit union using a stochastic cost frontier approach. The cost inefficiency estimates range from 0.04 to 0.12 with a mean inefficiency level of 0.07. The suggestion is that a typical credit union in 1995 produces its products at a cost that was approximated seven percent greater than necessary, with over all inefficiencies ranging from five percent to over twelve percent.

Isik and Hassen (2002) used panel data of Turkish banks from year 1988-96 to estimate stochastic cost and profit efficiency. They found out that the average cost and profit efficiencies over the year studied were about 90 percent and 84 percent respectively. This implies that during the period, Turkish banks would have needed only 90 percent of the resource they used to produce the services they generated, while earning only 84 percent of their potential profit on average.

Tefula (2002) applied the transandental logarithmic model on panel data to measure cost and profit efficiency of 89-banks drawn from nine sub-Sahara Africa countries over a period of eight years. He found that a mean profit and cost inefficiencies 34 percent and 19 percent respectively.

Kumbhakar and Sarkay (2004) estimated the Indian bank cost efficiency using panel data stochastic frontier approach. During the study periods that the Indian banking system was exhibited significant inefficiency, with the mean efficiency score varying from 69 percent in 1996 to 75 percent in 2000. The mean efficiency of the banking system as a whole, as well as each group, recorded an increasing trend.

Maggie and Hetternan (2005), applied stochastic frontier approach for a period of 1995-2002 to measure X-efficiency of China's banking sector. The mean x-efficiency score for 187 observations was 0.407. Suggesting that, for a given level of output the banks could use inputs more efficiently and so reduces costs by approximately 60 percent.

Bouchaddakh and salah (2005), using stochastic frontier approach scores cost efficiency of the Tunisia banks over the period 1997-2003, found an average cost efficiency of 86 percent. This reflects a degree of inefficiency of 14 percent. These scores mean that Tunisian banking industry could have obtain the same output by using only 86 percent of the resource available over the period 1997-2003 and that the wasting of resources over the same period was to a total value of 14 percent.

Andog et al. (2005) estimate the alterative profit X-efficiency of Namibian and Botswanan banks using stochastic frontier approach for the year between 1998 and 2003. The mean level of alterative profit x-efficiency for the over all banking sector in Namibia and Botswana were 83.4 percent and 63.7 percent respectively.

Studies on cost and profit efficiency of commercial banks in Ethiopia are almost not done. Muluneh Ayalew (May. 2006) is the one that work on cost efficiency of private commercial Banks in Ethiopia using stochastic frontier approach for the year between 1997 and 2005. He found that the cost efficiency for the first quarters of estimation period 67 percent and during the last four quarter of the period of estimation 89 percent. That means, the banks under review have began to operate to a point closer to the cost frontier during the last four quarters compared to the beginning four quarters.

We can comprehend from the empirical evidence that production technology in banking industry deviates from the efficient frontier suggesting that all banking industry have affected by some degree of inefficiency.

In subsequent to these results, several studies have also tried to find out the major influencing factors that cause inefficiency in the banking industry. Berger and Humphrey (1997) and Berger and Mester (1997) were stated major determinants of efficiency in financial institutions particularly in banking industry. They categorized the variables in to six categories: Bank size, Organizational form and corporate governance, other bank characteristic (like age, loan to deposit ratio…), market characteristics (like degree of local deposit market), regulation and risk. The cost and profit efficiency together seems to imply that as banks grow higher (increase in bank size), they are equally able to control cost, but it becomes harder to effectively create revenues. With regarding to

organizational form and corporate governance, empirical evidences confirm that to the extent that outside share holders can exert control over bank management; public traded banks become more efficient both in profit and cost. Growth of market demand for branch services allow less cost efficiency in the short run but more profit efficiency. Different indicators can capture the risk of banks; ratio of non-performing loan is the one that has negative relationships with efficiency as per the empirical evidences. According to Muluneh (2006) in the context of private commercial banks cost efficiency in Ethiopia branch network and asset size had positive relation with x-efficiency while capital was negatively related with x-inefficiency. However, age had insignificant positive relation with x-inefficiency.

In general, the determinant factor results are quite mixed; some of the potential correlates of efficiency have the predicted signs and statistically significant while others have little influences on efficiency and some have unexpected or mixed sign.

CHAPTER FOUR
METHODOLOGY AND DATA SOURCES

4.1. Techniques for measuring efficiency

Since engineering information on the technology of financial institution is not available, studies of frontier efficiency rely on accounting measures of costs, outputs, inputs, revenues, profits, etc to impute efficiency relative to the best practice within the available sample. However, there are really no consensus on the preferred method for determining the best practice frontier against which relative efficiencies are measured.

Five types of approaches have been employed in evaluating the efficiency of financial institutions and/or their branches. These methods differ primarily in the assumption imposed on the data, in terms of:

- The functional form of the best practice frontier,
- Whether or not account is taken of random error that may temporarily give some production units high or low outputs, inputs, costs or profits, and
- If there is random error, the probability distribution assumed for the inefficiencies (e.g. half normal, truncated normal) used to disentangle the inefficiencies from the random error.

Thus, the established approaches to efficiency measurement differ primarily in how much shape is imposed on the frontier and the distributional assumptions imposed on the random error and inefficiency.

4.1.1. Non parametric Approaches

Non-parametric approach involves the use of linier programming methods to construct a non-parametric piece wise surface (frontier) over the data without recurring explicit specification of functional form for either cost or production functions. Efficiency measures are then calculated relative to this surface. Data Envelopment analysis (DEA) and Free Disposal Hull (FDH) are the most common and widely used non-parametric methods.

However, it has three weaknesses. Firstly it does not assume a random error term. Secondly, it assumes no measurement error in constructing the frontier. Thirdly, deviation from the efficient frontier is regarded as inefficiency for some units. Thus, these weaknesses would cause to overstate the inefficiency.

4.1.2. Parametric approaches

Parametric approaches prespecify the functional form for the best frontier. A bank is labeled inefficient, if its costs are higher or profits are lower than the best practice bank after removing random error. The three main parametric frontier approaches are: Distribution Free Approach (DFA), Thick Frontier Approach (TFA) and Stochastic Frontier Approach (SFA). The study only explains SFA.

4.1.2.1. Stochastic Frontier Approach (SFA)

Sometimes SFA refers as economic frontier approach. SFA specifies a functional form for cost, profit or production relationship among inputs, outputs and environmental factors and allows for random error. SFA posits a composite error model where inefficiencies are assumed to follow asymmetric distribution, (usually the half normal), while random errors follow a symmetric distribution, (usually the standard normal distribution). The logic is that the inefficiencies must have a truncated distribution because inefficiencies cannot be negative. Both the inefficiencies and the errors are assumed to be orthogonal to the input, output and environmental variables specified in the estimating equation. The estimated inefficiency for any firm is taken as the conditional mean or mode of the distribution of the inefficiency term, given the observation of composed error term.

The disagreement on frontier model among researchers at present comes to one focus by preferring the lesser of the evils. The parametric approaches commit the sin of imposing a particular functional form (and associated behavioral assumptions) that presupposes the share of the frontier. If the functional form is mis-specified, measured efficiency may be confounded with the specification errors.

The non-parametric studies impose less structure on the frontier but commit the sin of not allowing for random error owing to luck, data problems, or other measurement errors. If random error exists, measured efficiency may be confounded with these random deviations from the true efficiency frontier.

The non-parametric methods generally ignore prices and can, therefore, account only for technical inefficiency in using too many inputs or producing too few outputs. These can not account for allocative inefficiency in mis-responding to relative prices in choosing inputs and outputs, nor can they compare firms that tend to specialize in different inputs and outputs, because there is no way to compare one input or output with another without the benefit of relative prices. In addition, similar to cost function there is no way to determine whether the inputs being produced in optimal without value information on the outputs. Thus, the non-parametric techniques typically focus on technological optimization rather than economic optimization and does not correspond to the cost and profit efficiency concepts.

So, we focus on alternative stochastic frontier approach to overcome the aforementioned drawbacks of linear programming method and other parametric methods and have become the most popular and widely used parametric approach for the measurement of economic efficiency (ZAMORANO, 2004).

4.2. Model Specification

This paper employs parametric stochastic frontier approach to examine X-efficiency of private commercial banks in Ethiopia. The approach would enable one measuring technological and allocative efficiencies. It also allows the separation of random error from the inefficiency term and avoids the consideration of exogenous events as inefficiency, where as the non-parametric techniques focus merely on analyzing technological efficiency.

We follow a two-stage estimation procedure so as to avoid the negative consequences of the one stage estimation procedure. (1) Dependent on the number and scaling of the independent factors in the single-stage maximum likelihood optimization becomes very lengthy and unstable. Different algorithms and small changes in the optimization rules lead to early abortion of the optimization procedure and/or to obtain very different estimation results. It should be noted that rescaling the independent factors is not an option. Though it could solve some optimization problems, at the same time it leads to model coefficients that are not very reliable. (2) Technical problem with a single stage procedure is that it does not allow us to adequately measure the marginal impact of the independent factors and their combined impact (Bos and Kool, 2004).

Hence, in the first stage we estimate cost and profit functions of all private commercial banks using maximum likelihood method. Then, we extract the inefficiency terms of profit and cost of the banks. The second stage take the inefficiency term driven from the first stage as dependent variable, and analyse the marginal impact of determinant factors (i.e. operational specific variable, market specific variable, macro variable, and risk variable) of inefficiency using OLS method.

4.2.1. Stochastic Cost and Profit frontier function

The core principle of parametric methods is based on introducing a composite error term and disentangling the inefficiency component from it. Following Kumbhhakor and Lovell (2000), a stochastic frontier functional form is expressed as:

$$C_{it} \geq c\,(y,w,\beta)\exp\{\varepsilon_{it}\} \text{ ---------- (1)}$$

$$\Pi_{it} \geq \pi\,(y,w,\beta)\exp\{\varepsilon_{it}\} \text{ ---------- (2)}$$

Where $C_{it}=\sum_n w_{ni}x_{ni}$ is the total expenditure incurred by bank 'I' facing the prices $w_n > 0$ for inputs x_{ni} and producing a vector of output Yi; β is a vector of parameters to be estimated. c $(y_i\ w_i,\beta)\exp\{\varepsilon i\}$ and $(y_i,w_i,\beta)\exp\{\varepsilon_i\}$ represent the stochastic cost and profit frontier. They consist of two part: a deterministic part c (y_i, w_i,β) for cost and π (y_i,w_i,β) for profit that is common to all banks and a bank-specific random term (error term), $\exp\{\varepsilon_i\}$, random shocks faced by each bank.

The random shock is considered as a composite error term, $\varepsilon_i = \mu_i + v_i$ consisting of the inefficiency factor μ_i which brings the cost and profit above /below/ those of the best performing bank and v_i standing for the random error to account for measurement error or other exogenous factors which can temporarily either increase or decrease the cost/profit (Podpiera at el, 2005)

We specify the functional relationship in equation (1) and (2) in logarithmic form as follows.

$$\ln C = \ln c(y_i, w_i, \beta) + \mu_i + v_i \quad i=1,2,\text{------}n \quad \text{--------} \quad (3)$$

$$\ln(\Pi + \theta) = \ln \pi(y_i, w_i, \beta) + \mu_i + v_i \quad \text{----------} \quad (4)$$

Estimating equation (3) and (4) requires

a) Specification of functional form for deterministic kernel,

b) An assumption about distribution of the random variable v_i, which is independently and identically, distributed normal random variable with mean zero and a constant variance i.e. $v_i \square iidN\left(0, \sigma_v^2\right)$, and

c) An assumption about distribution of random variable μ_i a component of non-negative random variable accounting for inefficiency in the cost /profit function. It is a deviation from the frontier, due to factors that are under the control of management as opposed to v_i s which are beyond the control of management. μ_i s are distributed either half normal or exponential distribution, while later, models assumed a more general truncated normal distribution for μ_i, with the truncation point occurring at zero to ensure non negativity of μ_i (Aigner, et al 1977; Kasak and Zajc, 2004; Jandrow et al, 1982.)

Based on Stochastic frontier prior distribution assumption of μ_i s the unknown parameters can be estimated using the maximum likelihood (ML) technique. This can be done to judge the appropriateness of the stochastic frontiers vis a vis the ordinary least square (OLS) functional approach of modeling efficiency.

Given those assumptions, the log likelihood function for the sample of N banks can begiven as (Kumbhaker and Lovell 2000)

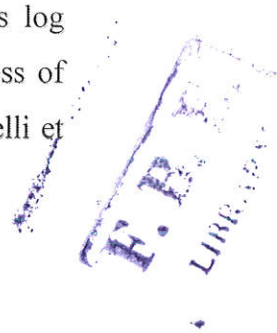
$$\ln = \text{constant} - N\ln\sigma + \sum\ln\phi\,(\varepsilon\lambda/\sigma) - 1/2\sigma^2\sum\varepsilon^2 \text{ ----------(5)}$$

$\varepsilon_i = \mu_i + v_i$, $\sigma_s^2 = (\sigma_\mu^2 + \sigma_v^2)$, $\lambda = \sigma_{ui}/\sigma_{vi}$ and $\phi(.)$ is the standard normal cumulative distribution function. Bettese and Corra (1977) suggested that the parameterization $\gamma = \sigma_\mu^2 / (\sigma_\mu^2 + \sigma_v^2)$, be used in place of $\lambda = \sigma_u/\sigma_v$ because the parameter space for γ can be searched for a suitable starting value for the iterative maximization algorithm involved (as the search can be restricted with in a known set). According to this scholars the log likelihood function, in terms of this parameterization is equal to:

$$\ln L = \text{constant} - N\ln\sigma + \sum\ln[1 - \phi(Z_i)] - 1/2\sigma^2\sum\varepsilon^2 \text{ ----------(6)}$$

Where $Z_i = \varepsilon_i/\sigma\sqrt{\gamma/1-\gamma}$

The log likelihood function can then be maximized with respect to the unknown parameters to obtain the ML estimates. Note that $\gamma(\lambda) \rightarrow 0$ when either $\sigma_\mu^2 \rightarrow 0$ or $\sigma_v^2 \rightarrow \infty$ and $\gamma(\lambda) \rightarrow 1$ when either $\sigma_\mu^2 \rightarrow \infty$ or $\sigma_v^2 \rightarrow 0$. In the first case, the stochastic frontier collapse to the OLS (average response function) with no inefficiency, while in latter case, the stochastic frontier collapse to the deterministic frontier with no noise. Thus log likelihood test on $\gamma(\lambda) = 0$ give us an information to decide on the appropriateness of stochastic frontier analysis Vis a Vis ordinary least square (Kumbhakar, 2004; Coelli et al, 1998).



The specification of cost and profit function in this paper takes translog form. Translog (Transcendental Logarithmic) function is the most popular parametric functional form used to estimate inefficiency, because it is sufficiently flexible functional form and it imposes no restriction up on returns to scale or substitution possibilities between inputs. However, it suffers by multicollinarity and degree of freedom; in fact the problem can be avoided by using panel data.

Most of the researchers utilized the fourier flexible version of the translog function, since it is a global approximation that adds orthogonal, fourier trigonometric (Sine and Cosine) terms to a standard translog functional form (Berger et al, 1993). This gives the data more freedom to choose shapes for best practice frontier, which greatly increase flexibility by allowing for many inflection points that help fit the frontier to the data whenever it is most needed.

Although, the translog form is not as good as Fourier Flexible frontier (FFF), from statically view point, FFF in addition to its unnecessary complication, it is not significant from an economic view point (Adongo, et. at., 2005). Empirical evidence shows that there is no difference in average efficiency. There is very little difference between the translog functional form and the fourier flexible form regarding inefficiency dispersion or ranking of X-efficiency estimate (Berger and Meser, 1997). The cost and profit functional form which this study employ look like:

$$\ln C = \alpha_o + \sum_{i=1}^{3} \alpha_i \ln w_i + \frac{1}{2}\sum_{i=1}^{3}\sum_{j=1}^{3} \alpha_{ij} \ln w_i \ln w_j + \sum_{k=1}^{3} \beta_k \ln y_k + \frac{1}{2}\sum_{k=1}^{3}\sum_{m=1}^{3} \beta_{km} \ln y_k \ln y_m + \sum_{k=1}^{3}\sum_{i=1}^{3} \delta_{ki} \ln y_k \ln w_i + v_i + u_i \quad --(7)$$

$$\ln(\prod + \theta) = \alpha_o + \sum_{i=1}^{3} \alpha_i \ln w_i + \frac{1}{2}\sum_{i=1}^{3}\sum_{j=1}^{3} \alpha_{ij} \ln w_i \ln w_j + \sum_{k=1}^{3} \beta_k \ln y_k + \frac{1}{2}\sum_{k=1}^{3}\sum_{m=1}^{3} \beta_{km} \ln y_k \ln y_m + \sum_{k=1}^{3}\sum_{i=1}^{3} \delta_{ki} \ln y_k \ln w_i + v_i + u_i \quad --(8)$$

Where C total cost

$\prod$ net profit

y_k the k^{th} output

w_i the i^{th}input price

v_i the error term

μ_i the inefficiency term

θ constant; it is the minimum profit of the considered bank generate.

Duality requires a number of restriction to be imposed a prior in order to estimate indirect cost and profit functions. Following Lang and Welzer (1996), the required symmetry and linear homogeneity in input prices is ensured by imposing the following parameter restrictions

Restriction 1, Linear homogeneity or homogeneity of degree one in prices

$$\sum_{i=1}^{3}\alpha_i = 1, \sum_{i=1}^{3}\alpha ij = 0 \text{ , for all i, } \sum_{i=1}^{3}\delta_{ki} = 0 \text{ for all i}$$

Dividing the total cost and the input prices by one of the price imposes these constraints of homogeneity.

Restriction 2, Standard symmetry or equality of error partial derivative entails.

$$\alpha_{ij} = \alpha_{ji} \text{ and } \beta_{km} = \beta_{mk}$$

4.2.2. Decomposing the error term

Once the parameter estimates in stochastic frontier model are known, the next step is to obtain the procedure specification inefficiency estimates. Estimates of ε_i, that is $\hat{\varepsilon}_i$ or $v+u$ are easily obtained from the residuals. However, this is composite estimate of $v+u$ from where we need to estimate on μ_i. It is obvious that $\hat{\varepsilon}_i$ contains information about μ_i. Since the expected value of v_i is equal to zero. μ_i is likely to be greater than zero when $\hat{\varepsilon}_i$ is greater than zero. Accordingly, the conditional distribution of v_i given ε_i could be exploited to get estimate of producer specific inefficiency. A firm specific cost/profit efficiency estimate of bank k at time t, is given by the mean of the conditional distribution of μ_{kt} given ε_{kt} (Jondrow, Lovell, Materov and Schimit, 1982) and known as JLMS technique. Either the mean or the mode of this conditional distribution is used as point estimator of inefficiency. (Coelli et al, 1998)

That is:

$$E(\mu_i/\varepsilon_i) = \sigma_*[\phi(\varepsilon_i\lambda/\sigma)/1-\Phi(-\varepsilon_i\lambda/\sigma) + (\varepsilon_i\lambda/\sigma)] \text{----------(9)}$$

Where $\sigma_*^2 = \frac{\sigma_\mu^2\sigma_v^2}{\sigma_\mu^2+\sigma_v^2}$ and we have used parameterization λ

Bettese and Coelli (1988), proposed another method point estimator for producer specific inefficiency:

$$E(\exp(-\mu_i)/\varepsilon_i) = 1 - \Phi(\sigma_A + \gamma\varepsilon_i/\sigma_A)/1 - \Phi(\gamma\varepsilon_i/\sigma_A)\exp(\gamma\varepsilon_i + 1/2\sigma^2{}_A \text{ ----- (10)}$$

Where $\sigma_A = \sqrt{\gamma(1-\gamma)\sigma_s^2}, \gamma\frac{\sigma_u^2}{\sigma_v^2}$

Using these estimates of producer specific inefficiency μ_i, we can obtain producer specific cost /profit efficiency.

$$CE=\exp\{-E(\mu_i/\varepsilon_i)\} \text{ ----------JLMS technique ----- (12)}$$

$$CE=E(\exp(-\mu_i)/\varepsilon_i) \text{ ----------Battese and Coelli methods – (13)}$$

Where CE denotes cost efficiency

This paper employs Battese and Coelli (1988) best predictor of exp $(-\mu_i)$ for the technique by JLMS is only first order approximation. This measure takes on the value between zero and one. One indicates a fully efficient bank while zero represents inefficient bank.

4.2.3. Time varying inefficiency model

To see the impact of policy intervention, it is of paramount importance to know the behavior of producer inefficiency (increasing, decreasing or constant). Bettese and Coelli (1992) proposed a time varying model that used to estimate the inefficiency effects in stochastic frontier production function for panel data, which is defined by

$\mu_{it} = \{ \exp [-\eta(t-T)] \ \mu_i, i=1,2,\text{----}N, \ t=1,2,\text{---}T\text{-----}(14)$

Where the μ_is are assumed to be *iid* as the generalized truncated normal random variable and is an unknown scalar parameter to be estimated.

In specification of the above equation (14), if the i^{th} firm is observed in the last period of the panel, period T, then $\mu_{it} = \mu_i$, because the exponential function, exp $\{-\eta(t-T)\}$, has value one when t=T. The random variable μ_i can be considered as the inefficiency effect for the i^{th} firm in the last period of the panel. For earlier periods in the panel, the inefficiency effects are the product of the inefficiency effect for the i^{th} firm at the last period of the panel and the value of the exponential function, exp $\{\eta(t-T)\}$, whose value depend on the parameter, η, ε, the number of period before the last period of the panel, $-(t-T)\equiv T-t$. If the parameter, η is positive, the $-\eta(t-T)\equiv\eta(T-t)$ is non negative and so exp $\{-\eta(t-T)\}$ is not smaller than one, which implies that inefficiency fall over time. Conversely, if η is negative, then the inefficiency increases over time.

4.2.4. Modeling inefficiency effects

A number of empirical studies (example Pitt and Lee, 1981 and Kalirajis, 1981) have investigated the determinant of inefficiency among firms in an industry (i.e. Banking) by regressing the predicted inefficiency effect obtained from an estimated stochastic frontier up on a vector of firm specific factors such as degree of competitiveness, input and output quality indicators, net work character(i.e. number of branches), ownership form, change in regulation, various management characteristic and the likes (Coelli, 1988 cited at Coelli et al, 1998 and Kumbhakar, 2004). The main motivations in second stage inefficiency analysis are to design appropriate policies to improve performance of producer and to rectify the problem that cause inefficiency.

However, a two-step procedure has its own shortcoming. None of the variable in the regression is completely exogenous and the endogenous of any regressor can bias the coefficient estimates on all the regressions and also makes conclusion about causation difficult.

As an alternative to regression analysis, simple correlations are provided in some papers to underscore the fact that causation may run in both direction (Berger and Messer, 1997 cited at Muluneh, 2006).

Bettese and Coelli (1995) specifies inefficiency effect in stochastic frontier model that are assumed to be independently (but not identically) distributed non-negative random variable. For the i^{th} firm in the t^{th} period inefficiency effect μ_{it} is obtained by truncation of normal distribution with mean, μ_{it}, and variance—

$$\mu_{it} = Z_{it}\delta + E_{it} \text{---- (15)}$$

Where Z_{it} is a (1xM) vector of observable explanatory variable whose values are fixed constants and δ is an (Mx1) vector unknown scalar parameter to be estimated, E_{it} is a random component ~ N $(0, \sigma^2_E)$.

OR

X-inefficiency variable μ_{it} can be expressed as follows:

μ_{it} =f (ROE, Capital, Asset, Branches Number, Share of deposit, NPL, GDP, δ) + E_{it}16

Where:

μ_{it} is X-inefficiency
ROE is return on equity
Capital is total capital of the bank
Asset is total asset of the bank
Branch number is total number of branches

Share of deposit is the share of total deposit of bank i from total banks deposit

NPL is total amount of non-performing loan

GDP is Gross Domestic Product

4.3. Data

4.3.1. Sample Selection

The analysis covers only six private commercial banks in Ethiopia during the period 2000-2005. Government Banks, Oromia cooperative Bank and Lion Bank are deliberately excluded this is not without a reason. The Commercial Bank of Ethiopia is still the leading bank maintaining the highest market share. Hence including the CBE to the sample would likely bias the result. The Development Bank of Ethiopia is excluded, as its very objective is not commercial oriented. It is intended to finance long-term investment. A simpler reasoning is given to Construction and Business Bank. It is a government bank. The Oromia Cooperative Bank is excluded for it is infant bank; it has been in operation for only two years. The Lion Bank is excluded because it has not yet officially inaugurated.

The error term component depends on length of study period. It is too short the random error might not average out, in which case random error would be attributed to inefficiency and it is too long, the firm core efficiency become less meaningful because of change of management and other events. Six year time period are accepted as a reasonable. (Berger and Messer, 1997) and hence the conclusions and policy recommendation to be drawn from the result of the present study would reflect the situation currently prevailed in the industry.

4.3.2. Data and Explanatory variable

All data and information used for the analysis are obtained from audited financial statement of all private commercial banks and interview feed back of banks' officials (which uses to supplement the some qualitative analyses). Other sources of information include annual and quarterly bulletins of National Bank of Ethiopia, various other bulletins, financial sector research working papers and financial journals.

We use an intermediation approach for input and out put specification.

The three out put used in this paper are: y_1, net loan amount, y_2, foreign currency deposits at correspondence banks and y_3, off balance sheet items. The inputs are: w_1 price of labors, w_2, price of physical capital and w_3, price of deposits.

Explanatory variables

The two-stage regression model analyses the potential correlates of X-inefficiency of profit and cost with exogenous variables. Such as bank strategic variable i.e. operational specific variables, market specific variable, macro economic variable and risk variable. These variables have a marginal impact on X-inefficiency.

Operational specific variable includes

Return on equity: measures profitability of the bank in a sense of income to share holder ratio. The higher the profitability of a specific bank implies a satisfactory performance of management. We infer an inverse relationship with X-inefficiency of cost and profit.

Capital and reserve: uses to absorb portfolio losses and an alternative to deposits as funding source for loans. It also allows banks to lend more for single borrower, enables the Bank to raise more funds by selling share, and to earn more profit. X-inefficiency of cost and profit is expected to have negative correlation with capital.

Asset: is the total worth of the bank and expresses the over all size of the bank. Large banks (i.e. own more assets) have more managerial inputs in identifying, resolving inefficiency. Cost and profit X-inefficiency will have inverse relationship with total asset.

Market specific variables include:

Number of branches (networks): are outlets that intermediation processes are taking place and products are delivered to customers. If a bank maintains various branches distributed through out the country's territory, it will attract more customers, mobilize more resources and maximize profit, provided that the branches are opened on adequate feasibility study. However, the cost of the bank would go up the more branches out lets it opened. Hence, X-inefficiency of cost has direct relation with number of branch while profit with X-inefficiency has inverse relation.

Bank deposit to total banks deposit: indicates the level and extent of the deposit market share of a bank in the industry. Banks usually earn more profit, if they are able to channel loans of various types to the different sector of the economy and collect them. At the same time, banks can incur more interest expense as interest bearing deposits are increased. Thus, we infer positive correlation with cost and negative relation with profit X-inefficiency.

Non-performing loan (NPL): loans whose arrears are reached higher level and an over due loan with less repayment or no repayment. Banks with more problem loans are likely to incur higher costs associated with extra monitoring and other sources of funds (Maggai et al, 2005). An increase in NPL may be due to bank X-efficiency. Thus, it has direct relationship with inefficiency. We use provision on loan as proxy of NPL, since the data on NPL is not available.

Gross domestic product growth rate: Once economic growth is sustainable and satisfactory, that country's financial infrastructure could be well established. Uncertainty for investors also becomes less. This creates a favorable environment to the well performance of banking industry and growth trajectory of the real sector. Therefore, we predict a negative relationship with X-inefficiency of cost and profit.

4.4. Estimation

The computer program of frontier version 4.1 is used to obtain maximum likelihood estimate of stochastic frontier of cost and profit function. The program was developed by Coelli (1996). There are two primary model specifications in the program. The first one uses to determine the time behavior of efficiencies (Bettese and Coelli, 1992) or call it model 1.

The other is (Bettese and Coelli, 1995) model or model 2, which is used to estimate stochastic frontier and predict firm level efficiency. Using these estimate function and then regressed the predicted inefficiencies up on firm specific variables and environmental variables.

CHAPTER FIVE

EMPRICAL RESULT AND DISCUSIONS

5.1. Econometric analysis

5.1.1. Hypothesis Testing

Here we test null and alternative hypotheses of parameters to determine the cost and profit functions and predicted inefficiency distribution that appropriately represents the data and the efficiency trend overtime.

1) The first null hypothesis test was selection of appropriate functional form. In order to estimates the null and alternative hypotheses and select the model that better describes the data, the generalized likelihood ratio test is required. Under the null hypothesis $H_0 : r = 0$, the model is equivalent to the conventional average function (OLS), which assumes no x-inefficiency effect, u_i =0. The test statistic is calculated as:

$$LR = -2\{\ln(L(H_0)) - \ln(L(H_1))\}$$

Where $L(H_0)$ and $L(H_1)$ are the values of the likelihood function under the null and alternative hypothesis, H_0 and H_1 respectively.

Table 1 shows the results obtained from frontier analysis and log likelihood function of cost and profit for the full stochastic frontier model is found to be 28.52 and -17.66 where as the value of OLS are 19.26 and -23.10, which are less than the full frontiers model of cost and alternative profit function respectively. These imply that generalized likelihood ratio statistics testing for the absence of x-inefficiency effects from the frontiers is calculated by:

$$LR = -2\{19.26 - 28.52\} = 18.52 \text{ - For cost}$$

$$LR = -2\{-23.10 - (-17.66)\} = 10.87 \text{ - For profit}$$

The critical values of cost and profit are 3.14 and 10.82 for degrees of freedom equal to 9 for both cost and profit as shown in table 1 (Kadde and Palm (1996)). There fore, 18.52 and 10.87 are significant because both exceed the critical values. Hence the null hypotheses that no x-inefficiency effects in private commercial banks are rejected. This implies the standard average response function does not adequately represent the data. As a result stochastic frontier function is selected to analyze the cost and alternative profit efficiencies of private commercial banks in Ethiopia.

Parameter γ (gamma) indicates the relevance of stochastic frontier model specification. It measures the variation between observed cost and profit x-efficiency and the best practice on the frontier. The acceptance of the null assumption $\gamma=0$ means that $\sigma_{u=0;}$ and that μ_i (x-inefficiency) must be removed from the model. But as shown in table 1, $\gamma\neq0$ and the share of inefficiency from total variance of cost and profit function were about 99 per cent and 74 per cent respectively. This suggest that the variance of error term ε or $(\mu+\nu)$ is explained much more by the variance of the component x-inefficiency μ than by that of the random error term ν. This reveals that the variation between actual value and the best practice on the frontier due to x-inefficiency. These ensure stochastic frontier model as appropriate to represent the data to measure the cost and alternative profit efficiency of private commercial banks in Ethiopia.

2) The second hypothesis test was a special case of the time varying inefficient model. The time invariant of inefficiency happened when $H_i:\eta=0$, which is considered as null hypothesis. This means no change in the x-inefficiency effect over time, given the specification of the time varying x-inefficiency model. The outcome in table 1 shows that, the positive value of η for the cost function was 0.13 and for the alternative profit function was 0.12. Though both functions have positive value, they have insignificant

t-ratio. This entails little improvement of cost and alternative profit x-inefficiency with in the sample period.

3) Third test is the distribution of μ (that is x-inefficiency). The null hypothesis $H_i : \eta_i = 0$, which specifies the stochastic frontiers x-inefficiency effects have a half normal distribution given the specification of alternative hypothesis, $H_1 : \mu \neq 0$. This means x-inefficiency distribution is truncated normal. The result found from the table reveals that cost x-inefficiency was -0.64, while alternative profit x-inefficiency was 0.21. They are insignificant in t-ratio, though the values of the μs are different from zero. Thus, the distribution of x-inefficiency in both function are half normal.

5.1.2. Maximum Likelihood Results of Cost and Alternative Profit x-(in)efficiency

Table 1 Estimation of the parameters using stochastic frontier model

Profit			Cost	
Parameters	**Coefficients**	**T-ratio**	**Coefficients**	**t-ratio**
B0	-82.5	-91.01	-157.49	-1.78
B1	24.7	26.91	3.97	0.38
B2	-10.03	-10.14	9.85	2.17
B3	-21.45	-21.79	1.74	0.41
B4	-1.46	-0.81	0.15	0.41
B5	0.028	0.2	0.11	0.33
B6	2.58	4.39	-0.71	-2.27
B7	0.22	0.15	-0.26	-2.61
B8	0.12	0.19	-0.26	-1.9
B9	-0.33	-0.13	0.42	3.8
B10	6.57	7.21	-17.9	-1.75
B11	6.62	3.33	26.64	1.88
B12	0.5	0.32	-0.62	-1.94
B13	-0.73	-5.89	15.28	1.83
B14	-0.021	-0.4	-1.11	-1.94
B15	-0.099	-0.23	0.78	1.37
B16	-2.18	-1.25	1.33	3.41
B17	-0.098	-0.0391	-0.42	-1.68
B18	-1.41	-71.13	-0.47	-0.6
B19	1.22	15.83	-1.03	-2.55
B20	1.29	5.13	0.0522	0.15
sigma square	0.33	0.21	0.24	3.18
gamma	0.73	0.38	0.96	71.98
mu	0.0214	0.38	-0.64	-1.23
eta	0.2	0.39	0.13	1.24
log likelihood		-17.66		26.23
LR test		10.87		13.95
number of restriction		9		9

Source: Author computation

Table 1 provides the estimated parameters of the translog cost and alternative profit function. Parameters of inefficiency function were estimated by frontier error correction model and technical efficiency model. Estimations were carried out using private commercial bank financial data for the period 2000-2005. The main focus of the analysis here is efficiency. Following, the conventional practice individual parameter estimates are not discussed, because the multicollinearity inherent in translog specification makes them difficult to interpret. The estimated coefficients are theoretically consistent for 15 out of 20 parameters for cost and 11 out of 20 parameters for alternative profit translog functions, which are significant at 5 percent level.

Table 2 Private Commercial Banks Cost and Alternative Profit x-efficiency Trend (2000-2005)

Year	Cost x-efficiency In percentage	Alternative profit x-efficiency In percentage
2000	69	74
2001	72	74
2002	76	68
2003	79	56
2004	81	67
2005	84	79
Mean	81	70

Source: Author computation

Descriptive statistics for estimated x-inefficiency are depicted in table 2. The second column shows cost x-inefficiency followed by alternative profit x-inefficiency in the third column. In these two columns, the over all or pooled average score of cost x-inefficiency was 19 percent while alternative profit x-inefficiency was 30 percent relative to best practice bank. There was a room to an average bank improve its cost and alternative profit x-inefficiency by 19 percent and 30 percent respectively, with existing available resources in the sample periods.

In economic terms, these measures indicate how private commercial banks are operating for above (below) the cost and profit frontier. This implies a typical private commercial bank on average produced its products at a cost approximately 19 percent greater than necessary and a profit approximately 30 percent less than necessary with the existing available resources in the sample period.

Scrutinized the inefficiency trend over the sample period, the decline in cost inefficiency is relatively better than that of alternative profit x-inefficiency, between 2000 and 2005. This entails that private commercial banks are comparatively better at managing costs than generating profits. Because higher cost inefficiency reflects management cost preference behaviors, which tend to subjugate the shareholder's best interest. In the case profit, the average profit inefficiency score was 26 percent in 2000; this score declined over the years, with lowest score of 21 percent in 2005. The same trend was observed in the case cost, where the x-inefficiency score declined from a high of 31 percent in 2000 to 16 percent in 2005. The over all evidence reveals that cost x-inefficiency improvement was better than profit.

The results also suggest that the banks had a potential for reducing cost x-inefficiency by approximately 19 percent, if they effectively used available resources in the sample period. They also have the capacity to produce actual output with 19 percent less resource in the same period. On the other hand, regarding the alternative profit x-inefficient banks had a potential to earn 30 percent more profit in the sample period, if they would effectively utilized the existing resources.

Table 2 shows, the trend in profit x-inefficiency over the sample period was not consistent. Private commercial banks had recorded little improvements in profit efficiency with in the framework of severe constraints. They faced serious challenges between 2002 and 2004. In those years the average profit x-inefficiency of the private commercial banks were reached minimum of 32 percent and maximum of 44 percent. But Abyssinia Bank's alternative profit x-inefficiency reached 80 percent in 2002 and 79 percent in 2005. This unexpected decline in profit efficiency of private commercial banks was due to various factors. These were: fall in world coffee price, an increase in world oil

price, Ethio-Eritrea boarder conflict, a fall in domestic crop production in 2001, the worst drought that hit the country in 2003, the September 2001 tragedy and the global recession due to Middle East conflict. These factors negatively affect financial sectors by making export receipts to decline; that also adversely affect import due to foreign exchange constraints, as a result reducing banks income from foreign transaction and loan to foreign transaction. In addition to the recession effects, banks also faced challenges from National Bank directives. The first one, saving interest rate cut on saving account by 3 percent followed by commensurate cuts in lending rate by all private banks. Second the NBE directive No. SBB/28/2002 enforced all banks to hold 100 percent provisions for doubtful loans in four phases. These all had a significant impact in swept away the banks' return and made them profit x-inefficient. Particularly an increase in profit x-inefficiency, subsequent to imposition of heavy provision requirement, suggests need critically examination of the banks' operational performance in various areas.

The other reason for increased Profit x-inefficiency is the misalignment practices. The alignment of technology, human resources, capital investment and resource allocation with in an appropriate production technology are key for banks to be efficient. Thus, to achieve this alignment, banks must have competent and skilled personnel or they heavily invest in senior managers having the required expertise. Most of the senior management members have no long vision to organization, because they are contract workers for two or three years. Their existence in the organization is uncertain and based on the interest of top managements (chief executive officers). Obviously, almost all private commercial bank managements are not stable. These uncertainty and lack of belongingness to the organization flux in to operational staff. This has great impact on inefficiency.

Lack of understanding of the production process by management and operational staff is the other factor, which causes for in x-inefficiency to go up. Production process (i.e. as per policy and operational procedures) is the way in which inputs are organized and consumed in order to accomplish a specified task of producing out puts. It also identifies the critical work design issues that lead to great value. However, private commercial banks have not clearly produced operational manual to every activities. Even if they have for major operation areas, the manuals are copy paste from others. These manuals are not

revised for long time and they do not properly describe each step of the tasks (that is, they have defects). Moreover, operational staff does not properly implement the guidelines of the operational manuals. For instance, banks contribute greatly to growth by promoting capital accumulation through the supply of credit. To execute this task banks need good credit policy and procedures, which must be implemented by the relevant personnel. However, the provision effect (NBE directive) showed that all banks have problems on allocation of resources in the form of loan (either on the policy/manual or implementation). Great volume of loan was found as non-performing that swept away the highest portion of the private commercial banks profit. This made banks in the sample to be profit x-inefficient in the sample period.

Human resource management practices of most private commercial banks are not in place to create value. It is understood that the architecture of human resource system provides a high level of framework and guiding principles for human resource management, while policies bring this framework down to an operational level. Human resource management practices are given less emphasis by almost in all private commercial banks. Human resource management practices are organizational structures, which attract and retain employee, reinforce employee behaviors and develop employee skills. These support profit-generating activities of the banks or their efficiency. Lack of appropriate alignment of these practices for cost minimization and revenue generation contribute for x-inefficiency. Other factor that influences x-inefficiency was the distortion created by dominance of the government in the banking system. Public enterprises that naturally have large amounts of fund and business transactions deal only with government banks. This is unusual in an economy that advocates a free market system. It also indicates the existence of unhealthy competition in banking industry. Government intervention through policy distortion with out strong ground has away the highest portion of profit from private commercial banks. Thus, private commercial banks are implicitly discriminated from the free competition market field and made less profitable.

5.1.3. Mean cost and alternative profit x-efficiency of private commercial banks

Table 3 Ranking of private commercial banks in Ethiopia according to profit x-efficiency (2000-2005)

Bank	Individual alternative profit x-efficiency estimation (%)	Alternative profit x-efficiency estimated relative to frontiers
Dashen	90	100
Nib International	81	90
Wegagen	67	74
Hibret	65	72
Awash	57	63
Abysinnia	55	61

Source: Author computation

Table 3 shows that, Dashen was most the alternative profit x-efficient private commercial bank in Ethiopia, followed by Nib International Bank. Suggesting that, Bank's management was more successful relative to other private banks in stimulating best practice. The result may also indicate that organizational architects of Dashen Bank have the capability of integrating various processes together to form a coherent structure. This means that management has been aligning inputs with the strategy of the bank, and specifying the production function of the bank in a most efficient manner. It also transformed inputs like human resource, technology, capital and deposits in to effective inputs and profitable output. Such as Dashen Bank was relatively best interims of credit allocation and income generation from the services it rendered to its customers.

As can be seen from the table above Abyssinia Bank was the most alternative profit x-inefficient private commercial bank in Ethiopia in the sample period. Its mean alternative profit x-inefficiency was 45 percent. This means the bank lost 45 percent of its potential profit, which would have been generated using the existed resources. In other words it had had a capacity to increase its profit by 45 percent with out any employing additional

resources. This also implies misalignment of management practice: that the bank depended on few prominent borrowers and most of the bank's loans were disbursed on with out collateral. This was the bank portfolio diversification problem leading it to record loss in year 2002, when the major borrowers became delinquent borrowers due to various reasons. In addition to the adverse effects of NBE directives (that is, higher provision requirements to doubtful loans, and cutting saving interest rate) and instability of internal management, NBE imposed a sanction on the bank not to open additional branch offices and pay dividends to its shareholders up to December 2004. In general, all these factors made alternative profit x-inefficiency stood at 80 percent in 2002 and 79 percent in 2003. The alternative profit x-inefficiency of 43% of Awash Bank may be resulted from management inability to control expense and more amount of profit was transferred to provision account for the doubtful loans security (yearly annual report).

Table 4 Ranking of private commercial banks in Ethiopia according to cost x-efficiency

Banks	Individual cost x-efficiency	Cost x-efficiency estimated relative to frontier
Nib International	96	100
Dashen	92	95
Abyssinia	87	90
Hibret	86	89
Wagagen	65	67
Awash	60	62

Source: Author computation

Table 4 shows that, for the sample period Nib International Bank was found to be the most cost efficient bank from the group. Next to Nib Bank, Dashen Bank had recorded best practices in controlling cost. Nib international Bank's cost x-inefficiency was 4 percent while that of Dashen Bank was 6 percent. Well capitalization, higher volume of healthy loan and small branch network may enable Nib International Bank to be most cost efficient bank than others in the sample period. Though Dashen Bank had higher number of branch network next to Awash Bank; appropriate alignment of management practice might enable it to minimize the cost inefficiency.

The above table also indicates that, Awash Bank and Wegagen Bank were the most cost inefficient banks relative to best practices in the sample period. On average, the cost inefficiency of Awash Bank was 38 percent while that of Wegagen Bank was 33 percent. The inefficiencies indicate wastage of resources in both banks. This implied that both banks were engaged in rapid expansion of the market share by participating in renting physical branches, acquiring building and land (Awash), and more bad quality of loan and advance (Awash held more amount provision for doubtful loans). These effects showed up as lower cost efficiency because higher amount of fixed assets employed to expand market share may have raised cost but not enough returns.

5.2. Factors that determine cost and alternative profit x-(in) efficiency

The foregoing discussion witnessed the existence of performance difference among the private commercial banks; despite they operate in the same markets. This may be due to a multitude of reasons.

This section deals with the factors, which are the source of inefficiencies. The factors that are expected to have impact on cost and alternative profit x-inefficiencies are operational specific variables, market specific variables, macro economic variables and risk variable. As per the empirical literature and availability of data, the variables have positive or negative impact on x-inefficiency.

Table 5 Profit and cost x-inefficiency with explanatory variable

Profit			Cost	
Parameters	**Coefficients**	**t-ratio**	**Coefficients**	**t-ratio**
δ0	0.024	0.025	0.00136	0.0136
δ1(ROE)	-0.069	-2.15	-0.18	-1.041
δ2(Capital)	0.28	2.5	-0.067	-3.0841
δ3(Asset)	-0.32	-2.4	-0.079	-2.11
δ4(No. of Branch)	0.091	0.071	0.079	3.089
δ5(NPL)	0.38	3.62	0.11	2.57
δ6(GDP)	-0.110	-3.69	0.022	1.987
δ7(Deposit)	0.0023	2.023	-0.037	-2.0529

Source: Author computation

Table 5 provides the predicted average cost and alternative profit x-inefficiency of the dependent variable, in correlation with the above-mentioned variable that cause inefficiency variables mentioned above. A positive sign on the parameters indicate that the associated variable has a negative effect on efficiency and a negative sign indicates a positive efficiency effect. As the table shows most of the coefficients have the expected sign (+/-). The unexpected sign also an indicator for the need of further examination.

Operational Specific Variables

Return on equity is an important factor that shows the profitability of private commercial banks. The result from the table 5 indicates that return on equity has an inverse relationship with cost and profit x-inefficiency. However, the cost x-inefficiency was not statistically significant. This implies that the profitability of the private commercial banks was not due to reduction in cost inefficiency or improvement in cost x-efficiency (e.g., Wegagen Bank). But it is due to excess demand for bank funds (services) and existence of weakened competitive environment. As the alternative profit x-inefficiency decrease, return on equity will increase as hypothesized.

Capital and reserve had an inverse relationship with cost inefficiency, which conforming the hypothesis. As the private commercial banks increase capital and reserve level, cost inefficiency will decrease. This indicates that banks would strengthen their capacity of controlling cost inefficiency and develop their potential of absorbing the portfolio risk.

However, the sign of the result showing the correlation between alternative profit x-inefficiency and capital is different from hypothesized one. This unexpected sign indicate the circumstances in the sample periods. The private commercial banks had faced with a problem of high non-performing loan during the sample periods; moreover NBE enforced these banks to hold more provision for the doubtful loans. As a result the private commercial banks prefer to increase there capital in order to strengthen their absorbing capacity of risky loan. At the same time an increase in capital helped banks to lend more amount of loan for a single viable borrower. The profit generated from such customers is expected to improve the x-inefficiency of profit.

Bank size is proxied by asset level of the bank. Asset is also the important factor that influences the x-inefficiency. With regard to assets, the result supports our hypothesis that asset has an inverse relationship with cost and alternative profit x-inefficiency. The implication of this is: As banks increase their asset level, they may acquire more managerial inputs that have capacity to resolve inefficiency of cost and profit (i.e. cost minimization and revenue generation). On the other hand, as asset level increase, major component of asset, like loan and advance will also increase. If the disbursed loans portfolio quality is good, the banks can make more profit. In addition they attain efficiency in resource allocation.

Market Specific Variables

Banks use their branches as out lets to their products and services. Most banks usually engage in expansion of branches to acquire more market share in terms of deposit and loan from the industry. The table 5 shows that area network (branch) had positive relation with cost x-inefficiency as hypothesized. However, the relationship between alternative profit x-inefficiency and number of branches do not conform the hypothesized sign. An expansion of branches, cause banks to incur more cost in the form of rent, administrative and to other contingent costs. This increases cost inefficiency since there is a direct relationship between cost and cost inefficiency. The unexpected sign for alternative profit x-inefficiency may be due to the problem of asset quality (that is, more non performing loan). More NPL make the private commercial banks to hold more provision bad debt from their profit. This will cause these banks to be profit inefficient even they have the greatest loan market.

Deposit of a bank to the total deposit of the industry is an indicator of the bank's capacity in resource mobilization. Deposit in this study is considered as an input. Banks transfer this input with a given technology in to an output (that is loan and advance). The table 5 shows that, deposit ratio is negatively correlated with cost x-inefficiency. As the banking environment in Ethiopia is not competitive; private commercial banks do not incurred an additional cost to attract more deposits. As total deposit is made up of interest bearing and non-interest bearing deposits, the cost incurred on the total deposit is insignificant (on average price of deposit was 0.02). This made cost of deposit affordable.

The correlation of deposit ratio with alternative profit x-inefficiency does not conform to the hypothesized sign. As banks' deposit ratio increase, the alternative profit x-inefficiency would also increase. This could be due to bad management or bad luck. Bad management mean private commercial banks allocated deposit resource in non-profitable projects or to none creditworthy customers. In the sample period, the swept away of profit due to imposition of high provision for doubtful loans was an empirical evidence on all commercial banks' loan position in Ethiopia. It also reveals problems on loan processing, and proper implementation of credit policy and procedures. Bad luck indicates the exogenous factors that may have devastating influence commercial bank's x-inefficiency. The recession of the country's economy and NBE directives were cost to the private commercial banks efficiency between 2002 and 2003.

Non-performing loan level is an important factor that represents the risk level of the banks. It has a positive relation with cost and alternative profit x-inefficiency. The pile up of non-performing loan is associated with inadequate follow up and loan collection performance of the banks. Thus, private commercial banks incurred additional cost to such kind of loans (i.e. monitoring cost, administrative cost, court cost etc.).

NPL has a direct relation ship with alternative profit x-inefficiency. As NPL of the private commercial bank increased, the alternative profit x-inefficiency also increased. This indicates that the sample banks' asset quality (loan and advances) was poor. This means there were more uncollectible loans in the sample periods. The expected return from such loan was nil and the banks were also enforced to hold provisions for such loans from the operating profit. Thus, the profit x-inefficiency increased.

Macroeconomic variable is here proxied by gross domestic products. Table 5 shows that, GDP has the sign in contrast to the hypothesized sign. This proved the worst events in the sample period. These are global and domestic economic recession as describe before. Direct and indirect adverse effects of these events are costs to the private commercial banks, because they are an evidence for cost x-inefficientcy to have positive relation with GDP. The negative relation of GDP with alterative profit x-inefficiency conform the hypothesized sign. This suggests private commercial banks had made small profit in constraints.

CHAPTER SIX

CONCLUTION AND POLICY IMPLICATION

6.1. Conclusion

Banks are giving service industry. They contribute to economic growth not by producing real goods, but by providing the financial means to facilitate production in other industries. An efficient banking sector will make the largest contribution to economic growth. Bank's balance sheet consists of short-term deposits on liability side and long term asset that can be difficult to liquidate quickly, may leave the bank to run. Bank failure can have substantial economic cost. This failure may be due to the inefficiency of the banks.

This paper assumed cost and alternative profit x-efficiency using the stochastic frontier approach, cited the potential of the banks to minimize cost and maximize profit in relative to the best practices with out additional resources and attempt to identify the factors that may influence x-(in)efficiency of private commercial banks in Ethiopia. The data is obtained from an audited financial statement of private commercial banks and NBE annual report over the period 2000-2005.

We test the null and alternative hypothesis to judge the appropriate data representative function. Using generalized likelihood ratio test. The result obtained from this test enables to choose stochastic frontier function, which properly represents the data. So we reject the null hypothesis, the conventional average model that considered cost and alternative profit x-ineffiency is zero.

Predicted inefficiencies distribution were also examined to know distribution was whether half normal or truncated normal distribution. Based on the frontier analysis insignificant t-ratio of μ(mu) even its value different from zero, we reject truncated distribution. The predicted inefficiencies distribution of private commercial banks was half normal.

By using the result of η (eta) from the frontier analysis, we tested the x-(in)efficiency trend of private commercial bank over the period 2000-2005. We found η different from zero indicating that that the cost and profit (in)efficiency trend were variant, since η is different from zero.

The result from the analysis indicates that Dashen Bank was the most alternative profit x-efficient private commercial bank in Ethiopia. Nib International Bank, Wegagen Bank, Hibret Bank, Awash Bank and Abyssinia Bank followed it respectively. On the other hand, Nib International Bank was the most cost x-efficient private commercial Bank. Dashen Bank, Abyssinia Bank, Hibret Bank, Wegagen Bank, and Awash Bank followed it respectively.

The highest score of alternative profit x-efficiency of Dashen Bank was emanated mainly from the best management practices. The bank has shown its capacity in aligning the available resources with its corporate strategy. The smallest number of branches and the higher amount of quality loans made Nib International Bank to be the most cost x-efficient private commercial bank. Mismanagement practices, bad quality of more loans, top management instability and sanction from NBE not to open new branch were made Abyssinia Bank to score the lowest alternative profit x-efficiency. Lowest score of Awash Bank cost efficiency was due to branch expansion practice and higher annual increment of expense.

The study found the mean level of cost and profit x-efficiencies of private commercial banks were 81 percent and 70 percent respectively. These suggest that, private commercial banks incurred cost approximately 19 percent more than necessary and lost approximately 30 percent of their potential profits with in the sample period due to x-inefficiency. These indicate the existence of room to improve cost and alternative x-inefficiencies of private commercial banks without employing additional resources.

The two-stage model result also provided the correlation of operational specific variable, market specific variable, macro economic specific variable, and risk variable with predicted cost and alternative profit x-inefficiency. ROE, capital, asset level, deposit ratio have negative correlation with predicted cost x-inefficiency, while number of branch and

NPL positively correlated. Similarly, ROE, number of branch and GDP negatively correlated with predicted alternative profit x-inefficiency, while NPL positively correlated. These result conform the hypothesized sign. GDP with cost x-inefficiency and capital, asset level, and deposit ratio with alternative profit x-inefficiency have positive relationship. But they do not support the hypothesized results.

6.2. Policy-Implications

The result of the analysis of this study has got some policy implication. Though conclusive recommendations need further research, possibly it requires more detailed data and sample years than this study.

The result of the analysis indicated private commercial banks in Ethiopia are operating under their performance. The existence of some percentile of inefficiency shows that private commercial banks have an opportunity to improve their efficiency with out need of additional resources. Thus, private commercial bank management can take corrective measures by identifying the problems.

Supervisor organ of commercial banks, by using this methodology in coordination with other supervisory mechanism (that is capital adequacy, liquidity ratio, asset growth, etc.) can prior identify the worst practice of the commercial banks. This help to design appropriate policy and to take corrective action.

Government policy should focus more on increasing the level of competition in the commercial banks. Distortions created by dominance of the government in the banking system must be removed. Public enterprises, which have large amount of fund and business transactions, have to be free to do business transactions with private commercial banks. Moreover government must revise policy that forbids foreign banks entry because foreign banks entry may bring modern techniques and business practices. It also stimulates the competitive environment of the banking industry in Ethiopia.

Private commercial banks' management instability and poor human resource practices, lack of proper policy and operational manual has an adverse effect on profitability of the bank. Thus, management and board in coordination have to take corrective measure by providing prudence human resource management policy and operational manuals. Also private commercial banks' managements have to do great effort to in increasing the capita level of the banks. This strengthens the risk absorbing capacity of the banks and increases their lending limit to single borrower. Management could do this by selling additional share to public or by taking some percent of retain earnings every year.

Branch expansion has an adverse effect on profit and cost efficiency. Private bank management have to take more consideration motives for opening the new branches, the need of banking service in the area, selection of the site and other relevant factors before opening the new branch.

Implementing advance technology has reduced the cost and time. It might improve the cost and profit efficiency of the commercial banks. However private commercial bank managements must carefully identify the organization's needs for data processing as well as customers' needs for the services, before implementing the new technology. Managements also should not take this as sole justification for internal data processing. Comprehensive feasibility study should precede any decision to develop an in-house system (for example Bank of Abyssinia) by providing extensive training to the IT staffs.

A bank's success and failure (efficiency and inefficiency) in large part depend on the experience capability judgments and integrity of its board of director and senior executives. They should have the capacity of understanding the degree to which the bank is exposed to the credit, market, liquidity, operational, legal and reputation risks. Also they should have skill to design and approve all significant policies relating to the risk arising from all activities. Thus they should be well educated and rich experienced in operational management specially in banking industry.

Lack of inadequate credit analysis, poor and incomplete documentation, heavily concentration p of loans secured by the same or similar type of collateral by one bank or different banks resulted in the increase in the NPL of the private commercial banks. This brought an adverse impact on profit and cost of private commercial banks. Thus managements on their part have to provide loan quality management training for all credit staffs and evaluate the credit worthiness of the delinquent borrower when they reschedule NPL and permit administrative renewal of dormant over draft. The regulatory body should also design common standard in evaluation of collateral to all banks and penalize those that violent this regulation.

Private commercial banks in order to avoid inefficiency of misalignment of management practices; they should develop senior management skill through providing training. This will enable them adequately managed risks (inefficiency) arising from all activities on both short term and long-term basis.

Macro economic variable and bank efficiency have strong relation as the study indicates, thus policy maker should set a policy of monetary and other to wards in considering financial system stability rather than focusing only price stability.

Increase in bank NPL is increase in cost and decrease in profit to the bank; low capacity and effectiveness of the court system are some sources that hinder the efficiency of banking system (i.e. enforcement problem). Though, foreclosure law authorize the lending bank to sell collateral after 30 days notice of delinquent borrower, its implementation takes from six months up to three years. Thus, government should produce appropriate policies on the existing court system.

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Annexes:

Annex: 1 Tables

Table 1: Alternative Profit X-Efficiency Trends of Private Banks (2000-2005)

BANKS	2000	2001	2002	2003	2004	2005
AWASH	0.66	0.74	0.44	0.56	0.51	0.61
DASHEN	0.87	0.89	0.90	0.89	0.91	0.94
ABYSSINIA	0.64	0.67	0.20	0.21	0.77	0.80
WEGAGEN	0.69	0.76	0.81	0.49	0.61	0.72
NIB	0.77	0.86	0.90	0.77	0.78	0.78
HIBRET	0.82	0.51	0.84	0.45	0.44	0.88
MEAN	***0.74***	***0.74***	***0.68***	***0.56***	***0.67***	***0.79***

Source: Author computation.

Table 2: Cost X-Efficiency Trends of Private Banks (2000-2005)

BANKS	2000	2001	2002	2003	2004	2005
AWASH	0.81	0.49	0.53	0.57	0.62	0.66
DASHEN	0.89	0.91	0.91	0.93	0.94	0.94
ABYSSINIA	0.83	0.85	0.86	0.88	0.90	0.91
WEGAGEN	0.56	0.61	0.86	0.68	0.71	0.75
NIB	0.95	0.96	0.64	0.97	0.97	0.97
UB	0.82	0.84	0.97	0.87	0.89	0.90
MEAN	**0.69**	**0.72**	**0.86**	**0.79**	**0.81**	**0.84**

Source: Author computation.

Table 3: Major Ratios and Provisions maintained at Private Banks

3.1. Awash Bank

Description	2000	2001	2002	2003	2004	2005
Price of Deposit	4%	4%	2%	2%	2%	2%
Provision for bad loan (Mn Birr)	18.5	23.5	44.3	72.7	80.40	91.6
ROE	21%	15%	7.2%	14%	24%	26%

3.2. Dashen Bank

Description	2000	2001	2002	2003	2004	2005
Price of Deposit	3%	3%	3%	2%	2%	2%
Provision for bad loan (Mn Birr)	17.7	22.9	27	48	63	71
ROE	25%	41%	31%	28%	45%	40%

3.3. Abyssinia Bank

DESCREPTION	2000	2001	2002	2003	2004	2005
Price of deposit T	3%	4%	3%	2%	2%	2%
Provision for bad loans (Mn. Birr)	7.8	18	38	62	73	61
ROE	17%	24%	5%	5%	28%	32%

3.4. Wegagen Bank

DESCREPTION	2000	2001	2002	2003	2004	2005
Price of deposit	4%	3%	3%	2%	1%	1%
Provision for bad loans (Mn. Birr)	6.6	15	20	29	42	51
ROE	14%	24%	19%	16%	34%	35%

3.5. Nib International Bank

DESCREPTION	2000	2001	2002	2003	2004	2005
Price of deposit	1%	2%	3%	2%	2%	2%
Provision forbad loans (Mn. Birr)	-	0.6	3.5	22	30	47
ROE	3%	28%	22%	15%	28%	29%

3.6. United Bank

DESCREPTION	2000	2001	2002	2003	2004	2005
Price of deposit	3%	3%	3%	2%	2%	2%
Provision for bad loans (Mn. Birrr)	0.5	1.3	2.5	7	15.5	23
ROE	11%	13%	7%	8%	10%	42%

Source: Author computation.

Annex: 2 Figures

Figure: 1

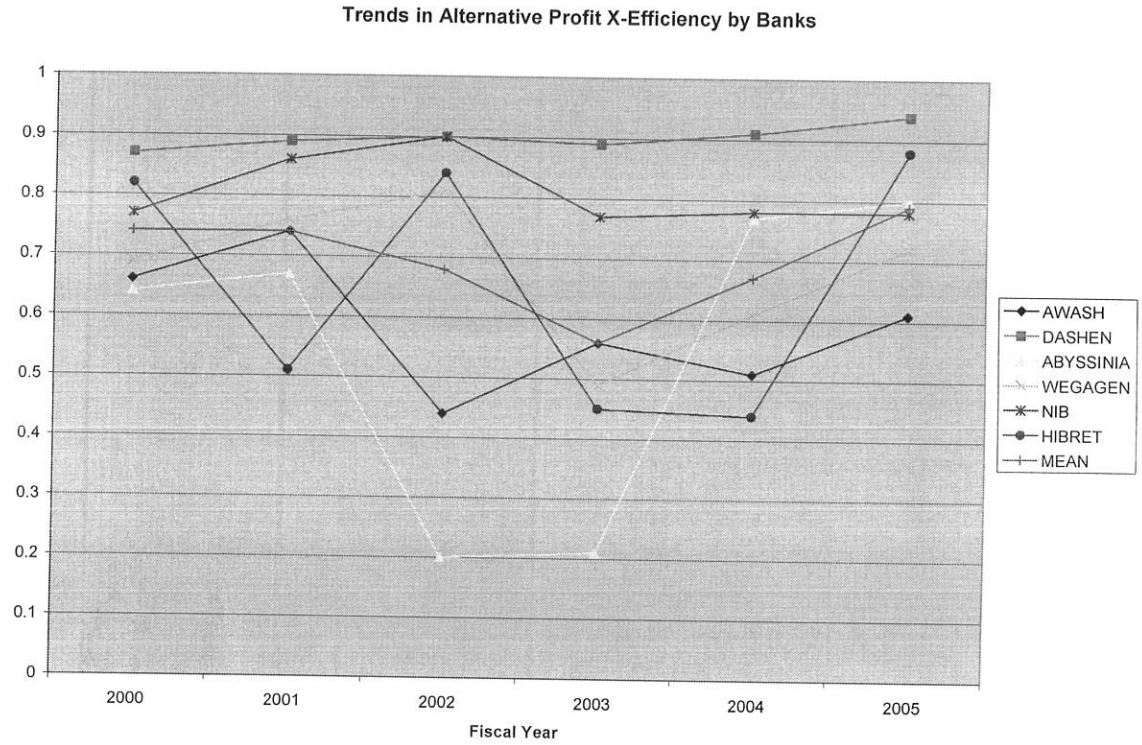
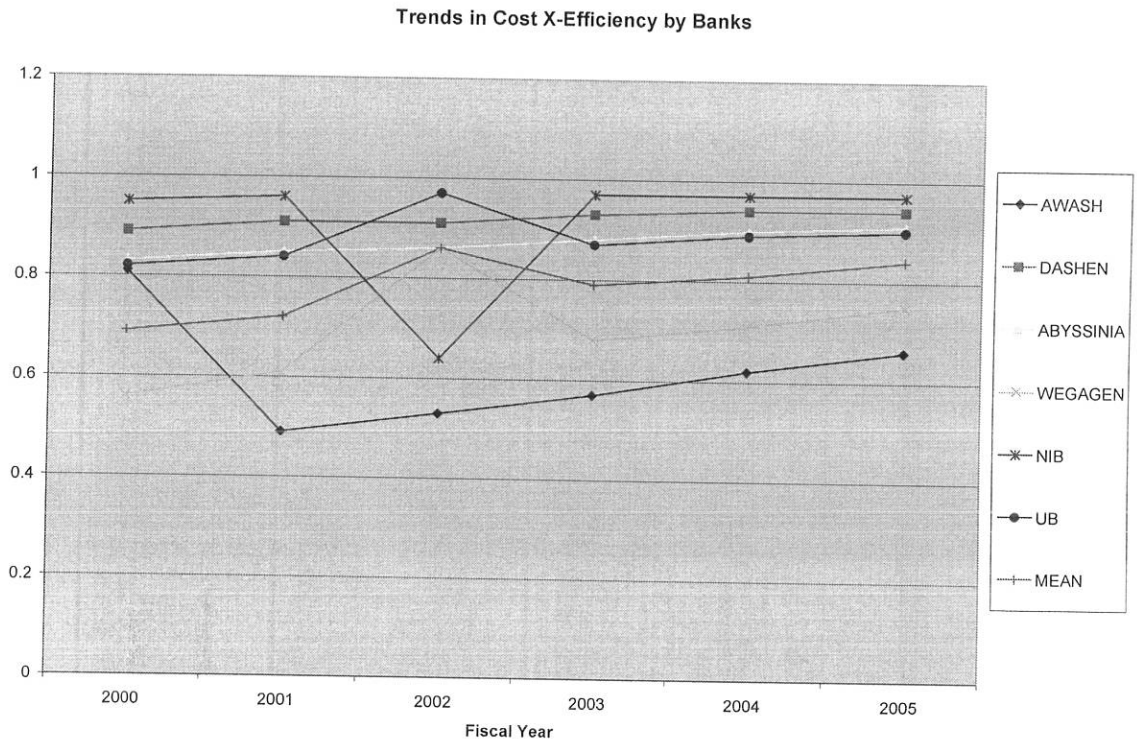


Figure: 2


Trends in Cost X-Efficiency by Banks
1.2
1
0.8
0.6
0.4
0.2
0
2000
2001
2002
2003
2004
2005
Fiscal Year
AWASH
DASHEN
ABYSSINIA
WEGAGEN
NIB
UB
MEAN

Annex: 3 Technical discussions

The specific altenative profit x-efficiency function that we estimate is:

$$\ln\left(\frac{\prod}{w_3 z}+\theta\right)=\alpha_o+\frac{1}{2}\sum_{i=1}^{2}\alpha_i\ln\frac{w_i}{w_3}+\frac{1}{2}\sum_{i=1}^{2}\sum_{j=1}^{2}\alpha_{ij}\ln\frac{w_i}{w_3}\ln\frac{w_j}{w_3}+$$
$$\sum_{k=1}^{3}\beta_k\ln\frac{y_k}{z}+\frac{1}{2}\sum_{k=1}^{3}\sum_{m=1}^{3}\ln\frac{y_k}{z}\ln\frac{y_m}{z}+$$
$$\sum_{i=1}^{2}\sum_{k=1}^{3}\delta_{ik}\ln\frac{w_i}{w_3}\ln\frac{y_k}{z}+\mu_i+v_i$$

The specific cost x-efficiency function:

$$\ln C=\alpha_o+\frac{1}{2}\sum_{i=1}^{2}\alpha_i\ln\frac{w_i}{w_3}+\frac{1}{2}\sum_{i=1}^{2}\sum_{j=1}^{2}\alpha_{ij}\ln\frac{w_i}{w_3}\ln\frac{w_j}{w_3}+$$
$$\sum_{k=1}^{3}\beta_k\ln\frac{y_k}{z}+\frac{1}{2}\sum_{k=1}^{3}\sum_{m=1}^{3}\ln\frac{y_k}{z}\ln\frac{y_m}{z}+$$
$$\sum_{i=1}^{2}\sum_{k=1}^{3}\delta_{ik}\ln\frac{w_i}{w_3}\ln\frac{y_k}{z}+\mu_i+v_i$$

To satisfy duality theory in translog function, dependent and input variable must be normalized by the price of deposit in order to impose linear homogeneity on the model. In addition to this to solve the problem of confounding scale inefficiency that is problem of heteroscedasticity, cost, alternative profit, and output must be normalized by bank's financial equity capital. So, z is financial equity capital.

Annex: 4 Variables in the Cost and Altenative profit x-efficiency functions

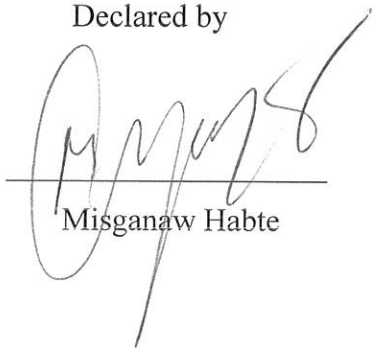
Symbol	Definition
Dependent variables	
$\Pi_{a\pi}$	Profit is total income minus total expense and tax.
C	Cost is general expense, interest expense and salary and benefit expenses.
Independent Variable Variable input price vector (w)	
W_1	Price of labor is total salary and benefit expense to employee divided to total number of employees.
W_2	Price of physical capital is total expense on fixed assets divided by book value of fixed asset.
W_3	Price of deposit is total deposit divided by total interest expense on deposits.
Variable output Quantities	

Y_1	Net loan amount is gross loan minus provision held to bad loans and advances.
Y_2	Foreign currency deposits at correspondence banks.
Y_3	Off balance sheet items is guarantee, contingent liabilities such as commitments and letter of credits.
Determinant factor variables	
δ_1	Return on equity
δ_2	Total capital and reserve
δ_3	Asset
δ_4	Number of branches
δ_5	Non performing loans
δ_6	Gross domestic products
δ_7	Bank total deposits to total banks deposits

Declaration

I declare that this thesis is my original work and has not been presented for a degree in any other university, and that all sources of material used for the thesis have been duly acknowledged.

Declared by



Misganaw Habte

Certified by