ADDIS ABABA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

HOW EFFICIENTLY ARE THE ETHIPIAN MFIs EXTENDING FINANCIAL SERVICES TO THE POOR? A COMPARISON WITH THE COMMERCIAL BANKS

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A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Master of Science in Economics (Economic Policy Analysis)

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Declaration

I, the under signed person, 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. The Examiners comments are duly incorporated.

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Acknowledgement

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Acronym

ACSI-Amhara Credit and Saving Institution

AEMFIs-Association of Ethiopian Microfinance Institutions

CBE-Commercial Bank of Ethiopia

CCBs-Conventional Commercial Banks

DECSI-Dedebit Credit and Saving Institution

DEA-Data Envelopment Analysis

JLLS-Joint Liability Lending Scheme

MFIs-Microfinance Institutions

NBE-National Bank of Ethiopia

OCSSCO-Oromia Credit and Saving Share Company

ROA- Return on Asset

ROE- Return on Equity

SFPI- Specialized Financial and Promotional Institution

SFM- Stochastic Frontier Model

TWECM-Two-Way Error Component Model

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Abstract

This study investigates how efficiently the MFIs are extending the frontier of financial intermediation by comparing their cost efficiency with that of the commercial banks using an unbalanced panel data of 21 firms (14 MFIs and 7 commercial banks) in Ethiopia over the period 2001-2008. The study used both non-structural and structural approaches to efficiency measurement. The non-structural approach is based on the interest rate margin analysis, while the structural approach utilizes the stochastic frontier technique to estimate the cost efficiency of the MFIs and commercial banks.

Both approaches resulted in same finding that the intermediation efficiency of the Ethiopian MFIs is by far less than that of the conventional commercial banks. Especially, the result from the stochastic frontier estimation (in which the heterogeneities in the working environments have been controlled for) indicates that the Ethiopian MFIs are, on average, 29.8 percent less cost efficient than the commercial banks. Hence, the efficiency gap is not attributed to differences in the working environments between the two groups. However, the study indicates that some of the MFIs such as ACSI, SFPI and DECSI have cost efficiency scores comparable to the commercial banks. Despite this wide gap, the study notes that there is a more or less fast tendency for convergence between the cost efficiency of the two groups.

Age of firm, branch networks, average loan size, average deposit size, risk-taking tendency, the share of commercial funds in the total outstanding loans and flexibility in lending scheme are found to enhance cost efficiency of the financial intermediaries, while firm size and market concentration are found to adversely affect cost efficiency.

Lastly, the study recommends that the firms should introduce flexibility in their lending scheme (especially for the commercial banks), should avoid excessive risk-aversion, and focus on commercial funds as a major source of loanable fund. Also, the regulators should work towards creating a more competitive market and keeping regulations dynamic enough to make them in line with changing socio-economic settings to enhance the cost efficiency of the financial intermediaries in Ethiopia.

Chapter One

Introduction

1.1 Background

Studies indicate that efficiency in the banking sector is crucial for economic growth as it has a direct impact on the productivity of all other sectors in the economy. Luccetti et al (2000), for instance, has shown the existence of an independent effect exerted by the efficiency of banks on regional economic growth in the Italian regions. Similarly, Misra (2003) argues that effectiveness of the banking sector's contribution to the economic growth and development is broadly determined by its efficiency in allocating the mobilized savings among the competing projects.

Now a days, the banking industry in most developing countries (including Ethiopia) is characterized by the joint operation of the Conventional Commercial Banks (CCBs) and Micro Finance Institutions (MFIs). Although the institutional framework and the motive for their establishment are somehow different, the main purpose of these financial institutions is mobilizing resources (in particular domestic savings) and channeling them to the would-be investors. Thus, their efficiency in intermediating funds is equally important for proper utilization of the existing resource.

In Ethiopia, following the reforms undertaken in the 1990s, several commercial banks and MFIs have been established. Though a lot has been said about the rapid growth of both (especially of MFIs), no attempt has been made to compare how efficiently they are operating. It may happen that the inefficiency of these financial intermediaries outweighs their welfare gains, unless well informed management and regulations are accompanied.

To make informed policy decisions regarding these financial intermediaries, regulators need to have fairly accurate information about the likely effects of their decisions. Also, effective policy making and management requires knowledge about factors enhancing/reducing efficiency of the firms.

It is important to note that a financial intermediary's ability to perform efficiently; that is, to obtain accurate information concerning its customers' financial prospects, and to write effective contracts and to enforce them, depends in part on the property rights, legal, regulatory, and contracting environments in which it operate (Hughes and Mester, 2004). This is especially true for heterogeneous group of financial institutions, such as CCBs and MFIs as the legal, institutional, risk, and marketing environments in which they operate may considerably differ, resulting in significant impacts on (in)efficiency estimates.

In such cases, the estimated inefficiencies may be a combination of true ''managerial inefficiencies'' and the impact of environmental factors not appropriately controlled for in the analysis. Thus, such heterogeneities should be carefully captured in the efficiency comparison of these institutions. This study will, thus, investigate how efficiently the MFIs are extending (broadening) the outreach of financial intermediation in Ethiopia by comparing their cost efficiency with that of commercial banks, by taking into account the underlying heterogeneities.

1.2 Statement of the Problem

Microfinance is intended to expand the frontier of financial intermediation by providing financial services to those traditionally excluded from conventional financial markets. Despite the short history of MFIs, considerable evidences show that in many circumstances and social contexts,

MFIs can lend to the poor no ordinary commercial bank would want to consider as a customer. Moreover, they do so with a reasonable degree of financial self sufficiency and repayment rates that are, for comparable loans, significantly higher than that of conventional lending institutions (Hossain, 1988; Morduch, 1999).

This seems especially true in Ethiopia[1]. The Ethiopian MFIs are growing at fast rates in terms of their outreach and financial products, and also, operationally and financially sustainable (Befekadu, 2007). Moreover, the default rates of most of the Ethiopian MFIs is lower (around 5 percent) as of 2005 (Befekadu, 2007) as compared to most of the commercial banks operating in the country. [2]

Theory suggests several distinct but complementary reasons underlying this success. First, many (but not all) of these lending institutions use Joint Liability Lending Scheme(JLLS), which resolves the major problem facing lenders - the information problem. Ghatak and Guinnane (1999), stated that members of a community may know more about one another i.e., each other's types (risk group), actions (whether the borrower utilizes the loan properly), and states (the real status of the borrower's project), than an outside institution such as a bank.

Second, conventional banks use collateral as an enforcement tool, and thus cannot reach potential borrowers having lucrative projects but lacking assets for collateral. This is especially apparent in the Ethiopian banking sector. Muluneh (2008) stated that in Ethiopia, banks have the tradition of focusing on collaterals rather than on the potential of the borrowers, which led to a lower market

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[1] The percentage of non-performing loans from the total outstanding loans was only 3.2 percent for MFIs over the period 2005-2007 (Befekadu, 2007). This is significantly lower as compared to 40 percent and 15 percent non-performing loans for the Commercial Bank of Ethiopia for the years 1995 and 2006 respectively (Alemayehu, 2006).
[2] For instance, the loan default rate for Commercial Bank of Ethiopia (the largest commercial bank in the country, with lion's share of the banking market) was more than 25 percent in the year 2003/04 (Alemayehu, 2006).

base for their increasing deposits-ultimately resulting in higher cost inefficiency. MFIs however use loan-repeating incentives and social sanctions (or peer pressure) as an enforcement tool (Ghatak and Guinnane, 1999).

Thus, MFIs that effectively utilize local information and social capital existing among borrowers can deal effectively with the four major problems facing a lender-namely adverse selection, moral hazard, auditing cost and enforcement problems- a feature that is lacking in the conventional banking system. Theoretically, this apparent strength of the MFIs may then seems to indicate that they are better positioned for cost efficiency. *But, how efficient (as compared to the conventional commercial banks) are the MFIs in extending the frontier of financial intermediation in practice?*

Previous studies[3] on the cost efficiency of commercial banks/MFIs focus on estimation of the cost efficiencies and investigation of factors underlying efficiency variation among individual banks/MFIs, and do not compare their efficiency under a common frontier framework. However, as long as the efficiency of these financial intermediaries is equally important for proper allocation of the existing resource, it is also important to empirically investigate whether there is cost efficiency gap between these financial intermediaries.

It is, however, worth noting that the two groups of financial intermediaries operate in different working environments, which may affect their efficiency and makes efficiency comparison based

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[3] Though studies on cost efficiency of the Ethiopian banks and MFIs is nil (perhaps except only for Muluneh, 2008), several studies have been made on cost efficiency of banks and MFIs internationally. Some of them include: Weill (2004); Hasan and Hunter, 1996; Bos and Kool, 2004; Tahir and Haron, 2008; DeYoung and Nolle, 1996; Miller and Parkhe, 2002; Mahajan et al., 1996; Kiyota, Peitsch and Stern (2007); Gonzalez (2008); Gregoire, and Tuya (2006), etc)

on a common frontier assumption unwarranted. Therefore, any attempt to compare the efficiency of these institutions should take into account these environmental differences.

The purpose of this study is to empirically investigate whether there is a cost efficiency gap between these two groups of financial intermediaries in Ethiopia, by taking into account the existing differences in their working environment. Measuring the cost efficiency of these financial institutions is crucial for government policy makers and the managers of the institutions. First, it helps to determine which approach of financial intermediation is more cost efficient and to what extent. Second, it helps to identify the sources of the efficiency gap between the two groups, which may help combine best practices from both groups. And, finally, it enables to identify firm-specific and other factors affecting the efficiency of the individual banks and MFIs.

1.3 Objectives of the Study

The general objective of this study is to empirically investigate whether there is a cost efficiency gap between the CCBs and MFIs in Ethiopia.

The specific objectives of the study are:

- To investigate whether the efficiency gap (if any) between them is due to differences in the working economic environments, or not;

- To explore (exogenous) firm-specific factors affecting the (in)efficiency of the banks/MFIs;

- To examine whether there is a tendency for the gap (if any) to close.

1.4 Significance of the Study

The study serves the following purposes:

- ❖ It fills the gap in the literature regarding the relative efficiency of commercial banks and MFIs in the practical world.
- ❖ It provides valuable information for regulators, policy makers and managers of the financial institutions on exogenous factors and firm characteristics affecting efficiency, and
- ❖ The study may have an important contribution for those who want to analyze the efficiency of heterogeneous firms and the determinants of efficiency.

1.5 Limitations of the Study

The major limitation of this study is the shorter time frame (2001-2008) because almost all of the microfinance institutions are young and started to report their performance since the year 2001, and quarterly data are lacking.

1.6 Scope of the Study

There are several performance measures that can be used to compare the performances of MFIs and commercial banks including cost efficiency, scale efficiency, profit efficiency, revenue efficiency, etc. This study focuses only on cost efficiency and factors determining it.

1.7 Organization of the Paper

The rest of the paper is organized as follows. The *second chapter* provides a review of literature (both theoretical and empirical) that covers the essence and rationale of the two groups of financial intermediation and their technologies, the concepts of efficiency and their empirical measurements, and the Ethiopian financial sector. The *third chapter* specifies the empirical methodologies employed in this study, explains the variables and characteristics of the data sets utilized, and the estimation techniques followed. *Chapter four* presents the estimation results.

Finally, *chapter five* draws conclusions, indicates policy implications, and provides some suggestions for future studies.

Chapter Two

Literature Review

2.1 Theoretical Literature

2.1.1 The Financial Sector

(a) The Commercial Banking

What do commercial banks do? What are the key components of banking technology? What determines whether banks perform efficiently? The literature on financial intermediation suggests that commercial banks, by screening and monitoring borrowers, can solve the potential moral hazard and adverse selection problems caused by imperfect information between borrowers and lenders. From the information obtained from checking account transactions and other sources, banks assess and manage risk, write contracts, monitor contractual performance, and when required, resolve nonperformance problems (Bhattacharya and Thakor, 1993; Hughes and Mester, 2008).

Banks can influence the process of economic growth in two major channels. First, they boost capital accumulation: by reducing transaction costs and diversifying risks, banks enable the mobilization of savings to finance the investments necessary to stimulate and sustain economic development. Second, they channel credit to the best users of finance (Lucchetti, Papi, and Zazzaro, 2001).

Banks' ability to align informational asymmetries between borrowers and lenders and their ability to manage risks are the essence of the bank services. These abilities are integral components of bank output and influence the managerial incentives to produce the financial

services prudently and efficiently. That banks' liabilities are demandable debt gives banks an advantage over other financial intermediaries. The relatively high level of debt in banks' capital structure disciplines managers' risk-taking and their diligence in producing financial services by exposing the bank to an increased risk of insolvency. The demandable feature of the debt, to the extent it is not fully insured, further heightens performance pressure and safety concerns by increasing liquidity risk. These incentives tend to make banks good monitors of their borrowers. Hence, the banking relationship can improve the financial performance of its customers and increase access to credit for firms too informationally opaque to borrow in public debt and equity markets. The uniqueness of bank services, in contrast to the services of other types of lenders, is derived from the special characteristics of banks' capital structure: the funding of informationally opaque assets with demand deposits (Hughes and Mester, 2008).

Banks ability to perform efficiently (to obtain accurate information concerning its customers' financial prospects and to write effective contracts and to enforce them) depends in part on the property rights, legal, regulatory and contracting environments under which they operate. Such an environment includes accounting practices, chartering rules, government regulations, and the market condition (e.g., market power) under which banks operate. These differences influence not only the efficiency of the banks but also the external and internal mechanisms that discipline bank managers. The internal discipline might be influenced by organizational form, ownership and structure, governing boards, and managerial compensation. External discipline might be influenced by government regulation, capital market discipline (takeovers, cost of funds, stakeholders' ability to sell stock (stock price)), managerial labor market competition, outside stake holders (equity and debt), and product market competition (Hughes and Mester, 2008).

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(b) The MFIs: Definition and Scope

What are the distinguishing features of MFIs? Microfinance is the provision of financial services (mainly credit and saving services) through the application of innovative credit technologies in circumstances where, given the traditional banking technologies, such provision would not have been profitable or sustainable (Gonzalez-Vega, 2003). Microfinance institutions (MFIs) are organizations that provide microfinance services.

At the heart of microfinance are innovations to overcome the difficulties of undertaking financial transactions for a target population. The difficulties of providing these services, particularly when using the traditional banking technologies, arise from the poverty and informality of the target population and from other characteristics of the transactions, such as their size, and the difficulties in evaluating the risks involved (Gonzalez-Vega and Villafani-Ibarnegaray, 2007).

Microfinance is thus intended to expand the frontier of financial intermediation by providing financial services to those traditionally excluded from formal financial markets (Hartarska, Caudill, and Gropper, 2006). Microfinance offers ''intelligent'' alternatives that minimize the risk involved in offering financial services to the poor who cannot offer any meaningful collateral. Risk, in this case, is mainly attached to issues of adverse selection and moral hazard that result from the incomplete and asymmetric information that lenders have about poor loan applicants and the absence of cost-effective mechanism for the enforcement of contracts. Microfinance also lowers the transaction costs of bridging the distance between lenders and borrowers (Gonzalez-Vega, 2003).

Lending to the poor involves high transaction costs and risks associated with adverse selection and moral hazard- which arise due to information asymmetry between lenders and borrowers

(Stiglitz and Weiss, 1981). Adverse selection arises when banks (and other lenders) cannot easily determine which types of customers are riskier. Thus, lenders are forced to treat different applicants as if they were equally risky, ultimately leading to a pooling equilibrium. The lender cannot use the interest rate in order to ration out risky borrowers. Instead, the lenders rely on non-interest credit rationing, which leads to allocation of credit that is not Pareto optimum (Stiglitz and Weiss, 1981). Moral hazard arises when the customers behave opportunistically (that is, undertake unobserved actions that hurt the lender's interests) and try to leave with the lender's money.

It is difficult for a typical bank to avoid adverse selection and moral hazard problems associated with lending to the poor because: (a) it faces higher transaction costs in handling many small transactions compared to handling few large transactions; and (b) poor borrowers do not own marketable assets for collateral that would cover risks perceived by the lending institutions.

MFIs use innovative lending technologies to avoid (reduce) these problems. Two main lending technologies can be identified: group-based (joint liability) lending and individual lending (Ledgerwood, 1999; Hartarska, Caudill, and Gropper, 2006).

Joint liability involves the creation of groups of people who demand financial services jointly and are willing to accept a joint liability on such loans. Some advantages of this approach are: (a) the use of peer pressure as a substitute for collateral, which increases repayment rates, and (b) the self-selection of members within the group, which shifts screening and monitoring costs to the borrowers. Some of the disadvantages of group-lending are: (a) in the event of repayment difficulties, the entire group may collapse, leading to the so-called domino effect; (b) group training costs tend to be fairly high and, ultimately, no individual borrower-bank relationship is

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established; and (c) many people may prefer to have individual loans rather than being financially punished for the failure of repayment by other group members (Ledgerwood, 1999; Hartarska, Caudill, and Gropper, 2006).

Gonzalez-Vega and Villafani-Ibarnegaray (2007) have identified better repayment rates by individual compared to group based borrowers (excluding village banks) during periods of adverse systemic shocks in Bolivia. In these cases the implicit (self)-insurance among group members collapsed.

In the individual lending scheme, on the other hand, loans are offered to individuals based on their ability to provide the MFI with assurance of repayment and some level of non-traditional collateral. Usually, this lending technology requires major efforts by the staff of the MFI to develop close relationships with their clients. These individual lending technologies may be less costly and less labor-intensive to establish than group-based models (Ledgerwood, 1999).

In general, microfinance is deemed to be a tool that, if used properly according to sound financial practices, increases the outreach of financial intermediation and broadens the financial services available to the poor. This is accomplished mostly by reducing transaction costs and surmounting information problems (Gonzalez-Vega, 2003).

But a natural question that should be asked here and that seeks empirical answer is: 'How efficiently are the MFIs extending and broadening the frontier of financial intermediation?'

2.1.2 Efficiency Measurement: Concepts and Developments

There are many ways in which one may define and measure the performance of industrial activities such as the banking industry. Hughes and Mester (2008) discuss two broad approaches

to measuring technology and explaining performance of financial intermediaries: non-structural and structural approaches. The non-structural approach uses a variety of financial ratios that capture various aspects of performance for comparing the performance of financial intermediaries. Furthermore, it considers the relationships of these performance indicators with other factors to investigate the sources of differences in performances among firms. This approach usually focuses on achieved performances such as return-on-asset, return-on-equity, the ratio of fixed costs to total costs, and interest rate margins and spreads. The most commonly used tools of such type for analyzing intermediation efficiency are interest rate margins and spreads (Beck and Hesse's, 2006).

The structural approach, on the other hand, is choice-theoretic and, as such, relies on a theoretical model of the banking firm and a concept of optimization. The older literature applies the traditional microeconomic theory of production to banking firms, while the newer literature views the bank as a financial intermediary that produces information intensive financial services and diversifies risks, and combines the theory of financial intermediation with the microeconomics of bank production (Hughes and Mester, 2008). The best examples of such approach are frontier based performance and efficiency measures such as cost efficiency, profit efficiency, revenue efficiency, etc.

(a) The Non-structural Approach to Efficiency Measurement

Interest rate spreads and margins are often used as proxy variables for efficiency in intermediation. While spreads are the difference between ex-ante contracted loan and deposit interest rates divided by total earning assets, margins are the actually received interest (and non-interest) revenue on loans minus the interest costs on deposits and borrowings (minus non-

interest charges on deposits) divided by total earning assets. The main difference between spreads and margins are lost interest revenue on non-performing loans, so that spreads are normally higher than loans (Chirwa and Mlachila, 2004).

Interest rate spreads, or the gap between lending and deposit rates, are due to market frictions such as transaction cost and information asymmetries. Transaction costs associated with screening and monitoring borrowers and processing savings and payment services drive a wedge between interest rate paid to depositors and the interest charged to borrowers. Also, these intermediation costs contain an important fixed cost element, at the client, bank and financial system level. Bossone et al., (2002) finds a negative relationship between the size of banks and financial systems and operating costs and interest margins and spreads.

Moreover, the inability of creditors to diversify risks in a competitive market due to market failures (or no-existing markets) results in a risk premium in the lending interest rate, increasing the lending interest rate beyond the level necessary to cover the creditor's marginal cost of funds plus its intermediation costs. Banks whose loan portfolios are more exposed to risky and volatile sectors, such as agriculture, are often considered to have higher ex-ante interest rate spreads (Beck and Hesse, 2006). If this is the case, the Ethiopian MFIs are expected to have higher interest rate margin and spreads than the commercial banks because the MFIs mostly operate in the rural areas focusing on poor farmers, while the loan portfolios of the commercial banks is more or less expected to be diversified.

Finally, the inability of lenders to perfectly ascertain the credit worthiness of borrowers and their project ex-ante; and monitor the implementation ex-post gives rise to adverse selection and moral hazard, effectively adding another risk premium on the lending interest rates (Stiglitz and Weiss,

1981). This is purely the inefficiency component of the interest rate margin and spread. However, lack of possibilities to diversify risks and asymmetric information can also result in higher loan-loss provisions, which will reduce bank's ex-post interest margins.

Interest rate spreads and margins are not only determined by bank characteristics but also by the market structure. More competitive systems are expected to result in more efficient banks with lower spreads and margins. Demirguc-Kunt and Huizinga (2001) finds that countries with higher share of foreign banks experience lower average margins, consistent with the hypothesis that foreign bank entry imposes competitive pressure with resulting efficiency gains. The ownership structure of the banking system may also be associated with prevailing differences in efficiency. This is because market and ownership structures can have important impact on the incentive for banks to overcome the market frictions and efficiently intermediate societies' savings to borrowers.

(b) The Structural Approaches to Efficiency Measurement

In comparison to the non-structural approach (ratio analysis), the cost efficiency measures derived from the application of efficiency frontiers provide a more sophisticated information on banks' performance. They provide measures that allow aggregation of different outputs. Unlike cost ratios, they are relative measures, meaning in particular that scale effects are taken in to consideration. In other words, a bank is compared with efficiency frontiers of a virtual bank that produces the same output, to observe the difference in costs between both banks. This allows disentangling the scale effect, which might come from (dis)economies of scale, whereas ratio analyses compare each bank with all other banks whatever their size (Bauer et al, 1998 and Weill, 2004).

In its dynamic context, the influence of exogenous factors (such as technological innovation) on the whole set of banks has some impact on the cost ratios, but does not affect the cost efficiency measures. For instance, a reduction of interest rates that allows the decrease of the financial costs, results in the reduction of average costs but does not lead to the improvement of the cost efficiency scores as the efficiency frontier methods are relative and consequently do not change when all banks evolve in the same direction (Weill, 2004).

Finally, the impact of variables that are exogenous to the managerial performance can be extracted from the efficiency scores. This is of utmost interest for this study as the difference between the cost efficiency of CCBs and MFIs may be the result of differences in the economic environment under which they operate. Therefore, though the analysis of cost ratio may help to get a first glance on the relative performance of the two financial intermediaries, an application of efficiency frontiers could lead to a better analysis.

The Frontier Approach to Efficiency Measurement

It is important for a firm, no matter what it produces, to use the inputs in such a way that the cost of producing a given level of output is minimized. Or, given a vector of inputs, the output should be the maximum permitted by the given technology.

The history of microeconomic efficiency measurement started with Farrell (1957) who defined a simple measure of firm efficiency that account for multiple inputs. In his seminal paper, Farrell (1957) argues that the efficiency of any given firm consisted of two components: technical efficiency, the ability of a firm to maximize output from a given set of inputs, and allocative efficiency, the ability of the firm to use these inputs in optimal proportions, given their respective prices. Combining the two measures provides a measure of cost or productive efficiency.

Farrell (1957) suggests that efficiency can be measured empirically in reference to an idealized frontier isoquant (the efficient isoquant)-or equivalently, disturbances in an econometric model (the deviation of individual firms from the fitted isoquant)-which forms the basis of subsequent analysis.

Figure 2.1: Technical, allocative and cost efficiency
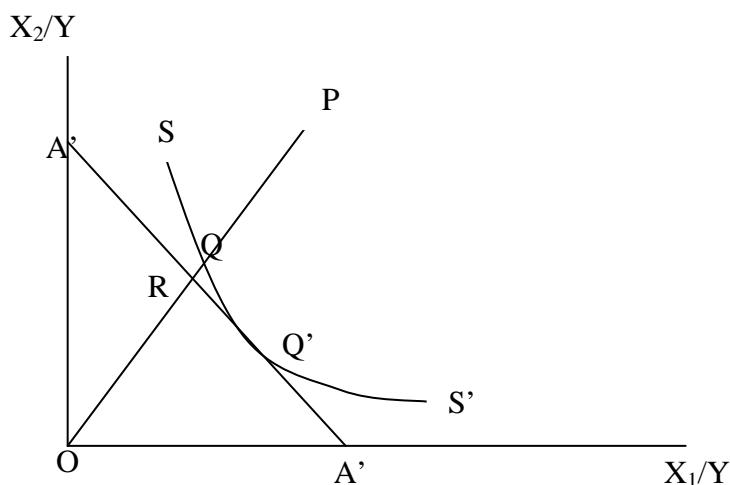
The essence of Farrell's (1957) argument is contained in Figure 2.1. Here two inputs X_1 and X_2 are used to produce a single output, Y, under the assumption of constant returns to scale (which can easily be relaxed). The isoquant SS' represents the various combinations of the two factors that a perfectly efficient firm might use to produce a unit output and is assumed to be known. This isoquant permits the measurement of technical efficiency. For a given firm using the quantities of inputs defined by point P to produce a unit of output, the level of technical efficiency may be defined as the ratio OQ/OP. This is the proportional reduction in all inputs (i.e., by movement to the more efficient isoquant) that could be theoretically achieved without any reduction in output. The technical efficiency score for a firm operating at point P will then be less than unity. Point Q, on the other hand, is technically efficient since it already lies on the

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efficient isoquant. The technical efficiency score of a firm operating at point Q is unity(OQ/OQ), thereby implying absolute or relative efficiency(depending upon the manner the efficient isoquant is constructed).

However, one may also need to measure the extent to which a firm uses the various factors of production in the best proportions, given their prices – allocative efficiency of the firm. Thus, in the above diagram, if AA' (showing different combination of inputs that can be purchased with a given cost outlay), has a slope equal to the ratio of the prices of the two factors, Q' and not Q is the optimal method of production; because although both points are equally (100 percent) technically efficient, the costs of production at Q' will only be a fraction OR/OQ of those at Q. Farrell (1957) called this ratio as the price efficiency of Q, which is commonly referred to as allocative efficiency. Here the distance RQ is the reduction in production costs that would occur if production occurred at point Q'-the allocatively and technically efficient point, rather than Q-the technically, but not allocatively efficient point.

Hence, total economic (cost) efficiency is the ratio OR/OP with the cost reduction achievable being the distance RP. Note that the cost efficiency ratio OR/OP is the product of technical efficiency ratio OQ/OP and allocative efficiency ratio OR/OQ. Cost efficiency measures how close a firm's cost is to what a best practice firm's cost would be for producing the same bundle of outputs. It then provides information on wastes in the production process and on the optimality of the chosen level of outputs.

In fact, these efficiency measures assume the production function of the fully efficient firm is known. In other words, they are methods of comparing the observed performance with some postulated standard of perfect efficiency. Farrell (1957) argues that though there are many

possibilities of defining the efficient production function, two at once suggest themselves- a theoretical function defined by engineers and an empirical function based on best results observed in practice.

Farrell (1957) suggests that as it is not really the case to specify a theoretically efficient function for a very complex process, the efficient isoquant must be estimated using the sample data. He suggested the use of either: (i) a nonparametric piecewise-linear convex isoquant constructed such that no observed point should lie below or to the left of it (known as the mathematical programming approach to the construction of frontier)-which leads to the Data Envelopment Analysis (DEA); or (ii) a parametric function, such as the Cobb-Douglas form, fitted to the data, again such that no observed point should lie to the left or below it (known as the econometric approach). These approaches use different technique to envelop the observed data, and therefore make different accommodation for the random noise and for flexibility in the structure of the production technology.

The econometric approach specifies a production function and recognizes that deviation away from this given technology (as measured by the error term) is composed of two parts, one representing randomness (or statistical noise) and the other inefficiency. In contrast to the econometric approaches, which attempt to determine the absolute economic efficiency of organizations against some imposed bench mark, the DEA approach seeks to evaluate the efficiency of an organization relative to other organizations in the same industry.

2.2 Econometric Approaches to Frontier Based Efficiency Measurement

In order to demonstrate the concept of empirical efficiency measurement, using econometric specification is more convenient than a graphical illustration. This section explains several issues

regarding the frontier methods of efficiency measurement by using the econometric specifications.

Formal econometric analysis of frontier production functions was first introduced by Aigner and Chu's (1968) reformulation of the Cobb-Douglas model. Greene (2008) specifies a simple mathematical model of efficiency estimation, based on the Aigner and Chu's (1968) framework. He assumes the existence of a well-defined production structure characterized by smooth, continuous, continuously differentiable, quasi-concave production or transformation function. Producers are assumed to be price takers in their input markets, so input prices are treated as exogenous. Assuming a single output production frontier, let

$$y \leq f(x) \dotfill (2.1)$$

denote a production function for a single output, y, using input vector x. Greene (2008), then, argues that an output based measure of technical efficiency is given as

$$TE(x, y) = \frac{y}{f(x)} \leq 1 \dotfill (2.2)$$

Greene (2008) suggests an econometric framework which embodies the above interpretation as well as the text book definition of production function. He begins with a model such as

$$y_i = f(x_i, \beta) TE_i \dotfill (2.3),$$

where $0 \prec TE(x_i, y_i) \leq 1$, β is a vector of parameters of the production function to be estimated, and i indexes the ith firm of the N firms in a sample to be analyzed. The production model is usually linear in the logs of the variables, so the empirical counterpart takes the form

$$\ln y_i = \ln f(x_i, \beta) + \ln TE_i = \ln f(x_i, \beta) - u_i \dotfill (2.4)$$

where $u_i \geq 0$ is a measure of technical inefficiency since $u_i = -\ln TE_i \approx 1 - TE_i$. Also, note that

$TE_i = \exp(-u_i)$.

(a) Deterministic Versus Stochastic Frontier Models

Greene (2008) defines deterministic frontier function as *frontier function in which the deviation*

of an observation from the theoretical maximum is attributed solely to the inefficiency of the firm.

This is in contrast to the specification of the frontier in which the maximum output that a

producer can obtain is assumed to be determined both by the production function and by random

external factors such as luck or unexpected disturbances in a related market. This second

interpretation is commonly referred to as *stochastic* frontier model. Greene (2008) uses a log-

linear (Cobb-Douglas) production function suggested by Aigner and Chu's (1968) to demonstrate

the distinction between *deterministic* and *stochastic* frontier models.

$Y_i = AX_{1i}^{\beta_1} X_{2i}^{\beta_2} u_i$ ....(2.5),

in which u_i (which corresponds to TE$_i$) is a random disturbance between 0 and 1. Taking logs

produces

$$\ln Y_i = \alpha + \sum_{k=1}^{K} \beta_k x_{ki} - \varepsilon_i$$

$$= \alpha + \sum_{k=1}^{K} \beta_k x_{ki} - \varepsilon_i ....(2.6)$$

where, $\alpha = \ln A$, $x_{ki} = \ln X_{ki}$, and $-\varepsilon_i = \ln u_i$

The non stochastic part of the right hand side of the above expression, $\alpha + \sum_{k=1}^{K} \beta_k x_{ki}$, is viewed as

the deterministic frontier. It is labelled 'deterministic' because the stochastic component of the

model is entirely contained in the inefficiency term, $-\varepsilon_i$. Aigner and Chu (1968) suggested two

methods of computing the parameters that would constrain the residual $-\varepsilon_i$ to be nonnegative: linear programming and quadratic programming.

Several methodological questions arise regarding the deterministic frontier models. Greene(2008) states that a fundamental practical problem with the deterministic frontier models is that any measurement error and any other outcome of stochastic variation in the dependent variable must be embedded in the one-sided disturbance. In any sample, a single errant observation can have profound effects on the estimates. Unlike measurement error in Y_i, this outlier problem is not alleviated by resorting to large sample results.

The stochastic production frontier proposed by Aigner et al. (1977) and Meeusen and Van den Broeck (1977) is motivated by the idea that deviations from the production frontier might not be entirely under the control of the firm being studied. Under the interpretation of the above deterministic frontier, some external events, for example, an unusually high number of random equipment failures, or even bad weather, might ultimately appear to the analyst as inefficiency. Worth yet, any error or imperfection in the specification of the model or in the measurement of its component variables including the dependent variable (output), could likewise translate into increased inefficiency measures. This is an unattractive feature of any deterministic frontier specification. A more appealing formulation holds that any particular firm faces its own production frontier, and that frontier is randomly placed by the whole collection of stochastic elements that might enter the model outside the control of the firm.

In Greene (2008) this is specified as follows,

$$y_i = f(x_i)TE_i e^{v_i},$$

where all terms are as defined above and v_i is unrestricted. v_i embodies measurement errors, any other statistical noise, and random variation of the frontier across firms. The reformulated model is

$$\ln y_i = \alpha + \beta x_i + v_i - u_i$$

As before $u_i > 0$ but v_i may take any value. A symmetric distribution, such as the normal distribution, is usually assumed for v_i (see below). Thus, the stochastic frontier is $\alpha + \beta x_i + v_i$ and as usual u_i represents the inefficiency component. Note that the ultimate objective in the econometric estimation of the frontier models is to construct an estimate of u_i or at least $u_i - \min_i(u_i)$. Greene (2008) notes that the first step in estimating the inefficiency term u_i is to compute the technology parameters α, β, σ_u, and σ_v (and any other parameters). It does follow that if the frontier model estimates are inappropriate or inconsistent, then estimation of the inefficiency term u_i is likely to be problematic as well.

(b) Issues Regarding the Distribution of the (In)efficiency Term

Several distributional assumptions have been made by different authors about the form of the inefficiency. While these assumptions differ in the restrictions imposed on the distribution of inefficiency, Green (2008) argues that inefficiency estimates are mostly robust to the distributional assumptions made about the inefficiency. The following paragraphs explain the most commonly used assumptions about the distribution of inefficiency.

The literature on the stochastic frontier models begins with Aigner et al's(1977) normal-half normal model in which the idiosyncratic error, v_i is $N(0, \sigma_v^2)$ and the one-sided error (the inefficiency component), u_i is distributed as the upper half of a normal distribution $N(0, \sigma_u^2)$

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In this model, the ratio $\lambda = \sigma_u \big/ \sigma_v$ characterizes the distribution of the inefficiency. If $\lambda \rightarrow +\infty$, the deterministic frontier results. If $\lambda \rightarrow 0$, the implication is that there is no inefficiency in the disturbance, and the model can be efficiently estimated by OLS Green (2008).

The assumption of half-normality ''is seen as'' unduly narrow, and numerous alternatives have been suggested. Green (2008), discusses the log likelihood and associated results for exponentially distributed disturbance constructed by Aigner et al., (1977) and Meeusen and Van den Broeck (1977).

Stevensen (1980) argues that the zero mean assumed in the Aigner et al.(1977) model was an unnecessary restriction. He produced results for a truncated (as opposed to half-normal) distribution. That is, the one sided error term, u_i is obtained by truncating at zero the distribution of a variable with possibly nonzero mean. The complete parameterization can be written as;

$v_i \sim N(0, \sigma_v^2)$,

$U_i \sim N(\mu, \sigma_u^2), u_i = |U_i|$

where the notation $| \ |$ is used for absolute value

Kumbakar and Lovell (2000) have derived the log likelihood function for the truncated normal distribution. Green (2008) argues that the parameters of the truncated normal distribution u_i provide a mechanism for introducing heterogeneity into the distribution of inefficiency. The mean of the distribution (or the variance or both) may assumed to depend on exogenous factors. One way such factors might be introduced into the model could be to use

$\mu_i = \mu_0 + \mu' Z_i$,

where Z_i is any variable that may affect the inefficiency term.

The best example of a model with such form is the widely used Battessi and Coelli (1995) model, in which the conditional mean of the inefficiency term is a function of several explanatory variables for inefficiency.

2.3 Empirical Literature

2.3.1 The Role of Heterogeneity in (Working Environments) in Efficiency Estimation

a. Common Frontier and the Issue of Heterogeneity

In estimating stochastic frontier models for the banking sector one, typically, compares the efficiency of the banks under the assumption that they operate under a common environment and they are homogenous. The interpretation of the resulting efficiency scores thus depends on the validity of this assumption. In practice, relative bank efficiency may be influenced by factors not generally included in the efficiency analysis, such as differences in the type of business a bank conducts, the characteristics of the markets it operates in, and differences in the economic climate. In such cases, the assumption of a common frontier may be unwarranted.

One illustration of this issue is the cross-country comparison of efficiency of firms (banks). Awareness of the bias that can occur in this type of cross-border bank efficiency comparison has led recent studies to incorporate country specific environmental conditions (Dietsch and Lozano-Vivas, 2000; Chaffai et al.,2001; Lozano-Vivas et al., 2001, 2002; Weill, (2004); Sathye, 2002; etc). For example, Dietsch and Lozano-Vivas (2000) emphasize that the assumption of a common frontier could yield misleading efficiency results for firms from different countries because such approaches do not control for cross-country differences in regulatory, demographic and environmental conditions that are out of the control of the management of the banks. The authors

find that efficiency scores based on the common frontier model tend to be low (high) for firms that operate under bad (good) home country conditions.

There are also studies that compare efficiency score of different types of banks operating in the same market. For instance, some studies have found that foreign owned banks are more efficient than domestic owned banks (Hasan and Hunter, 1996; Bos and Kool, 2004; Tahir and Haron, 2008; DeYoung and Nolle, 1996; Miller and Parkhe, 2002; Mahajan et al., 1996, etc). Bos and Kool (2003) analyzed cost and profit efficiency for large general banks, specialized banks and small general banks for the Netherlands over the period 1992-200. They found that small general banks loose on average. Large general banks outperform small general banks in terms of profit efficiency, possibly due to product and market differentiation, market power, or scale economies. Specialized banks are found to be equally profit efficient as large general banks perhaps because niche markets allow for a combination of product differentiation and market power.

The above results provide strong evidence that the assumption of a common frontier may be inappropriate in situations where firms are operating under different environmental conditions and/or the firms are not totally homogeneous. If so, estimated inefficiencies may be a combination of true managerial inefficiencies and environmental influences.

b. *Accounting for Heterogeneity in the Working Environments*

The fact that commercial banks and MFIs are not operating in the same socio-economic environment, along with the heterogeneity in the nature their businesses may bias the efficiency comparison. This necessitates some efforts to control for the heterogeneity. In fact, one may argue that the ''stochastic'' component v_{it} of the *stochastic frontier model* models the production

technology as having the firm-specific and time-specific shift factor, v_{it}, so that the model is not homogeneous.

What is meant by the homogeneity in such models is that firms differ only with respect to this random, noisy shift factor. Hence, there is a need to incorporate other forms of heterogeneity in the model. This includes, among other features, heteroskedasticity in the random parts of the model and shifts in the technology that are explainable in terms of variables that are neither inputs nor outputs (Greene 2004b, 2008).

Greene (2008) also identifies two types of heterogeneity: observable and unobservable. By observable heterogeneity, we mean as reflected in measured variables. This would include specific shift factors that operate on the production or cost function (or elsewhere in the model). How such variables should enter the model is also an important question. Alvarez et al. (2006) argue that they might shift the production/cost function or the inefficiency distribution (i.e., enter in the regression functions) or scale them (i.e., enter in the form of heteroskedasticity), or some combination of both.

Unobserved heterogeneity, in contrast, enters the model in terms of ''effects''. This is usually viewed fundamentally as an issue of panel data. Unobserved heterogeneity enters the model as characteristics, usually time invariant, that may or may not be related to other variables existing in the model.

In cases where heterogeneity is observable, we are sometimes interested in models in which those variables can enter in the form of parameterized functions of ''exogenous variables.'' Two different views exist in the efficiency measurement literature regarding the way these

heterogeneities could be captured. The first approach assumes that the environmental factors influence the shape of the technology and hence that they should be included directly in to the production function as control variables (e.g., Good et al (1993)). The second approach assumes that the environmental factors influence the degree of technical inefficiency (and not the shape of the technology) and hence that they should be modeled so that they directly influence the inefficiency term (e.g., Battese and coelli (1995)).

Both approaches appear to be reasonably appealing and prior selection is difficult. But they differ significantly in that the first produces technical efficiency scores which are net of environmental influences, while the second gives scores that incorporate the environmental influences and hence may be termed as gross efficiency scores. To make these score comparable, Coelli, Perelman, and Romano (1999) proposed methods that may be used to convert the net technical efficiency scores into the gross measures and vice versa.

Measuring net efficiency allows one to predict how the firms would be ranked if they were able to operate in equivalent environments. Thus, net efficiency indicators can be viewed as being indicators of managerial performance, given that the gross efficiency predictions have been purged off the major environmental influences. Furthermore, these measures allow us to estimate the expected impact on efficiency of a change in the environmental context when it is at least partially, under the control of the policy makers or indirectly modifiable by the companies themselves (Coelli, Perelman, and Romano, 1999).

Apart from the controversy where to put the environmental variables, there is still another unresolved issue concerning the view that heterogeneities affect the inefficiency (rather than shape of the technology). First, Battese and Coelli (1995), and Kumbhakar, Ghosh and

McGuckin (1991) discuss single-stage estimation procedures where the efficiency measure is an explicit function of a number of independent factors and a constant. That is, they do not change the assumption of the uniform efficiency frontier, but include independent factors exogenously in the noise term (the error term measuring inefficiency score).

However, as noted by Bos and Kool (2004), there are important negative consequences of taking this approach. Accordingly, dependent on the number and scaling of the independent factors in the single-stage procedure the maximum likelihood optimization becomes lengthy and unstable: different algorithms and small changes in the optimization rules lead to early abortion of the optimization procedure and/or very different estimation results. They note that re-scaling the independent factors is not an option. It could solve some optimization problems but at the same time leads to model coefficients that are not very reliable.

The second, and more widely used, procedure adopt a two-stage estimation approach, in which the first stage involves the specification and estimation of the stochastic frontier production/cost function and the prediction of the technical efficiency scores of the firms. The second stage of the analysis then involves the specification of a regression model where the technical efficiencies are regressed upon some explanatory factors, such as the environmental and/or managerial factors. Some of the studies that adopt this procedure include: Pitt and Lee, 1981; Kalirajan, 1989; Bos and Kool, 2004; Gonzalez, 2008; Gregoire and Tuya, 2006; Worthington, 2000; etc.

Wang and Schmidt (2000) make a convincing argument that not accounting for exogenous influences at the first step will induce a persistent bias in the estimates that are carried forward in to the second. They argue that this is akin to an omitted variable problem in the linear regression. The biases in the estimated coefficients will be propagated in subsidiary estimates computed

using those coefficients. Similar arguments are made by Caudill and Ford (1993). Ultimately, the case made by these authors is that when heterogeneity in the model is parameterized in terms of observables, those features should all appear in the model at the first step.

There is also inconsistency in the above two-stage method. As noted by Battese and Coelli (1995), the stochastic frontier production function is estimated in the first stage under an assumption that the inefficiency scores (error term) are identically distributed, while in the second stage the predicted technical efficiencies are regressed on a number of factors, and hence suggesting that the inefficiency scores are not identically distributed.

More recently, Battese et al. (2004) have proposed a method used to estimate country-or regional specific frontiers and end up with efficiency score that can be compared in an absolute sense. They construct the so-called meta-frontiers by enveloping regional-specific frontiers. Bos and Schmiedel (2003), apply this methodology to Eight European banking markets for the period 1993-2000. The authors conclude that for most countries included in the study, profit efficiency in particular improves significantly when estimated using a meta-frontier instead of a common frontier. They tentatively argue that this may be evidence that local market circumstances play an important role in determining efficiency.

However, they acknowledge that this approach is somewhat problematic for two reasons. First, it is not clear for which groups of banks we need to estimate separate frontiers. Second, we know little of the underlying determinants of differences in efficiency frontiers if we simply estimate them separately or in a meta-analysis. The meta-analysis therefore does not help us understand the marginal contribution of different types of environmental factors that may explain differences in bank efficiency.

2.3.2 The Determinants of Bank/MFIs Cost Efficiency

Though obtaining the cost efficiency scores is a crucial step in the efficiency analysis, it is also interesting and helpful to explore the sources of variation in efficiency. Freid, Lovell, and Schmidt (2008) argue that ''the identification and separation of controllable and uncontrollable sources of performance variation are essential to the adoption of private practices and public policies designed to improve performance.''

Theory and empirical works identified a number of factors that influence the efficiency of financial intermediaries. These include: characteristics of the operating environments, characteristics of the management, level of economic activity (business cycle) and firm specific features that are related to the administration of its financial resources. The following are some of these variables.

Ownership Structure: Jensen and Meckling (1976) defined agency cost as the difference in value of a firm owned entirely by its manager (so that there is no agency problems) and one where the manager does not own all of the firm. Morck, Shliefer, and Vishny (1988) hypothesized that managerial ownership creates two contrasting incentives: a higher ownership stake, first, better aligns the interest of managers and outside owners and, second, enhances managers control over the firm and makes it harder for managers to be ousted when they are not efficient. Measuring firm performance by Tobin's q, these authors provide (a quite intuitive) evidence that the so-called alignment-of-interests effect dominates the entrenchment effect at lower levels of managerial ownership, while the entrenchment effect dominates over a range of higher levels.

Thus the reason why different ownership forms can lead to different efficiency level of financial intermediaries is mainly related to the principal-agent problem: mangers in foreign owned or privatized institutions are supposed to be more constrained by capital market discipline. On the contrary, lack of owners' control makes management more free to pursue its own agenda and few incentives to be efficient.

However, recent studies yield mixed or inconclusive result about the role of ownership. For example, Bonin et al. (2005) find that privatization by itself is not sufficient to increase bank efficiency by using a sample of banks from eleven transition countries. Similarly, Fries and Taci (2005) find, for a sample of banks in fifteen transition economies, that there is no significant evidence that privatization or major foreign ownership has a direct effect on cost efficiency. La Porta, Lopez-de-Silanes, and Shleifer (2002) examine the ownership structure of banks in 92 countries and find that higher government ownership of banks was associated with slower financial sector development and lower productivity growth.

Also, Kiyota, Peitsch and Stern (2007) have investigated the relative performance of state-owned and private banks in Ethiopia. They found that controlling for other factors, the costs of state-owned banks are significantly higher (1.6 percentage points) than private banks; the ROA (return-on-asset) of state owned banks is 1.7 percentage points lower than private banks; and the interest spread is 1.5 percentage points smaller for state-owned banks than private banks. The first two findings imply that state owned banks are less efficient than private banks.

Asset Size and branch net-work: Theory suggests that as the size and number of branches of a bank increases, attention of management may divert from cost minimization to routine administrative activities. Hence, other things being equal, small firms are expected to be more

cost efficient than large firms. Several studies confirm this possibility. Muluneh (2008) has shown that number of branches and asset size are positively related to X-inefficiency for the private commercial banks in Ethiopia. Similarly, León(2008) found that small and medium sized non-bank MFIs are more efficient than the larger ones in Peru, for the period 1994-1999.

Capital size: Higher capital size allows banks to exploit scale economies. That is banks with higher level of capital have the legal right to allow single borrowers to borrow a higher amount of money and reduce their transaction costs. In addition, higher capital connotes availability of more funds for lending without borrowing from other sources that require incurring additional costs. Muluneh (2008) found that size of capital is negatively related with X-inefficiency for private commercial banks in Ethiopia.

Age (experience): Theory of learning-by-doing predicts that firms become more efficient over time. The activities performed by financial intermediaries should be usually tailored to the specific clients and their specific demand. Understanding this segment of the market takes time and trial-and-error learning. Gregoire, and Tuya (2006), for instance, have found a negative and statistically significant relationship between experience and inefficiency for MFIs in Peru. They argue that MFIs that have been in operation for a longer period of time build up market knowledge and experience in managing their portfolios, which allows them to become more efficient. Gonzalez (2008), and Muluneh (2008) have also found that firm age has positive impact on cost efficiency for Mexican MFIs, and Ethiopian private commercial banks, respectively.

Other determinants of financial intermediaries' efficiency

Apart from the above mentioned factors, a number of authors include other firm specific characteristics as regressors of cost (in)efficiency scores. Among others, these include market

share (Gregoire, and Tuya (2006), delinquency rate (Gregoire, and Tuya (2006)), outreach (Hermes, Lensink, and Meesters (2008); Gonzalez (2008)), intermediation ratio-measured by deposit-loan ratio (Gregoire, and Tuya (2006); Leon(2003)), macroeconomic performance such as unemployment rate, inflation rate, etc., (DeYoung, Hasan, and Kirchhoff (1997); Gregoire, and Tuya (2006); Fuentes and Vergara (2003)).

2.4 The Ethiopian Financial Sector

2.4.1 Brief History of the Ethiopian Financial Sector

Modern banking in Ethiopia started in 1905 with the establishment of Abyssinian Bank. The bank was owned and managed by the British-owned National Bank of Egypt and was given a 50 years banking monopoly including the right to issue coins and notes. In 1908 a new development bank (called Societe Nationale d' Ethiopie Pour Le Development de l'Agriculture et du Commerce) and two foreign banks (Bankue de l'Indochine and the Compagnie de l'Afrique Orientale) were also established (Belai, 1987). Because these banks were criticized for being wholly foreign owned, the Ethiopian Government purchased the Abyssinian Bank, which was the dominant bank, in 1931 and renamed it the Bank of Ethiopia-the first nationally owned bank in the African Continent. The Bank of Ethiopia was also authorized to issue notes and coins and act as the government's bank (Belai, 1990; Befekadu, 1995).

After few years of operation the Bank of Ethiopia was closed following the Italian occupation. During the five-years of Italian occupation (1936-41) several Italian banks opened branches in Ethiopia. After independence from the Italy's brief occupation, where the role of Britain was paramount owing to its strategic planning during the second world war, Barclays Bank was established and it remained in business in Ethiopia between 1941-43   (Befekadu, 1995).

Following this, in 1943 the Ethiopian government established the State Bank of Ethiopia, which was operating as both commercial and a central bank until 1963 when it was remodeled in to today's National Bank of Ethiopia (the Central Bank, re-established in 1976) and the Commercial Bank of Ethiopia (CBE). After this period many other banks and non-bank financial intermediaries were established and stayed in business until the 1974 revolution[4] (Belay, 1990).

All privately owned financial institutions including three commercial banks, thirteen insurance companies, and two non-bank financial intermediaries were nationalized on 1 January 1975.[5] The nationalized banks were reorganized and one commercial bank (the Commercial Bank Of Ethiopia), a national bank (recreated in 1976), two specialized banks- the Agricultural and Industrial Bank (AIB), renamed recently as the Development Bank of Ethiopia (DBE), and one insurance company (Ethiopian Insurance Company)— were formed. Following the regime change in 1991 and the liberalization policy in 1992, these financial institutions were reorganized in to work in a market-oriented policy framework. Moreover, new privately owned financial institutions (including commercial banks and Microfinance institutions) were also allowed to work alongside the publicly owned ones. (Alemayehu, 2006)

The period 1990s was a turning point for the development of the Ethiopian financial sector. Following Proclamation no. 84/1994, that allowed the private sector (owners have to be Ethiopian nationals, however) to engage in banking and insurance businesses, the country

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[4] Some of them were Banco di Napoli, Imperial Saving and Home Ownership Public Association, National Bank of Ethiopia (NBE), CBE, Addis Bank Share Co., Ethiopian Saving and Mortgage Share Co., Ethiopian Investment Share Co., Banco di Roma (Ethiopia) Share Co., and Agricultural and industrial Development bank.

[5] The commercial banks were Banco di Napoli, Addis Bank Share Co., Banco di Roma (Ethiopia) Share Co.. the insurance companies were African Solidarity, Ethio-American Life, Blue Nile, Ethiopian General, Imperial, Afro-Continental, Pan-African, Union, Ras, and the Ethiopian life and Rasi. The non-bank financial intermediaries were Imperial Saving and Home Ownership Public Association and Ethiopian Saving and Mortgage Share Co. (Gidey, 1990).

witnessed a proliferation of private banking and insurance companies. Currently, there are more than thirteen private commercial banks and eight insurance companies in operation. The proclamation also allowed the establishment of microfinance institutions and currently there are more than, twenty six microfinance institutions operating both in the urban and rural areas of the country.

2.4.2 Market structure and Regulatory Environments of the Ethiopian Financial Sector

The financial sector is not yet opened to foreign participation and competition. Foreign firms are not allowed to provide any financial intermediation according to proclamation number 84/1994 of the country. According to Kiyota, Peitsch and Stern (2007), the financial liberalization index, which measures banking security and independence from government on a scale of 10 to 100 (100 being the most liberal), is only 20 for Ethiopia (the lowest in Sub-Saharan Africa). Moreover, bank concentration, defined as the asset share of the three largest banks, is 87.9 percent in Ethiopia (the highest in East Africa) according to these authors. The authors, however, noted that the asset share of the private banks has increased from 6.4 percent in 1998 to 30.4 percent in 2006.

A more or less similar situation explains the Ethiopian microfinance industry. According to Kereta (2007), out-of the 27 MFIs (as of December 2007) operating in both rural and urban areas of the country, two of them ACSI and DECSI, take more than 65 percent share of the clients served and 62 percent share of the total outstanding loan provisions by MFIs.

Regarding the regulatory frameworks, proclamation number 40/1996 empowers the NBE to regulate and supervise microfinance operations in the country. According to this proclamation, the Ethiopian MFIs are allowed to engage in all banking activities, except foreign banking. As stated above, in proclamation number 84/1994 the ownership of banking and insurance companies are reserved for the Ethiopian nationals and legal personalities only. In line with this proclamation, the microfinancing business too is reserved for the Ethiopian nationals and legal personalities only.

Microfinance businesses are provided preferential treatments in terms of minimum capital requirements and a possibility of exemptions from tax. Accordingly, the minimum capital requirement for a MFI is Birr 200,000 (Directive number MFI/01/96) as compared to Birr 75 million for commercial banks.

Also, the NBE is expected to provide technical assistance to MFIs according to Article 11. Likewise, the Ministry of Finance and Economic Development determines the manners and conditions of tax exemption (according to Article 19) and approves line of concessional credit or any assistance from foreign sources for the purpose of lending or capitalization.

The National Bank of Ethiopia Directive Number SBB/29/2002 limits the aggregate loan or extension of credit by any commercial bank to any single borrower to a maximum of 25 percent of total its capital, and Directive Number MFI/17/2002 limits the maximum lending to a single borrower to 0.5 percent of the total capital for MFIs with a precondition that the total lending does not exceed some 20 percent of the preceding year's disbursement.

Similar to the commercial banks, MFIs are given the legal right to fix their lending interest rates (Directive number MFI/12/98), while the minimum saving (deposit) rate is fixed at 3 percent per annum.

2.4.3 Performance of the Ethiopian Financial Sector

(a) The Commercial Banks in Ethiopia

Studies on the *performance of the Ethiopian commercial banks* are extremely limited. Only studies by Geda (2006); Kiyota, Peitsch, and Stern (2007); and Muluneh (2008) are worth mentioning.

Kiyota, Peitsch, and Stern (2007) compare the performance of state-owned and private banks in Ethiopia by using bank level panel data for the period 1998-2006. They used a linear regression focusing on three performance indicators: cost per total assets, Return On Asset (ROA) and interest rate spread. They found three important results. First, the costs (per asset) of the state-owned banks are significantly higher (1.6 percentage points) than those of private banks. Second, the ROA of state-owned banks is 1.7 percentage points lower than private banks. Third, the interest rate spread is 1.5 percentage points smaller for state owned banks compared to private banks.

The first two results are suggestive of the relatively better performance of private banks, while the third result suggests that the state-owned banks are better placed in intermediation efficiency. However, some features of the model make the results less reliable. First, not enough controls are made for the heterogeneities existing among the firms. For instance, the authors included only market share (based on asset) and lagged value of asset (the latter is included to control for size) as regressors, apart from the ownership-dummy variable. But some other control variables such as capital size, branch network, age, etc should have been included owing to the heterogeneity between state-owned and private banks along these lines. Also, the coefficients for the ownership-dummy for the first two performance indicators (cost per asset and ROA) are significant only at 10 percent significance level.

Muluneh (2008) analyzes the cost efficiency of private commercial banks using the stochastic frontier model. He used bank level quarterly panel data for the period first quarter of 1997/98 to the second quarter of 2005/06. The study also examines the market structure of commercial banking industry in Ethiopia, and finds a highly concentrated market towards the public banks,

especially in total asset and deposits. Regarding, the cost efficiency, the private commercial banks in Ethiopia exhibited an average cost inefficiency ranging from 67 percent (during the first four quarters of the observation) to 89 percent (during the last four quarters). Also, capital size is found to be negatively related to cost inefficiency, while asset size, branch network and age are found to be positively related to cost inefficiency.

Several aspects of the study can be questioned, however. First, the study did not consider deposit mobilizations as outputs of the banking activity, which could bias the cost efficiency estimates. Second, the study did not consider several factors that may drive the cost efficiency of the banks such as average loan size, average deposit size, the degree of competition, etc.

Alemayehu (2006) compares the performance of the Ethiopian financial sector before and after liberalization. The study considered outstanding loans, deposit mobilizations, interest rate spreads and sectoral composition of loans both before and after liberalization and found that the performance of the financial sector has by and large been in line with the target set by IMF, with occasional movement above and below the target set.

(b) Performance of the Ethiopian MFIs

The literature on the Ethiopian MFIs concentrates largely on the impact of the institutions on poverty and gender empowerment, their challenges and prospects, ignoring aside an equally important issue, the performance of the institutions. Among, the very few recent studies on the performance of the Ethiopian MFIs are: Wolday (2008) and (Befekadu, 2007).

According to Befekadu (2007), Microfinance in Ethiopia is at its infant stage. Based on the data for 2006, he indicates that the industries outstanding loans to GDP was 1.7 percent. He also

shows that the total mobilized client savings by MFIs in Ethiopia had reached 3.6 percent of the country's gross national savings.

The MFIs are totally concentrated on short-term loans ranging from 6 to 24 months, while the interest rates they charge ranges from 14 to 24 percent. The variations in the interest rates are based on variations in man power and material costs involved in processing and monitoring of loans, in risks involved in the type of businesses, and in vulnerability to draught or extreme poverty (Befekadu, 2007).

Regarding the performance of the Ethiopian microfinance industry, Return On Asset (ROA) and Return On Equity (ROE) for the Ethiopian MFIs have increased from less than 2% and 4% in 2001 to more than 3% and 10% in 2007, respectively. Similarly, the dependency ratio as measured by the ratio of donated equity to total capital declined from 63 percent in 2001 to 31 percent in 2007, while financing loan through donated capital declined over the years from 42.5 percent to 11.1 percent. Also, the ratio of non-performing loans (loans that are at least 90 days overdue) to out-standing loans decreased from 3.7 percent in 2005 to 3.3 percent in 2007 (Befekadu, 2007).

Wolday (2008) indicates that, as a result of increase in outreach, the Ethiopian MFIs have shown a consistent decline in their operating expense to loan portfolio ratio, which reduced their overhead costs. ROA and ROE have shown a significant improvement over the period 2003 to 2006. According to the study, the number of MFIs with positive ROA increased from two in 2003 to thirteen in 2006, while the number of MFIs with positive ROE increased from two in 2003 to five in 2005.

Chapter Three

Methodology, Data and Estimation

This study uses the stochastic frontier model to investigate cost efficiency of the Ethiopian MFIs and commercial banks. In order to strengthen the frontier analysis, the study starts with one of the most widely used non-structural (ratio) analysis. The following sections build these two models, explain the characteristics of the data set used in both models and the estimation techniques followed.

3.1 Specification of the Non-Structural Model

Interest rate spreads and margins are often used as proxy variables for efficiency intermediation. Though in a world with no market frictions or transaction costs deposit and lending rates are equal, intermediation costs and information asymmetries, resulting in agency costs, drive a spread between interest rate paid to savers and interest rate charged on borrowers, with a negative repercussion for financial intermediation (Beck and Hesse, 2006).

The logic behind using interest margins and spreads as a proxy for intermediation efficiency is, thus, because more efficient banks- banks which have lower intermediation costs- are expected to have lower interest rate margins and spreads.

Thus, in this study, comparison of the interest rate margin/spread of the commercial banks and MFIs will be made to investigate which group of firms are more efficient in financial intermediation.

However, one should cautiously view the results based on interest rate margin/spread analysis because interest rate margins and spreads are also driven by exogenous factors in addition to

intermediation (transaction) costs and information asymmetries. Especially, in the cases where the financial intermediaries are heterogeneous (like commercial banks and MFIs in Ethiopia) in terms of their nature of businesses, the economic conditions and regulatory frameworks under which they operate, taking interest rate margins and spreads as a proxy for intermediation costs could be misleading. However, these analyses could yield non-negligible tentative evidence about the intermediation efficiency of the financial institutions.

Determinants of Interest Rate Margin/Spread

Once the interest rate margins and spreads are used to investigate the intermediation efficiency of the firms, the next step is to examine factors that underlie the efficiency differences among the firms.

The Two-Way Error Component Model (TWECM) will be used to explore the determinants of the interest rate margin and spread. Extending Beck and Hesse's (2006) Pooled Regression model, the two-way error component model can be written as:

$$Intermdineff_{it} = \alpha + \omega_i + \lambda_t + X_{it}^{'} \ \beta + v_{it}$$

where

- ω_i denotes the unobserved individual specific effects,

- λ_t denotes the unobserved time effect,

- v_{it} is the remainder stochastic disturbance term,

- X_{it} is a vector of explanatory variables that derive the interest rate margins/spreads, and

- α, and β are a vector of parameters to be estimated.

Note that ω_i is time invariant and it accounts for any individual specific characteristics that is not included in the model, while λ_t is individual-invariant and it accounts for any time-specific effect that is not included in the model.

The vector of explanatory variables (X_{it}) considered include ratio of overhead costs to total asset (OVERHD), number of firms providing the same kind of services in the market region of a firm (NOFIRMS), branch network (BRANCH), total asset (LNASSET), proportion of loan in total asset (PROPLOAN)-which is included as a measure of the managers' risk taking, average loan size (AVERLOAN), Herfindahl Index (HI) of loan market concentration (HERFIND), ratio of commercial funds to total outstanding loan (COMMERCE), proportion of non-earning liquid assets in the total asset (LIQUID_ASSE), group-dummy (GROUPDUMMY) assuming a value of 1 for MFIs and 0 for commercial banks and ownership dummy (OWNEDUMMY) assuming a value of 1 for government owned firms and 0 otherwise. These variables are briefly explained in the next section.

3.2 Specification of the Stochastic Frontier Model (SFM)

Several techniques have been proposed in the literature to measure efficiency with frontier approaches. The most commonly used techniques are: Data Envelopment Analysis (DEA), the Stochastic Frontier Analysis (SFA), the Thick Frontier Approach and the Distribution-Free Approach.

DEA is non-parametric while the latter three are parametric methods (Berger and Mester, 1997a). These techniques differ mainly in the distributional assumptions used to disentangle inefficiency differences from random errors.

Distribution-free approach does not allow assessment of evolution of efficiency as it assumes that (bank) efficiency score is stable over time. Thick Frontier approach only provides the average efficiency score for the whole tested sample, whereas this study aims to compare the efficiency of the two groups of financial intermediaries. Finally, DEA approach assumes that all deviations from the estimated frontier represent inefficiency. Moreover, in the DEA it is not easy (relative to the SFM) to capture the control variables in the estimation of a cost frontier. (see Bauer et al, 1998 for a detailed note on comparison of frontier efficiency methods).

Therefore, in view of the environmental differences that exist between the CCBs and MFIs and their potential impact on the efficiency comparison, the SFM is preferred to the DEA in this study for its relative technical simplicity in capturing these environmental heterogeneities. Thus, here the stochastic frontier approach will be employed to estimate the cost efficiency scores (Aigner et al (1977)), following the applications by Mester (1996), Allen and Rai(1996), Altunbas et al(2000), Weill(2004), and Coelli, Perelman and Romano(1999).

The stochastic frontier cost function will be used, which allows the observed cost of the firms to deviate from the efficient frontier (the benchmark) due to either random events and/or possible inefficiencies. Following Kumbakar (1996), the minimum cost function (also known as the cost frontier) is defined as:

$$C^*(W,Y) = \min_{X}\{(W'X)/h(Y,X) \geq Y, X \geq 0\} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(3.1)$$

where W is the vector of input prices (prices of labor, physical capital and loanable fund); X is the vector of inputs (labor, physical capital, and loanable fund) and Y is the amounts of a vector of outputs produced, which may include outstanding loans and deposit mobilizations. Finally, $h(\ )$ is an input transformation function that shows the mathematical relationship between the

output vector Y and the input vector X. The conditions $h(Y,X) \geq Y$, $X \geq 0$ imply that the maximum possible outputs, given a vector of non-negative inputs, can never be less than the level of outputs produced (Kumbakar, 1996).

There are two main reasons for the selection of the cost function instead of the alternative dual form-the production technology. First, more often, the explicit assumption of the production function approach that input levels are fixed and that managers are attempting to maximize output will not hold. Particularly, one would expect that for financial institutions, such as commercial banks and MFIs, the imposition of capital adequacy requirement would tend to limit the amount of output possible at a given time period. Hence, a more suitable behavioral objective for these institutions would be that of cost minimization, rather than output maximization. Second, commercial banks and MFIs are multiple output firms including loans, investment in financial assets (such as government treasury bills, and bonds), and saving mobilization. Thus the necessity of integrating multiple financial outputs enhances the argument for using a cost function (Cebenoyan et al, 1993; Mester, 1987, 1993; Mc Killop and Glass, 1994).

The general model is specified, following Kumbakar (1996), as follows:

Let the technology of financial intermediation be defined by the following transformation function.

$$h(Y_{1it}, Y_{2it}, \ldots \ldots Y_{mit} ; X_{1it}, X_{2it}, \ldots X_{kit}) = 0 \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (3.2),$$

where X, Y and $h(\ )$ are as defined above. The subscripts i and t respectively denote the firm and time periods. Kumbakar (1996), states that X and Y can be viewed as a vector of management decision variables. There is an objective function $J(\ )$, and the optimal management

strategy X^* is the value of $X \geq 0$ that minimizes the objective function. As stated above, we assume that the objective of the management is to minimize cost,

$$C_{it} = \sum_j W_{jit} X_{jit} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.3),$$

given the demand for the products and the technology equation (3.2), where X_{jit} is a vector of inputs and W_{jit} are their prices, for $j = 1\ldots k$. Thus the problem of a typical financial intermediary at any point in time is to determine the X_{jit} that minimizes $\sum_j W_{jit} X_{jit}$ subject to equation (3.2). Assuming that the transformation technology satisfies the necessary regularity conditions (including monotonicity, smoothness and quasiconcavity), we may deduce that the solution of X_{jit} from the above problem, $X_{jit}^*(\ )$ gives the input demand function of the following form

$$X_{jit}^*(\ ) = g_j\left(W_{1it}, W_{2it} \ldots W_{kit}, Y_{1it} \ldots Y_{mit}\right), \quad j = 1 \ldots k \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.4)$$

The optimal value of $J(\ )$ defines the minimal cost function (cost frontier) $C^*(\ )$, which is

$$C^*(\ ) = \sum_j W_{jit} X_{jit}^*(\ ) = f\left(W_{1it} \ldots\ldots W_{kit}, Y_{1it} \ldots Y_{mit}\right)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.5)$$

where, the cost function is monotonic in outputs, monotonic in each input price, linearly homogeneous in the input prices and so on.

If there are inefficiencies (and possibly random shocks beyond the control of firms) the actual costs of the firms will exceed the frontier costs, which are to be estimated using data on input prices and outputs. Thus the actual cost C_{it} is related to the frontier cost C^* in the following way:

$$C_{it} = f(X_{it}, \beta) + \varepsilon_{it}, \quad\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.6)$$

$$\varepsilon_{it} = v_{it} + \mu_{it}$$

where: C_{it} is the logarithm of the total cost of the i-th firm (i=1, 2…,N) over the period of time t (t=1, 2, …,T).

f is some functional form defining the minimum cost (the cost frontier)

X_{it} represents (redefined for the sake of reducing notation burden) a kx1 vector of input prices and output of the i-th firm over the period of time t

β is a kx1 vector of unknown parameters to be estimated

The disturbance term ε_{it} is composed of two random variables: v_{it}, which is called the random error term and μ_{it}, which is a non negative random variables that represent the cost inefficiency in production.

The intuition behind the error component specification is that any deviation from the frontier caught by the inefficiency term, μ_{it}, is the result of factors under the firm's control, such as the will and effort of the financial intermediary and its employees, and factors such as the ability to distinguish between good and bad borrowers, to monitor their activities, to enforce them, and to control costs (Aigner, Lovell and Schmidt(1977)). However the frontier itself can vary randomly across firms due to the random error v_{it} which is interpreted as being the result of favourable or unfavourable external events such as luck or climate (factors beyond the firm's control), and measurement error.

To estimate the parameters of the above model using the maximum likelihood method, one must select the distributional forms for the two error terms (v_{it} and μ_{it}). The most widely used assumptions are that the random error term v_{it} is independently and identically distributed as

$N\left(0,\sigma_v^2\right)$, and the non-negative inefficiency random variable μ_{it} is distributed independently of v_{it} and has a half-normal distribution. That is, it has a distribution equal to the upper half of the $N\left(0,\sigma_\mu^2\right)$ distribution.

In this study μ_{it} are assumed to be independently distributed as truncations at zero of the distribution

$$N\left(m_{it},\sigma_\mu^2\right); \text{ where } m_{it} = \delta Z_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(3.7)$$

where Z_{it} is a vector of variables (including firm specific organizational characteristics) which may influence the cost efficiency of a firm and δ is the corresponding vector of parameters to be estimated.

There are three reasons for choosing the truncation distribution rather than the commonly used half normal distribution. First, the parameter m_{it} of the truncated normal distribution for μ_{it} provides a mechanism for introducing heterogeneity into the distribution of the inefficiency term, which is crucial in this study owing to the heterogeneity in the working environments and businesses characteristics of the banking and microfinancing industries. Also, there is a wide disparity in size among the firms involved in this study. For instance, the privately owned banks in Ethiopia have a very small size as compared to the publicly owned Commercial Bank of Ethiopia. The same situation explains the MFI industry of the country. The three largest MFIs- ACSI, DECSI and OCSSCO- control 29%, 33% and 16% of the total outstanding loans by MFIs (Befekadu, 2007). There is also size difference between the commercial banks and the MFIs.

Second, the zero mean assumption in the half-normal distribution is an unnecessary restriction.

Third, assuming that μ_{it} are identically distributed is inconsistent with the two-stage approach of exploring the determinants of inefficiency-which is part of the objectives of this study.

Given the definition of the stochastic frontier cost function in equation (3.6), we note that the realizations of the μ_{it} are not observable. That is, in the estimation of the unknown parameters of equation (3.6), the residuals of the model will be realizations of $\varepsilon_{it} = v_{it} + \mu_{it}$, not that of μ_{it}. Battese and Coelli (1988) observe that an appropriate predictor for the technical inefficiency term μ_{it} is given by the conditional expectation of $\exp(\mu_{it})$, given the random variable ε_{it}. That is, one may define the cost inefficiency score (μ_{it}^p) as:

$$\mu_{it}^p = E\left[\exp(\mu_{it})/\varepsilon_{it}\right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.8)$$

The Cost Frontier and Heterogeneity in the Working Environment

As mentioned earlier the commercial banks and MFIs operate in different economic environments which may subsequently have an influence on their cost efficiency levels. The above defined frontier model, however, does not account for this possibility. In order to take into account the environmental heterogeneities it is assumed that these environmental conditions affect the production technology. This requires modeling the cost function by introducing some representative variables, aside the production factors.

Following the works by Coelli, Perelman, and Romano (1999); Good et al. (1993) in terms of equation (3.6) and assuming that R factors representing the working environment, E_{rit}, enter in a simple linear way in the cost frontier, the modified cost frontier becomes:

$$C_{it} = f(X_{it}, \beta) + \sum_{r=1}^{R} \theta_r E_{rit} + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.9)$$

where the θ_r are parameters to be estimated.

Using equation (3.8) to define predictors of cost efficiency relative to the frontier model defined in equation (3.9) yields cost efficiency measures net of environmental influences.

3.2.1 Variables of the Model

Estimating equation (3.6) requires the formulation of a suitable cost function and defining its variables.

a. *Variables of the cost function*

In modeling banks' cost efficiency, one of the most debated issues in the literature is the definition of the inputs and outputs of multi-product financial firms. The debate concentrates on the treatment of deposits, considering that they have both input and output characteristics. In fact this is contingent upon one's a priori conceptualization of the role of financial institutions, for which two primary approaches exist.

The first of this, the production (or value added, user cost) approach, underlines the role of financial institutions as producers of loans and providers of services for account holders. This approach argues that deposits should be considered as an output because they involve the creation of value added associated with liquidity, safekeeping and payments services provided to depositors. In this instance, outputs are defined as the number of such accounts, or their transaction costs, whilst capital and labor expenses, and total operating costs, define the firm's inputs and total costs respectively (Chakrabarti and Chawla, 2004).

The second approach, the intermediation approach, considers financial institutions mainly as mediators of funds between savers and investors. Under this approach, the funds raised (deposits)

and their cost should be included as inputs in the analysis, since they constitute the raw material to be transformed into loans and investible funds. Hence, the values of loans and investments are used as output measures, labor and capital as inputs, and operating costs plus interest costs are the relevant cost measure (Sealey and Lindey, 1977).

Berger and Humphrey (1991) and Bauer et al (1993) proposed another approach called modified production approach, which allows both the input and output characteristics of deposits to be considered in the cost functions. According to this approach, the interests paid on deposits should be accounted as input, while the volume of deposits should be considered as output.

Most studies use the financial intermediation approach. However, Rossi, Winkler and Schwaiger (2005) have shown that the F-test procedure chooses the modified production approach rather than the first two approaches. The fact that financial institutions influence the process of economic growth through capital accumulation and credit allocation also enhances the argument that deposit mobilizations should be considered as outputs of financial intermediaries.

In this study the modified production approach will be used following the works of Rossi, Winkler and Schwaiger (2005). Accordingly, the outputs of the financial institutions (both commercial banks and MFIs) include loans (performing and nonperforming) with customers (y_1), and volume of deposits by customers (y_2). Labor(x_1), loanable funds-which is simply the sum of deposits and borrowings (x_2), and physical capital(x_3) are considered as inputs (and payments for them as input prices). Finally, the total cost (C_{it}) is the total interest and non-interest expenses of the institutions i.e., total operating and financial costs of the institutions.

Here one may argue that financial capital is missing in the vector of inputs. However, almost all of the previous empirical studies do not consider financial capital as input of financial

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institutions. Hence, these studies rely on accounting (as opposed to economic) concept of cost, which includes the interest paid on debt (including deposits and borrowings) but not the required return on equity.

Hughes and Mester (2008) argue that failure to include equity capital among the inputs can bias efficiency measurement. Equity capital directly affects costs by providing an alternative to deposits as a funding source for loans. If a bank were to substitute debt for some financial equity capital, its accounting costs could rise, making the less-capitalized bank appear to be more costly than a well-capitalized one.

To solve this problem, a method suggested by Hughes and Mester (2008) is used in this study. Accordingly, equity capital is included as a quasi-fixed input in the cost function so that the resulting cost function captures the relationship of accounting cost to the equity capital, and the (negative) derivative of cost with respect to equity capital-the amount by which accounting cost is reduced if equity capital is increased- gives the shadow price of equity capital (Hughes and Mester, 2008). Table 3.1 shows definition of the cost function variables used in this study.

Table 3.1: Definition of the cost function variables

Variable	Definition
Total cost(C)	Includes operating(non-interest costs) such as labor cost, cost of physical capital and other overhead, and financial costs(interest costs)
Loans(y_1)	Total outstanding loans (loans that have already been disbursed and need monitoring and supervision)
Deposits by customers(y_2)	The sum of time, saving and demand deposits
Labor input price (W_1)	Calculated by dividing personnel costs by the number of workers
Price of loanable fund (W_2)	Calculated by dividing total interest expenses by the sum of deposits and borrowings
Physical capital price (W_3)	The ratio of depreciation to the value of fixed assets net of depreciation
Equity Capital *(cap)*	The sum of paid-up capital and legal reserve

b. *Control variables for heterogeneity in the working environments*

In order to account for the possible differences in the working environments of commercial banks and MFIs, three control variables are included in the cost frontier.

First, in view of the differences in the level of infrastructural development (which affects the transaction costs of intermediation) and the diversification of loan portfolio (which affects the level of risks), annual average interest margin *(exogintermar)* for each group of firms has been used to account for the differences in transaction costs and level of risks that may exist between the banking and micro financing businesses. Moreover, annual average interest margin for each group is used instead of firm specific interest margin in order to make the variable exogenous to

any one firm in each group. This is appropriate because interest margin could be high due to inefficiency of the firm in addition to transaction costs and risks associated with production.

Second, in order to account for the influences of possible differences in the intensity of demand between the two groups of firms, average annual non-earning liquid assets as a percentage of total assets *(exogliquidty)* for each group of firms is used. The reason behind using group-average value as opposed to firm specific one is similar to that of interest margin. Assets could stay idle due to inefficient management in addition to lack of demand at the market price.

Finally, a group-dummy *(mfi-dummy)* variable is included in order to account for any other unobserved differences between the working environments of the two groups. Possibly these may include the influences of differences in regulatory directives, differences in weights attached to cost efficiency (note that MFIs may attach significant weight to outreaches in addition to controlling costs to ensure their sustainability), etc.

c. *Determinants (covariates) of cost inefficiency*

The determinants of cost (in)efficiency are introduced into this model through the distribution of the inefficiency term, μ_{it}. These are the variables denoted as Z_{it} in equation (3.7). Following the existing literature, the potential explanatory variables for firm inefficiency to be considered include the following.

Business experience *(age-of-firm)*: this is measured by age of the firm, and it is expected to have a positive effect on a firm's efficiency because firms have a tendency to learn more about the nature of their businesses and management of their assets over time (learning-by-doing).

Branch and agency network *(branch)*: this is measured by the number of branches of the firm. The number of branches of a firm is expected to have a negative impact on its efficiency because as the number of branches expands attention of the management may divert from cost minimization to other routine administrative activities. However, it may also be expected that a bank's/MFI's branch network has no significant efficiency cost on its performance in view of less concentration of portfolios on fewer customers in banks/MFIs with larger outreach (i.e., geographical risk pooling).

Ownership structure *(govtowned)* a dummy variable assuming a value of 1 if the firm is government-owned or 0 otherwise will be included to see the effect of ownership on cost efficiency of the firms. There are six public and fifteen privately owned firms. Private firms are expected to be more cost efficient because managers in such firms are assumed to be more restraint to capital market discipline while managers in public firms are considered to have few incentives to be efficient.

Size of firm *(lnasset):* a firm's asset size will be used as a measure of size. As a firm's asset size increases management becomes more burdened and efficiency will decrease. Thus a negative impact is expected. Additionally, each firm's loan market share *(loanmktshare)* is included as some studies also use market share as a measure of size. The former is an absolute measure of size while the latter is a relative measure.

Market concentration and intensity of competition: Market concentration is defined as number and size distribution of firms in the market. Herfindahl Index (HI) [6] of deposit market

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[6] The Herfindahl Index(HI) is a measure of (market) concentration that can be used as a tool to examine the incidence of competition in a given market. It is defined as the sum of squared market share of the firms multiplied by 10,000- and ranges from 0 (in a perfectly competitive industry) to 10,000(in a pure monopoly).

concentration *(depoherfind)* will be used as a proxy for the overall market concentration. Higher market concentration is associated with poor competition, or more precisely, dominance of few firms, which may lead to less cost efficiency. The number of firms operating in the market-region of the firm *(no.firms)* is also included in view of the regional market sharing nature of the microfinance industry. Firms operating in markets in which many other firms are providing the same kind of services are expected to be more cost efficient to reduce the prices they charge due to possible competition and fear of loss of customers to their rivals.

The proportion of non-earning liquid assets *(liquidity)*: these are assets that are not generating any revenue. High proportion of non-earning liquid assets in the total assets may significantly reduce the cost efficiency of a firm because these assets are kept idle (but expenses are being incurred on them), while they could have been transformed into revenue generating outputs.

Average size of loan *(averloan)*: larger loan size may reduce costs for each unit of money lent, and enhances efficiency. However, it is also possible that larger loan size may increase a bank's/MFI's inefficiency due to the credit risk effect that appears when portfolios are concentrated on fewer clients.

Average size of deposit accounts *(averdepo)*: larger average deposit size may help a firm reduce the transaction costs associated with keeping deposits.

Flexibility of Lending Policy *(group+indv)*: a dummy variable assuming a value of 1 for those financial intermediaries that offer both individual and group loan (joint liability lending) and 0 for the others is included to see the impact of flexibility in lending scheme on cost inefficiency of the firms.

Commercialization *(commerce)*: commercialization refers to using commercial funds such as deposits and borrowings (as opposed to non-commercial funds such as equity) for lending. The ratio of commercial funds (deposit plus borrowings) to total outstanding loans is used in this study. Firms that use higher proportion of commercial funds as a source of loanable fund are expected to be more cost efficient because they are considered to be more disciplined in the credit market.

Proportion of loan in the total asset *(loan-assetratio)*: firms that allocate larger proportion of their asset to lending are considered as less risk-averse. No prior expectation about the direction of influence of this variable because both positive and negative signs are possible depending on the level of risks taken. Both taking excessively high risks and excessive risk-aversion may have significant efficiency costs.

3.2.2 Choice of Functional Form

The functional form used to estimate the frontier cost function is the translog, similar to Berger and Mester (1997), Fuentes and Vergara (2003), Gregoire and Tuya (2006), and others. The advantages of this formulation, as compared to the familiar Cobb-Douglas, are twofold. First, the translog formulation places no a *priori* restrictions on the elasticity of substitution between inputs, and second, economies of scale are not restricted to be uniform across all firms. However, the translog also suffers a number of deficiencies. Esho and Sharpe (1994) have shown that most of these relate to the estimation of economies of scope and scale. Also, problems with the large number of parameters to be estimated apply to cost efficiency estimates.

The full model is specified with non-neutral technological progress in the cost function and accounting for the environmental differences between the commercial banks and MFIs as follows:

$$\ln(c_{it}) = \alpha_o + \sum_{j=1}^{2} \beta_j \ln(y_{jit}) + \sum_{m=1}^{2} \gamma_m \ln(w_{mit}) + \frac{1}{2}\sum_{j=1}^{3}\sum_{k=1}^{3} \beta_{jk} \ln(y_{jit})\ln(y_{jit})$$

$$\frac{1}{2}\sum_{m=1}^{2}\sum_{n=1}^{2} \gamma_{mn} \ln(w_{mit})\ln(w_{nit}) + \sum_{j=1}^{3}\sum_{m=1}^{2} \eta_{jm} \ln(y_{jit})\ln(w_{mit}) + \phi_1 \ln cap + \phi_2 (\ln cap)^2$$

$$+ \lambda_t T + \lambda_{tt} T^2 + \varphi prov \exp + \sum_{r=1}^{3} \theta_r E_{rit} + v_{it} + \mu_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.10)$$

where T and T^2 are linear and quadratic time trend terms included to capture the impact of technological change (shifts in the cost function over time), $c_{it} = {C_{it}}/{W_{3it}}$, $w_{mit} = {W_{mit}}/{W_{3it}}$, and the other notations are as explained before.

In order to account for the possible quality difference in the loan portfolios of the firms, the ratio of loan-loss-provision expense to total outstanding loan *(provexp)* is included as a control variable in the cost frontier because data on non performing loans are not available for most of the firms as stated in Muluneh (2008). This may help to avoid labeling unmeasured differences in product quality as differences in efficiency. However, loan-loss-provision expenses may not change proportionally with nonperforming loans (at least strictly) because the former is more of a function of the provisioning directive of the National bank of Ethiopia than that of total nonperforming loans of a bank/MFI.

Beattie and Taylor (1985) have proven that duality requires a number of restrictions to be imposed a priori in order to estimate indirect cost functions. Following Lang and Welzel (1999), the required symmetry and linear homogeneity in input prices is insured by imposing the following parameter restrictions, respectively:

$\beta_{jk} = \beta_{kj}, \forall_{j\neq k}$, $\gamma_{mn} = \gamma_{nm}, \forall_{m\neq n}$, for symmetry

$$\sum_{m=1}^{2}\gamma_m = 1, \quad \sum_{m=1}^{2}\gamma_{mn} = 0, \forall_m, \sum_{n=1}^{2}\gamma_{mn} = 0, \forall_n, \sum_{m=1}^{2}\eta_{jm} = 0, \text{ for linear homogeneity in input prices}$$

Lastly, without loss of generality, linear homogeneity in input prices is imposed by subtracting $\ln w_{3it}$ from both sides (or by dividing the total cost, and the prices of labor and loanable fund by the price of physical capital). Consequently, only the coefficients for the prices of labor and loanable fund are estimated directly. The coefficient for $\ln w_{3it}$ is retrieved from the imposed restrictions.

3.3 Data

This study uses an unbalanced panel data of 21 firms (14 MFIs and 7 commercial banks) in Ethiopia for the period 2001 to 2008. (See Appendix C for the name of the firms included in this study). The data on MFIs are obtained from the MIX Market Inc. data base web site *www.mixmarket.com,* while the data on commercial banks are obtained from the published annual reports of the individual banks. The data on both groups of firms includes not only balance sheet and income statement information but also various performance and outreach indicators such as number of workers, number of branches, etc.

There are around 30 MFIs in Ethiopia as per the National Bank of Ethiopia's 2009 annual report. We could access data on only 14 MFIs from the MIX Market Inc. data base. Few of the MFIs did not regularly report data on some variables, and in such cases data published on performance analysis bulletin of Association of the Ethiopian MFIs (AEMFIs) were used to fill the missing values. Also, because the data were reported in USD, each year's end of period exchange rates

(based on which the initial conversion to USD was made) have been used to convert the data in Ethiopian Birr.

Also, only 7 among 12 (as of 2009 report of National Bank of Ethiopia) commercial banks are included in this study because three of them are too young to have consolidated annual reports for the years before 2007 while the other two are not willing to cooperate in providing the information required for this study. The choice of the period is based on availability of data. Though it is possible to get data on commercial banks prior to the year 2001, almost all MFIs have data only for the period 2001 to 2008.

However, it is worth mentioning some problems with the data. First, because data on interest rate spread is lacking for the MFIs, only interest rate margin will be used as a proxy for the intermediation efficiency. Interest rate margin is simply the ratio of net interest income to earning asset. Second, investments in government securities and shares could be considered as an important output of banks and MFIs. However, data on these variables are not consistently reported for most of the microfinance institutions, thus only loans and deposit mobilizations are considered as the outputs of the financial intermediaries in this study.

Regarding the determinants of inefficiency, the literature consider average loan size as an important determinant of (in)efficiency. Because data on the number of borrowers is not available for most of the commercial banks, however, loan size per number of branches is used as a proxy for average loan size. In fact, this requires an assumption that number of borrowers and branch network of the firms change proportionally. Similar approach is used to see the impact of average deposit size on inefficiency of firms because data on the number of depositors is not accessed for most of the commercial banks.

3.4 Estimation

The first model will be estimated by using *Eviews* econometrics program because it provides a relatively easy mechanism for handling estimation of two-way error component models under different assumptions. *FRONTIE 4.1C* program, developed by Coelli (1996), was used to estimate the stochastic frontier model because it has the most flexible options available in terms of modeling the stochastic frontier model with truncated normal distribution assumption for the inefficiency component.

The program follows a three-step procedure in estimating the maximum likelihood estimates of a stochastic frontier cost/production function Coelli (1996). First, Ordinary Least Square (OLS) estimates (β) of the function are obtained. All such estimates with the exception of the intercept will be unbiased. Second, a two-phase grid search of γ is conducted (in the parameter space[7] of γ), with the β parameters (except β_0) set to the OLS values and the β_0 and σ^2 parameters adjusted according to the corrected ordinary least squares formula presented in Coelli (1995). Any other parameters (like the δ parameters in this study) are set to zero in this grid search. Third, the values selected in the grid search are used as starting values in an iterative procedure (using the Davidon-Fletcher-Powell Quasi-Newton method) to obtain the final maximum likelihood estimates.

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[7] Note that FONTIER uses parameterization from Battese and Chorra (1977), replacing σ_v^2 and σ_μ^2 with

$\sigma^2 = \sigma_v^2 + \sigma_\mu^2$ and $\gamma = \dfrac{\sigma_\mu^2}{\sigma_\mu^2 + \sigma_v^2}$. The values of γ should normally be between 0 and 1.

Finally, estimates of individual cost efficiency scores are calculated using the expression in equation (3.8).

Chapter Four

Results and Discussion

4.1 Results from the Non-Structural Model

4.1.1 Comparison of Intermediation Efficiency

Table 4.1 shows the average interest rate margin for commercial banks and microfinance institutions for the period 2001-2008.

Table 4.1: Average interest rate margin of MFIs and commercial banks in Ethiopia

Year	Commercial Banks		MFIs	
	Mean	Median	Mean	Median
2001	0 .051	0 .051	0.22	0.23
2002	0.041	0.041	0.19	0.16
2003	0.034	0.035	0.18	0.14
2004	0.04	0.043	0.16	0.13
2005	0.04	0.043	0.12	0.13
2006	0.044	0.046	0.13	0.13
2007	0.05	0.051	0.14	0.15
2008	0.051	0.05	0.15	0.16
Total	0.044	0.044	0.16	0.14

Source: Own calculation based on the published annual reports of each firm (for the commercial banks) and MIX Market Inc. data base (for the MFIs)

As it can be seen from the Table 4.1, the interest margin for the MFIs is by far higher than that of commercial banks in each year. This, at face value, may indicate that MFIs are weak in controlling intermediation costs.

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But, it is important to note that the Ethiopian MFIs use non-commercial funds such as donations, grants and borrowings at preferential rates, in addition to funds from commercial sources, for loan extensions (see Appendix B). This, by reducing their interest expenses, may lead to higher interest rate margins. The higher interest margin of the MFIs could also be due to the nature of the business of microfinancing rather than intermediation inefficiency. MFIs offer small loans and administer small deposit balances per individual as compared to commercial banks, while the costs of administering small loans and deposits could be near the costs of administering higher loans and deposits.

Moreover, the difference in the interest margin between the two groups could be due to difference in the level of risks associated with their businesses. Obviously, MFIs offer loans to poor borrowers without any requirement of collateral, while commercial banks often request assets to be seized as collateral. This may add some risk premium on the interest margin of the MFIs. Poorer infrastructural development in the rural areas of Ethiopia (where most of the MFIs under review are operating) may also inflate the intermediation costs for the MFIs, ultimately resulting in higher interest margins.

Lack of competition in the microfinancing industry could also explain the higher interest margin. This is so because, though the number of MFIs is large, there is high market segmentation in the microfinancing business. Most microfinance institutions operate only in one region and there is no intersection in market areas. The situation is completely different in the banking business. Almost all the commercial banks have branches in the major towns of the country.

In addition to these differences in the working environments and the nature of the businesses of the two groups, several firm specific (organizational) characteristics such as size, branch

networks, management of assets, proportion of overhead costs, etc may explain the difference. All the MFIs have lower asset and capital sizes as compared to the commercial banks. (See Appendices A and B). All the above discussions on factors that drive the interest rate margin cast a great doubt on the appropriateness of using interest margin as a proxy for intermediation efficiency, especially when heterogeneity in the working environments cannot be ignored.

However, we notice a narrowing gap in the interest margin over time, due to a more or less decreasing trend in the interest margin of the MFIs (see Figure 4.1). The figure shows a fast and continuously declining trend in both mean and median interest rate margin gaps for the period 2001-05, but a slightly increasing one after 2005. This could, perhaps, be a tentative evidence of improving intermediation efficiency of MFIs and declining intermediation efficiency gap between the commercial banks and MFIs. The declining trend in the interest margin of the MFIs could in turn be attributed to the inclination of these firms to a commercial funding as opposed to non-commercial ones such as donation (see Appendix B).

Figure 4.1: Mean and Median interest rate margin gaps
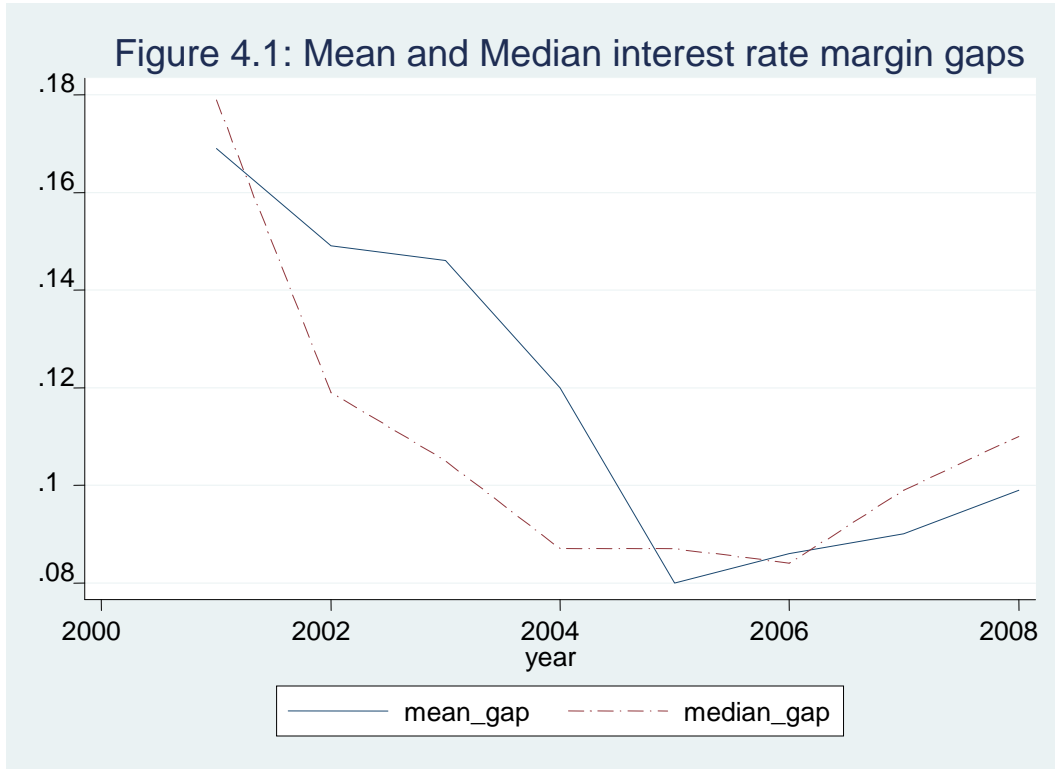
4.1.2 Determinants of Interest Rate Margin

Several restrictions of the TWECM were estimated. The Pooled Model (PM) is chosen based on Chow-test of redundant fixed effects. The test rejects fixed effects specification in the individual specific and period specific effects in favour of the Pooled model. This might be due to rich specification of our model in terms of firm specific variables. Similarly, random effect specification for the individual specific effects and fixed effect specification for the period specific effect fails to pass the Hausman's test of correlated random effects. Table 4.2 shows results for the Pooled and Median Least Squares (MLS) models.

To correct for the potential effect of heteroskedasticity in the Pooled model, Estimated Generalised Least Squares (EGLS) estimation technique was used. This estimation technique uses all observations available, but assigns different weights to avoid the impact of outliers.

Specifically, through an iterative process, observations are weighted based on the absolute value of their residuals, whereby observations with large residuals are assigned smaller weights.

Also, given the dispersion of the data and the need to control for the potential effect of outliers, Median Least Square (MLS) regression is estimated to see whether the estimated results are robust to estimation methods. The last two columns of Table 4.2 show results for the MLS regression.

Table 4.2: Results for the Pooled and MLS models

Explanatory Variables	Coefficient for the PM (Preferred)	Prob.	Coefficient for the MLS regression	Prob.
OVERHD	0.557673	0.0000	0.759929	0.0000
NOFIRMS	-0.002714	0.0139	-0.003753	0.0517
BRANCH	0.000453	0.0000	0.000434	0.0035
LNASSE	-0.004295	0.1797	-0.005859	0.3655
HERFIND	0.076661	0.0000	0.049841	0.2642
LIQUID_ASSE	0.196770	0.0000	0.154983	0.0301
AVERLOAN	0.000699	0.0000	0.000607	0.0599
PROPLOAN	0.093501	0.0000	0.104397	0.0046
AGE	-0.000169	0.6334	3.70E-06	0.9958
COMMERCE	-0.002684	0.7858	-0.003862	0.8708
OWNEDUMMY	-0.066363	0.0000	-0.055686	0.0225
GROUPDUMMY	-0.102663	0.0000	-0.060509	0.1138

| Adjusted R-squared | 0.844632 | Pseudo R-squared 0.605523 | | |
| Durbin-Watson stat | 1.71072 | Adjusted   R-squared   0.574529 | | |

As it can be seen in Table 4.2 the results for the two models are fairly similar. The coefficient for

the variable *age of firm (AGE)* is negative in the Pooled model but positive in the MLS model, though insignificant in both cases. Also, the coefficients for *group dummy* and *Herfindahl index* variables are insignificant in the MLS model. Hence the results are more or less robust to estimation techniques.

To come to the determinants of interest rate margin, the coefficients for *asset*, *age of firm* and *commercial fund* are found to be statistically insignificant. *Overhead cost per total assets*, the *proportion of liquid asset in the total assets* and *group dummy* are found to be the major determinants of interest rate margin. These results are consistent with previous studies on the determinants of interest rate margin such as Beck and Hesse (2006) and Vennet (2002). For instance, Beck and Hesse (2006) have found positive coefficients for the first two variables for the Ugandan banks. Similarly, interest rate margin for the commercial banks is 10.3 percentage points lower than that of the MFIs.

The positive and statistically significant coefficient of *branch network* indicates the existence of trade-off between intermediation efficiency and outreach. Branch expansion leads to higher overhead costs while loan advancements may not increase by the same proportion. Once again this result is similar to Beck and Hesse (2006).

Also, positive and statistically significant coefficients are observed for *Herfindahl index*, *average loan* and *proportion of loan in the total assets*. The positive sign of the coefficient of *Herfindahl index* implies that more concentrated markets result in higher interest rate margin. This is consistent with the negative sign of *number of firms*, which suggests that a firm that competes with larger number of firms is forced to earn lower interest rate margin due to possible competition. Similarly, higher *proportion of loan in total assets* results in higher interest rate

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margin. This shows that less risk-averse firms charge higher interest rate margin. Of course, it could also be because loans are the most earning assets.

The positive sign of *average loan* is an unexpected result. In fact the variable is not really the average loan size as a firm's number of branches (as opposed to number of borrowers) was used as a denominator due to lack of data on the latter. The negative sign of *ownership dummy* indicates that the interest rate margin for government owned firms is 6.6 percentage points lower than that of private firms. These results are also similar with Beck and Hesse (2006).

4.2 Results for the Stochastic Frontier Analysis

This section explains the stochastic frontier results. Table 4.3 shows results from maximum likelihood estimation of the stochastic frontier model.

Table 4.3: FRONTIER estimation results for coefficients

(a) Cost Function Variables	Coefficient	t-ratio	(b) Control Variables	Coefficient	t-ratio
lnw1	0.154*	1.83	*provexp*	0.118***	43.4
lnw2	0.237***	4.34	*mfi-dummy*	1.18***	27.6
lny1	0.86***	10.04	*exogliquidty*	0.298***	3.35
lny2	0.219***	4.48	*exogintermar*	-2.06***	-7.5
$0.5(lnw1)^2$	-0.182***	-26.2	**(c) Determinants of inefficiency**		
$0.5(lnw2)^2$	0.13***	12.75	*constant*	3.34***	5.79
$0.5(lny1)^2$	-0.11***	-12.8	*branch*	-0.0053**	-2.18
$0.5(lny2)^2$	0.052***	7.1	*age-of-firm*	-0.048***	-4.3
lnw1lnw2	0.07	0.38	*no.firms*	-0.021	-1.3
lny1lny2	0.019***	2.93			
lny1lnw1	-0.097***	-2.46	*liquidity*	0.154	0.27
lny1lnw2	0.119***	4.06	*lepoherfind*	2.2***	3.5
lny2lnw1	0.072***	2.5	*group+indv*	-0.258***	-2.6
lny2lnw2	-0.038	-1.59	*govtowned*	-0.218	-0.976
lncapital	-0.21***	-5.51	*lnasset*	0.08	1.39
$(lncapital)^2$	0.015***	4.22	*loanmktshare*	8.81***	6.97
T	-0.014***	-2.34	*averloan*	-0.065***	-5.1
T^2	-0.0002	-0.4	*commerce*	-0.49**	-2.32
Constant	1.05***	5.3	*averdeposit*	-0.02**	-2
σ^2	0.138***	16.6	*loan-assetratio*	-1.2***	-3.4
γ	0.98***	1550			
Log-likelihood function	57.73				
Number of Observ.	154				

*The notations ***, **, * show significance at 1%, 5% and 10% respectively.*

As it can be seen from Table 4.3, 15 out of the 18 cost function variables are significant at 1% - 10% significance levels. The signs for the coefficients of the first four variables (price of labour, price of capital, outstanding loan and total deposit mobilization) are all positive. This is strictly required for monotonicity of the cost function with input prices and outputs. Because the coefficients of *lnw1* and *lnw2* sum-up to less than unity, a positive coefficient can be inferred for the price of physical capital from the linear homogeneity restrictions imposed.

The coefficients for *lncap and (lncap)²* can be used to obtain the shadow price of equity capital. For instance, other things being equal, a one percent increase in equity capital reduces a firm's accounting cost by more than 7.5 percent for a firm with Birr 1 billion level of capital, or equivalently, the opportunity cost of using a unit of equity capital (as opposed to debts) is more than 7.5 percent of the ratio of accounting cost to the level of equity capital for a firm with Birr 1 billion level of equity capital.

It is important to note that all the three variables included in the cost frontier to control for heterogeneity between the two groups of financial intermediaries are significant at 1%. This indicates the important role of working environments on firms' ability to control costs.

4.2.1 Tests of Overall Performance of the Model

First, we test whether any form of the stochastic frontier cost function is required at all. Likelihood Ratio (LR) test for one sided error, which translates into testing the null hypothesis $H_0 : \gamma = 0$ shows rejection of the null hypothesis. If the null hypothesis of $\gamma = 0$ were accepted, this would indicate that $\sigma_\mu^2 = 0$ and hence that the μ_{it} term should be removed from the model, resulting in a specification with parameters that can be consistently estimated using ordinary least squares.

The test statistics is derived from the estimation of the model under both the null and alternate hypothesis. Under the null hypothesis, the model is equivalent to the traditional OLS regression with only the idiosyncratic error (without the inefficiency component, μ_{it}). The test is done using the usual likelihood ratio test, but the test statistic has a mixed chi-squared distribution and the critical value for a given level of significance is lower than that reported in the usual chi-squared tables (Coelli, Rao and Battese, 1998). The test statistic value is 95.82, which is statistically significant at 1%.

Hence, our test overwhelmingly rejects the null hypothesis of no cost inefficiency effects. This shows that the OLS model is insufficient to analyze the cost behavior of the Ethiopian commercial banks and MFIs and a frontier model is required. Moreover, the value of γ equals 0.98 indicating that the main factor generating disturbance around the cost frontier is the cost inefficiency rather than a random noise.

Second, LR-test was used to choose between the more general *translog* and the restricted *Cobb-Douglass* cost specifications. The value for the log-likelihood function of the restricted model is -11.21, resulting in a LR-test statistic of 137.88. This is by far higher than the critical level at 1%. Hence, the Likelihood ratio test rejects the Cobb-Douglass specification in favor the more general translog specification.

4.2.2 Cost Efficiency Comparison

Table 4.4 shows the mean and median values of cost efficiency estimates (net of the influences of the environmental factors) for the two groups of financial intermediaries. FRONTIER produces cost efficiency scores as: the ratio of the actual costs incurred to costs to be incurred if the firm

was able to operate at the most optimal point (on the cost frontier). Hence the cost efficiency estimates are all greater than or equal to 1. According to this definition a cost efficiency score of 1 shows that the firm is 100% efficient (it is producing on the cost frontier) while a score of above 1 shows over use of resources. For instance, a cost efficiency score of 1.5 shows 33.33% wastage of resources relative a best-practice firm facing the same conditions.

Alternatively, and more conveniently, cost efficiency score can be defined as the ratio of the ideal costs of production (the frontier cost) to the actual costs, resulting in a score ranging from 0 (for 100% wastes of resources relative to the best practice) to 1 (for 100% efficient firms). Accordingly, a firm with cost efficiency score of 0.80 is thus 80% efficient or equivalently wastes 20% of its resources relative to the best-practice firm facing the same conditions. This later definition is simply a reciprocal of the former, but more convenient for reading. Table 4.4 shows cost efficiency scores that follow the second definition.

Table 4.4: Cost efficiency score of MFIs and commercial banks in Ethiopia

Year	Commercial banks		MFIs	
	mean	Median	Mean	Median
2001	0.798	0.79	0.525	0.544
2002	0.787	0.783	0.545	0.542
2003	0.892	0.946	0.655	0.642
2004	0.898	0.878	0.769	0.809
2005	0.898	0.89	0.662	0.669
2006	0.892	0.942	0.665	0.705
2007	0.88	0.895	0.7	0.696
2008	0.908	0.889	0.804	0.898
Total	0.87	0.89	0.67	0.66

As it can be seen in Table 4.4, the intermediation efficiency of the commercial banks is by far better than that of MFIs. The average cost efficiency of the Ethiopian commercial banks for the period 2001-2008 was 87 percent, while that of the MFIs was only 67 percent. This simply shows that what costs Birr 1.0 for commercial banks costs Birr 1.298 for MFIs to produce. Hence, the Ethiopian MFIs are 29.8 percent less efficient than the conventional commercial banks. In fact, MFIs came to do what the commercial banks could not. However, the resource wastes due to inefficiency might outweigh the welfare gains from extended frontier of financial services.

The efficiency gap was even more pronounced for the years 2001 and 2002, in which the MFIs are 52 and 44.4 percent less efficient, respectively. This could be due to lack of business experience in the Ethiopian microfinancing industry[8]. Hartarska, Caudill and Gropper (2006) argue that MFIs become more efficient over time, given that the activities performed by these firms should be usually tailored to specific clients and their specific demand. Hence, understanding this feature of the business takes time and trial-and-error learning. Also, MFIs had been operating under excessive restriction on maximum lending limit (only Birr 5000 to a single borrower) before May 2002, which could inflate the transaction costs associated with administering loans.

For the years 2004 and 2008, however, the efficiency gap was relatively narrow: MFIs are only 16.8 percent and 12.9 percent less efficient than the commercial banks. The relatively narrow gap observed for the year 2004 could be the effect of relaxed[9] maximum lending limit for the MFIs

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[8] Note that microfinancing in Ethiopia has only 12 years history while the commercial banking sector has a one century history. It takes time until the microfinancing business is institutionalised and become cost efficient.
[9] National Bank of Ethiopia directive number SBB/29/2002 limits the aggregate extension of credit by any commercial bank to any single borrower to a maximum of 25 percent of total capital of the bank, while directive number MFI/17/2002 limits maximum lending to a single borrower to 0.5 percent of the total capital of a microfinancing institution with a precondition that the total sum of money to this kind of lending do not exceed some 20 percent of the preceding year's disbursement.

and commercial banks, which was declared in May 2002. This could help both groups of firms minimize transaction costs by lending higher amount of loan to a single borrower (and rightly so, in view a sharp increase in the cost efficiency of both groups for the year 2003). But the MFIs might have benefitted more due to excessive restriction in place earlier on. It could also be because the commercial banks were excessively risk-averse in the year 2004, perhaps due to fear of expected political instabilities following the country's national election in the year 2004/05 (See Figure 4.2 below). The relatively high average loan-asset ratio for the MFIs could be due to possible government intervention.

Figure 4.2: Loan-asset ratio of MFIs and commercial banks
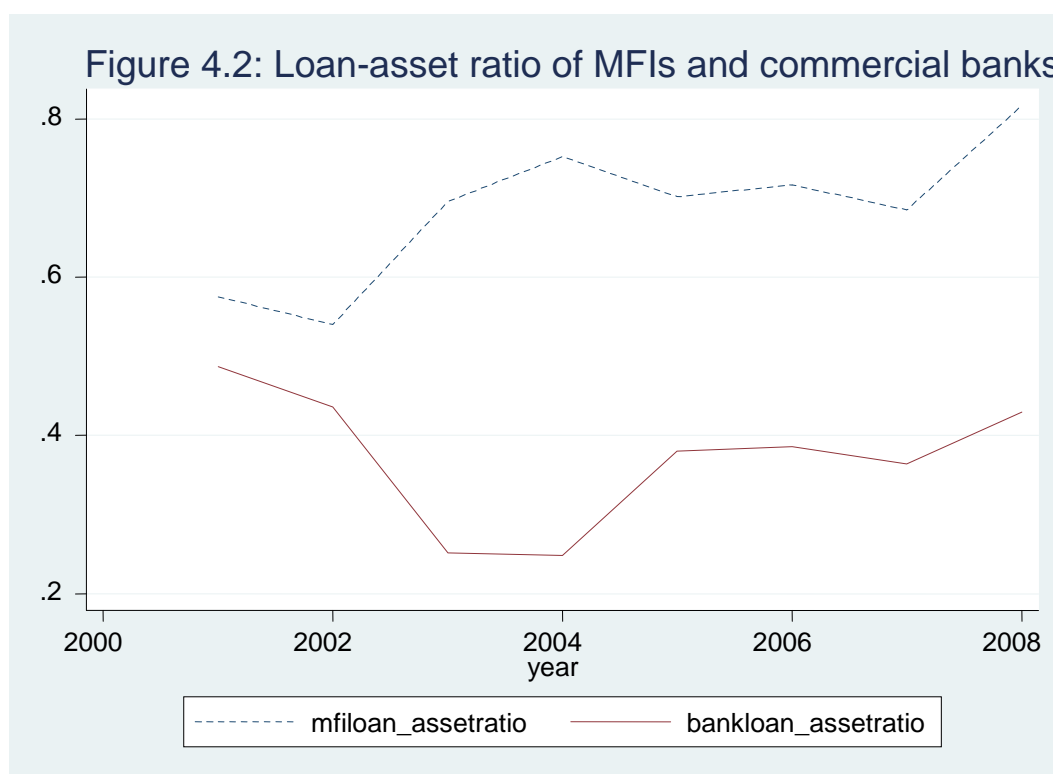
Regarding best performances in both groups, *Amhara Credit and Saving Institution (ACSI), Specialized Financial and Promotional Institution (SFPI), and Dedebit Credit and Saving Institution (DECSI)* are the three most efficient MFIs in Ethiopia with average efficiency score of

0.881, 0.84 and 0.814, respectively. On the side of commercial banks *Dashen Bank, Bank of Abyssinia* and *Nib Bank* are the three most efficient commercial banks for the period 2001-2008 with mean cost efficiency score of 0.923, 0.918 and 0.917, respectively. One can notice that the efficiency gap between these best performers of the two groups is not pronounced. It is worth mentioning that there is surprisingly high efficiency variation among the MFIs, while the efficiency score of the commercial banks is fairly concentrated. The average cost efficiency of the Ethiopian MFIs ranges from 0.391 to 0.881, while that of the commercial banks ranges from 0.833 to 0.923.

The result is more or less comparable to previous studies made on the efficiency of MFIs and commercial banks. For instance, Hassan and Sanchez (2009) has found 70%, 69% and 78% mean technical efficiencies for Latin American, Middle East and North African, and South Asian MFIs, respectively, for the year 2005. However, Gregoire and Tuya (2006) have found an average cost efficiency of as high as 82 percent for MFIs in Peru for the period 1999-2003. The lower cost efficiency score observed for the Ethiopian MFIs in this study could be due to comparison with the more efficient commercial banks, which obviously pushes the cost frontier down. Similarly, Muluneh (2008), using quarterly panel data for the period 1997/98 to 2005/06, has found an average cost efficiency score ranging from 69 percent (during the first four quarters) to 89 percent (during the last four quarters) for the private commercial banks in Ethiopia.

It is important to note that these efficiency gaps between commercial banks and MFIs in Ethiopia are not due to the existing differences in the working environments of the groups, in view of the fact that most (to the extent possible) of the existing difference in the working environments have been controlled for in the cost frontier. The control variables include group-averaged yearly interest margin (which is included to control for the influences of differences in infrastructures,

risks and other business features that may affect the transaction costs, but exogenous to the firms in each group); group-averaged yearly nonearning liquid assets as a percentage of total asset (which is expected to control for the influence of differences in the intensity of demand between the two groups) and finally, a group dummy variable (*mfi-dummy*) which is included in order to control for any unobserved heterogeneity between the two groups (possibly including the influences of different regulations, difference in weight attached to cost efficiency, etc). The fact that the coefficients of all these variables are statistically significant confirms the important influences on cost efficiency of working environments in financial intermediation.

4.2.3 Determinants of Cost Inefficiency

In Table 4.3 the results from the fitted conditional mean model are reported. Note that this study uses the single-stage estimation technique where the cost function and the conditional mean model (for the inefficiency term) are estimated simultaneously, as opposed to the two-stage estimation (in which the cost efficiency scores are estimated first and then the result is regressed on factors determining efficiency). Hence, there is no problem of methodological inconsistency noted by Battese and Coelli (1995). (See chapter two).

As it can be seen in Table 4.3, 9 of the 14 variables are found to have a statistically significant influence on cost efficiency of the firms. Branch network (*branch)* is found to have a significant and negative influence on inefficiency. This is contrasting to the view that larger branch network results in higher overhead costs and ultimately higher cost inefficiency. However, this view holds true only if the additional branches are operating under their full capacity. If the additional branches are operating with their full capacity, there is no reason to expect a positive relationship

between branch network and inefficiency. Furthermore, higher branch network amounts to geographical diversification of loan portfolio composition, ultimately enhancing cost efficiency.

More importantly, since deposit mobilizations are considered as one of the outputs of financial intermediation in this study, higher branch network could substantially increase the outputs of the firms (mainly the amount of deposit mobilization), resulting in higher cost efficiency. This could be the reason behind inconsistency of this result with, for instance, Muluneh (2008) and Bos and Kool (2004) who observed a positive relationship between X-inefficiency and branch network. Both Muluneh (2008), and Bos and Kool (2004) consider deposit mobilization totally as an input of financial intermediation.

The coefficient for the ownership dummy (*govtowned*) is not only statistically insignificant but also has unexpected sign. This could be due to lack of significant difference in the ownership structure of the MFIs in Ethiopia. First, the ownership structure of most of the Ethiopian MFIs is actually characterized by joint ownership of multiple stock-holders including NGOs, Associations, Regional Governments, private organizations and individuals. In this study, a microfinance institution with a regional government as one of the share holders is considered as government owned, owing to the possible intervention by the regional governments in decision making. Second, individual owners, except in very few cases, have merely posed as owners at the request of either an NGO or Regional Governments. Hence, the ownership structure of the MFIs is very loose-the so-called owner has no real control over the shares.

The negative sign and statistical significance of the coefficient of *age of firm*, indicates the important role of business experience for controlling costs. This is consistent with the theory of

'learning by doing' and several previous studies such as Gonzalez (2008), and Gregoire and Tuya (2006).

From the variables for market structure: *Herfindahl index of deposit market concentration, (depoherfind)* and *number of firms operating in the market region of a firm (no.offirms)*, only *Herfindahl index of deposit market concentration* has statistically significant coefficient. The positive sign of *Herfindahl index of deposit market concentration* suggests that higher market concentration could adversely affect the cost efficiency of the financial intermediaries. This result is consistent with theory and several previous studies such as Gregoire and Tuya (2006). However, some of the previous studies have found a contrasting result. For instance, Berger and Hannan (1998) found that reduced market concentration is associated with a loss of bank cost efficiency far more significant than any welfare loss due to monopoly result.

Similarly, the coefficients of *asset size (lnasset)* and *loan market share (loanmktshare)* have the expected signs but only the latter is found to be statistically significant. In fact the *asset size* of most of the firms (especially the MFIs) is not too large to lead to lose of focus on cost minimization. The positive coefficient of *loan market share* is suggestive of significant management (monitoring) burden associated with increase in size of loan advancement. Similar results are observed by Rossi, Schwaiger and Winkler (2005), Muluneh (2008) and Bos and Kool (2004). But, Gregoire and Tuya (2006) have found a negative relationship between cost inefficiency and loan market share for the MFIs in Peru.

Average loan size (averloan) and *average deposit size (averdeposit)* affect cost inefficiency negatively. The result provides a strong explanation for the wide cost efficiency gap between MFIs and commercial banks explained above. The interesting feature of this result is that average

loan and deposit sizes are not really calculated based on number of borrowers and depositors, but by using number of branches as a denominator-assuming that both number of borrowers and number of depositors change proportionally with number of branches. Hermes et al (2008) found similar result for the influence of average loan size.

The coefficients for the *proportion of liquid asset in the total assets* (*liquidity)* and *proportion of commercial funds in the total outstanding loans* (*commerce)* have the expected sign, but only the latter is found to have a statistically significant influence. The negative sign of *proportion of commercial funds in the total outstanding loans* is suggestive of the fact that firms that use commercial funds (deposits and/or borrowings at commercial interest rate) as a major source of funding are more cost efficient, perhaps due to more credit market discipline associated with such firms. However, the result might also be because the more efficient firms (the commercial banks) have overwhelmingly higher commercial funding ratios (see Appendix B). Similar result is obtained by León (2008). The statistical insignificance of the coefficient of *proportion of liquid asset in the total assets* is most probably due to insignificant difference among the firms in terms of non-earning liquid assets (see Appendices A and B). Hence, it does not lead to demeaning the danger of keeping assets idle.

A statistically significant negative coefficient is found for the variable *loan asset ratio (loan-assetratio).* That is, firms that allocate higher proportion of their asset to lending are more efficient than those with lower loan to asset ratio. This result indicates that less risk-averse banks are more cost efficient than highly risk-averse ones. Similar results are obtained by Rossi, Schwaiger and Winkler (2005) for Central and Eastern European commercial banks, and Gregoire and Tuya (2006) for the MFIs in Peru.

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Finally, a statistically significant negative sign is observed for the coefficient of *flexibility of lending policy dummy (group+indv)*. This indicates that financial intermediaries that use group and individual lending scheme are more efficient than those that use only group loan (joint liability lending scheme) and only individual lending scheme. This might be due to their flexible lending policy. Such firms offer individual loans for those who could offer valuable assets that can be seized as a collateral or third party guarantee. They use join liability lending scheme for poor borrowers who cannot offer any valuable asset as a collateral or third party guarantee, but could offer feasible projects. Hermes et al (2008) found a similar result for MFIs in different countries.

4.2.4 The Dynamics of Efficiency Gap- Is There Evidence of Convergence in Cost Efficiency between MFIs and Commercial Banks?

In Table 4.4 it can be observed that the cost efficiency of both the commercial banks and the MFIs (especially) increased over the period 2001-2008. As a result, there is a decreasing trend in the cost efficiency gap between the two groups.

Table 4.5 and Figure 4.3 show the mean and median cost efficiency gaps between commercial banks and MFIs over the period 2001-2008. Though, the line for the median gap shows ambiguous trend, the line for the mean cost efficiency gap is suggestive of a more or less declining trend in the gap. The gap continuously declined for the period 2001-2004, and then increased for the period 2004-2005, finally declining for the period 2005-2008. If we ignore the year 2004, a more or less clear declining trend can be observed.

Table 4.5: Mean and median cost efficiency score gaps

Year	Mean gap	Median gap
2001	0.273	0.246
2002	0.242	0.241
2003	0.237	0.304
2004	0.129	0.069
2005	0.236	0.221
2006	0.227	0.237
2007	0.18	0.199
2008	0.104	-0.009
Total	0.204	0.189

Figure 4.3:Mean and Median Cost efficiency gaps
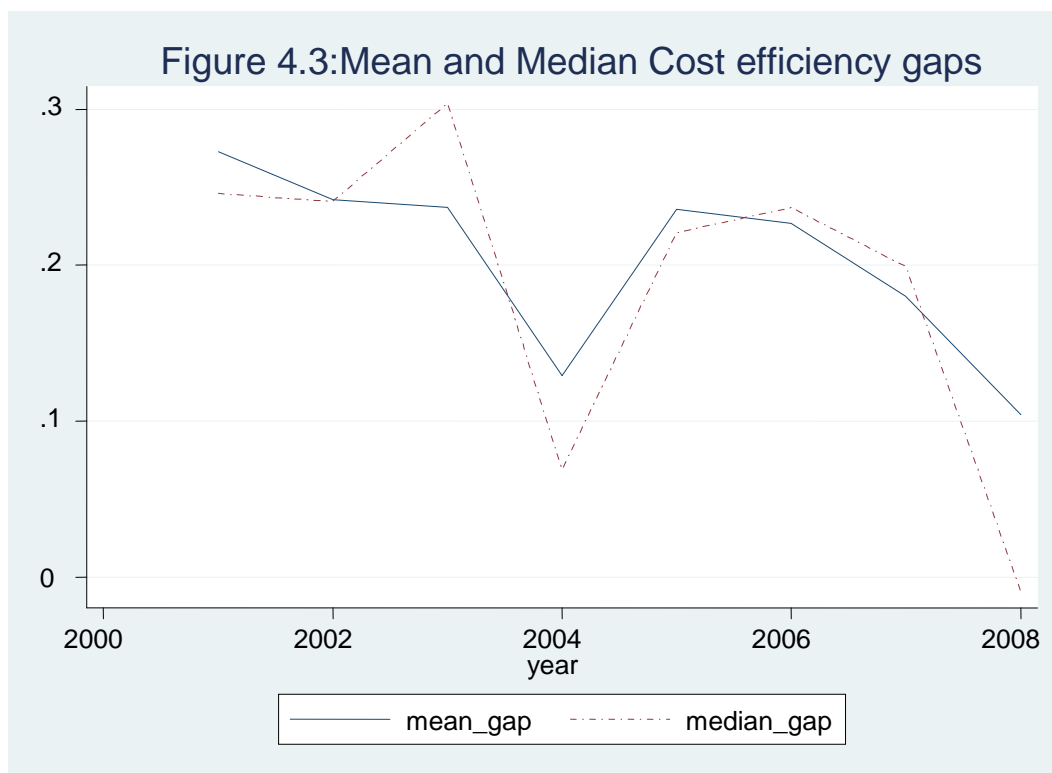
This result suggests that the Ethiopian MFIs are catching-up the commercial banks in intermediation (cost) efficiency. Several reasons can be mentioned for this gradually converging

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cost efficiency gap between the two groups. First, the MFIs are acquiring business experience, which has a significant impact on cost controlling. Second, the MFIs are inclining to commercial funding sources, which might have made them more disciplined in choosing their borrowers and in controlling costs. For instance, according to Wolday (2008), grant/donation equity accounts for only 12 percent of the loans extended by the MFIs in the year 2006. This figure was more than 30 percent for the years 2003 and before (Befekadu, 2007).

Third, the MFIs might be getting more matured in terms of capital and client bases which may lead to better performance. Lastly, some restrictive regulatory directives (especially, the restriction on maximum amount of loans that can be lent to a single borrower) have been relaxed, which will obviously make the MFIs more beneficial.

Chapter Five

Conclusions, Policy Implications and Suggestions for Future Studies

5.1 Conclusions

The study concludes that the cost efficiency of the Ethiopian MFIs is very poor as compared to that of the commercial banks, though there is a strong evidence of a tendency for the efficiency gap to close.

Market structure, business experience, risk and financial managements, and regulatory directives have important implications for the cost efficiency of financial intermediaries in Ethiopia. That is, (a) a competitive market enhances firms' incentives to control costs; (b) firms learn more about the nature of their businesses and management of their assets over time; (c) firms that allocate higher proportion of their assets to loans (less risk-averse firms) and that rely on commercial funds as a major source of loanable funds are more cost efficient; and (d) excessively restrictive regulations such as maximum amount of lending limit to a single borrower distort firms' cost controlling strategies.

The study concludes that flexibility in lending scheme enhances the cost efficiency of the financial intermediaries significantly. That is, firms that use both individual lending (based on collateral and/or third party guarantee) and group lending (joint liability lending) are more cost efficient than those which use only one of them. This is because such firms are less likely keep their assets idle owing to more expanded market base.

Finally, working environments have a significant influence on the firms' ability to control costs.

5.2 Policy Implications

Based on the findings of this study, the following recommendations are put forward to different stake-holders.

First, the Ethiopian financial intermediaries (especially the MFIs) should focus on commercial funding as a major source of loanable fund. This, in addition to enhancing the managers' disciplines in risk-taking and incentive to control costs, is also a cheaper source of fund, in view of a relatively high shadow price of equity capital observed in this study. Moreover, managers should not be excessively risk-averse and should allocate larger proportion of their assets to the most earning products such as loans.

The financial institutions should also look for ways of introducing flexibility in their lending policy. This especially concerns the commercial banks. The Ethiopian commercial banks have a tradition of focusing on collaterals rather than the potential of the borrower or the projects. This seems a right way to minimize loss in cases of default and for better enforcement. But, in view of the agrarian socio-economic settings of the country and the fact that land is forbidden by law from being used as collateral, it could be difficult for borrowers to come up with enough collateral, that today's banks expect. Implementing optimal equity-share policy (not too low to lead to moral hazard problem and not too high to ration lucrative projects) could be a possible way. But still the policy should be flexible enough by putting aside the orthodox one-policy for all-borrowers system. MFIs that rely on joint liability lending scheme alone should also learn from the others with flexible lending policy such as ACSI and DECSI.

Second, the government policy makers should work towards reducing market concentration and creating a more competitive environment. This can be achieved by encouraging private investors to enter into the business, though relaxing the capital adequacy requirement could also be supportive.

Furthermore, regulation directives should be dynamic enough to be in line with the changing socio-economic environments. For instance, the maximum lending limit to a single borrower has been relaxed once in May 2002, but not after that. This might have a significant cost on the performance the firms, in view of the macroeconomic dynamics of the country such as high inflation and economic growth, which would affect the client demand. Also, the policy is uniform for firms operating in different socio-economic setting. For instance, the customers of the MFIs operating in urban areas are more or less engaged in activities such as small trade, cottage industries, etc, while customers in the rural areas may focus on agriculture. Implementing a uniform policy (such as maximum loan size to a single borrower, maturity period, etc) in such different settings may have a cost in the sense that the customers' needs could differ.

5.3 Suggestions for Future Research

First, there are some limitations of this studies that future studies may attempt to resolve. For instance, because data on the number of borrowers and depositors were not accessed, average loans and deposits were calculated by using number of branches of a firm as a proxy for the number of borrowers and depositors, assuming that both change proportionally with the number of branches of a firm. Also, the study was based on a shorter time frame (2001-2008) and covered only 21 firms (14 MFIs and 7 commercial banks). Using quarterly or semi-annual data (if accessible) and including more firms from both sides could enhance the reliability of the results

obtained. Also, due to lack of data, this study considers only loans and deposit mobilizations as outputs of the financial intermediaries. However, the firms may also make other financial investments (such as investments in government securities) that could be seen as output.

Moreover, this study compares the performance of the MFIs with that of commercial banks only from cost efficiency aspect. But, because (a) the MFIs and the commercial banks could differ in terms of the weights they attach to cost efficiency as compared to other goals such as outreach, profitability, etc, and (b) the cost efficiency measure is not an exhaustive measure of performance, future researches should attempt to extend the aspects of comparison. Possible extension lines are the use of non-structural performance measures such as return-on-asset, return-on-equity and Tobin's q-ratio, and structural performance measures such as profit efficiency and revenue efficiency.

Furthermore, future studies on comparison of the performance of these industries should attempt to control for the existing heterogeneities in the working environments of the industries. The influences on firm performances of factors such as duration and sectoral compositions of loan portfolios, which are missing in this study due to lack of data, should also be investigated.

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Appendix A

Descriptive statistics of cost function variables for the MFIs and commercial banks

1. Descriptive statistics of cost function variables for the MFIs

Year	Cost (in millions of Birr)			Outstanding loan (in millions of Birr)			Deposit mobilizations (in millions of Birr)			Personnel cost (in millions of Birr)			Number of workers		
	Mean	median	sd	Mean	Median	sd	mean	median	Sd	mean	median	sd	mean	median	Sd
2001	2.95	0.72	5.08	24.58	5.96	41.92	17.88	1.52	37.36	1.25	0.33	2.13	197	36	383.8
2002	4.36	1.35	6.42	27.25	7.62	46.89	19.74	2.32	39.65	1.75	0.62	2.64	225.3	61.5	386.7
2003	4.55	1.61	6.29	41.87	9.2	72.21	22.11	2.72	45.96	1.91	0.83	2.69	254.9	85	402.8
2004	4.99	1.63	6.82	69.92	11.58	124.99	29.3	3.75	57.58	2.26	0.78	3.1	296.1	92.5	459.2
2005	10.31	2.58	14.57	110.87	14.66	200.8	26.12	1.58	54.03	3.27	1.3	4.66	381.3	97.5	547.8
2006	13.06	3.8	17.24	145.59	25.95	245.21	33.21	3.15	69.79	4.36	1.26	5.57	489.9	128	632.4
2007	20.87	5.33	30.21	219.96	30.89	364.88	82.98	10.47	159.87	6.01	1.97	8.05	587.4	152.5	756.7
2008	32.51	8.33	48.8	344.22	40.14	548.7	130.32	13.29	242.16	9.03	2.91	11.25	697.2	176.5	899.8

....continued

Year	Net fixed asset (in millions of Birr)			Depreciation (in millions of Birr)			Loanable fund (deposit +borrowings) (in millions of Birr)			Interest expense (in millions of Birr)			Capital (paid-up capiatal +legal reserve) (in millions of Birr)		
	Mean	Median	sd	Mean	median	Sd	mean	median	Sd	mean	median	Sd	Mean	median	Sd
2001	0.76	0.51	0.89	0.16	0.09	0.19	12.99	1.06	30.02	0.64	0.05	1.47	15.95	3.15	28.47
2002	1.16	0.56	1.23	0.24	0.16	0.24	26.22	2.39	50.04	0.81	0.07	1.61	18.62	3.51	34.29
2003	1.22	0.54	1.18	0.27	0.17	0.25	27.08	4.26	51.78	0.69	0.12	1.27	23.1	5.11	36.01
2004	1.72	0.44	2.26	0.27	0.18	0.27	44.15	6.52	86.02	1.07	0.17	1.95	27.18	8.66	39.88
2005	2.99	1.14	4.36	0.48	0.2	0.63	73	11.14	164.95	2.43	0.43	4.56	50.82	10.23	73.68
2006	4.44	1.43	7.1	0.58	0.26	0.64	112.09	19.47	228.08	3.75	0.65	6.67	62.04	13.46	85.77
2007	7.21	1.33	12.99	0.63	0.26	0.74	212.61	23.59	398.21	6.19	1.1	10.48	78.32	15.66	122.07
2008	10.46	1.97	18.09	1.11	0.36	1.34	289.76	30.83	518.39	11.71	1.8	20.14	89.96	15.92	131.05

Source: *Calculated based on MIX Market Inc. data base web site (www.themixmarket.com) and Association of Ethiopian MFIs*

Performance Analysis Bulletins

1. Descriptive statistics of cost function variables for the commercial banks

Year	Cost (in millions of Birr)			Out-standing loan (in millions of Birr)			Deposit mobilizations (in millions of Birr)			Personnel cost (in millions of Birr)			Number of workers		
	Mean	median	sd	mean	median	Sd	mean	median	sd	mean	median	Sd	Mean	Median	Sd
2001	199	54	411	1817	561	3647	2936	652	6415	22.8	8.9	41.4	1480	566	2610
2002	258	59	553	1750	637	3286	3240	909	6752	25.9	10.0	45.7	1570	629	2627
2003	136	72	199	1769	789	2807	3597	1076	7033	27.9	10.9	46.6	1631	656	2591
2004	171	69	270	1971	948	2748	4503	1275	8639	34.6	14.4	56.5	1700	757	2460
2005	158	87	196	2460	1234	3255	5023	1627	9001	41.5	20.0	63.9	1800	928	2367
2006	211	150	213	2910	1872	2896	5862	2177	9862	51.0	30.0	62.9	1961	1043	2399
2007	294	172	350	3422	2305	2911	7123	2746	11460	64.3	38.9	75.2	1952	1050	2568
2008	360	240	327	4800	2738	5591	8341	3478	12703	84.3	48.0	97.7	2390	1450	2500

.......continued

Year	Net fixed asset (in millions of Birr)			Depreciation (in millions of Birr)			Loanable fund (deposit+ borrowing) (in millions of Birr)			Interest expense (in millions of Birr)			Capital (paid-up capital +legal reserve) (in millions of Birr)		
	Mean	median	sd	mean	median	Sd	mean	median	sd	mean	median	Sd	Mean	median	Sd
2001	44.46	12.00	83.57	6.90	3.10	10.10	2938	652	6415	78	27	155	259	89	465
2002	46.71	14.00	80.24	6.70	3.00	9.02	3240	909	6752	76	29	142	208	122	275
2003	49.10	15.00	76.33	8.58	4.90	11.28	3597	1076	7033	53	26	88	188	129	192
2004	56.04	19.00	79.34	8.97	5.30	10.32	4503	1275	8639	59	29	93	210	137	184
2005	61.39	35.00	78.54	10.23	7.90	9.71	5023	1627	9001	68	33	99	390	243	461
2006	69.43	38.00	74.35	11.51	8.20	8.34	5862	2177	9862	84	41	109	481	342	460
2007	83.80	42.00	75.20	12.12	7.40	8.36	7123	2746	11460	104	60	111	978	425	1434
2008	101.04	65.97	93.93	13.92	8.56	9.11	8341	3478	12703	159	93	169	1140	598	1512

Source: *Calculated based on published annual reports of each bank*

Appendix B

Descriptive statistics of other variables for the MFIs and commercial banks

1. Descriptive statistics of other variables for the MFIs

Year	Asset (in millions of Birr)			Age of firms			Number of branches			Non-earning liquid asset divided by total asset			Provision expense (in millions of Birr)		
	Mean	median	sd	mean	Median	Sd	mean	median	sd	mean	median	Sd	Mean	Median	Sd
2001	42.73	9.65	75.09	2.57	2.50	0.98	26.6	3.5	44.1	0.31	0.32	0.05	0.17	0.01	0.
2002	50.45	12.18	88.70	3.43	3.50	1.16	31.1	5.5	44.5	0.31	0.32	0.06	0.46	0.12	0.
2003	60.19	13.81	102.20	4.43	4.50	1.16	35.8	10.0	46.8	0.33	0.32	0.10	0.85	0.22	1.
2004	92.92	16.53	164.74	5.50	5.50	1.22	40.0	13.0	49.8	0.29	0.25	0.13	0.26	0.06	1.
2005	158.00	19.22	272.48	6.50	6.50	1.22	41.3	11.0	51.1	0.20	0.16	0.09	0.90	0.42	1.
2006	203.08	30.75	333.53	7.50	7.50	1.22	43.0	13.5	51.1	0.13	0.13	0.06	0.94	0.50	1.
2007	321.09	37.67	529.01	8.50	8.50	1.22	49.9	14.0	61.1	0.14	0.13	0.07	1.92	0.52	4.
2008	421.35	51.10	662.64	9.50	9.50	1.22	50.2	15.5	60.6	0.11	0.11	0.05	3.49	1.17	6.

Source: Calculated based on MIX Market Inc. data base web site (www.themixmarket.com) and Association of Ethiopian MFIs

Performance Analysis Bulletins

2. Descriptive statistics of other variables for the commercial banks

Year	Asset (in millions of Birr)			Age of firms			Number of branches			Non-earning liquid asset divided by total asset			Provision expense (in millions of Birr)		
	Mean	median	sd	mean	Median	Sd	mean	median	sd	mean	median	Sd	Mean	median	Sd
2001	3730	981	7974	12.4	5.5	20.6	38	21	59	0.30	0.32	0.06	74.2	5.4	182.5
2002	4016	1224	8006	13.4	6.5	20.6	39	22	59	0.40	0.38	0.05	94.6	4.1	234.9
2003	7044	1535	15076	14.4	7.5	20.6	41	23	58	0.40	0.38	0.07	22.7	13.0	26.6
2004	7938	1792	16368	15.4	8.5	20.6	44	23	57	0.41	0.40	0.10	39.8	11.0	76.0
2005	6471	2057	11796	16.4	9.5	20.6	46	27	57	0.38	0.38	0.09	9.6	9.0	7.2
2006	7539	2834	12515	17.4	10.5	20.6	50	32	56	0.33	0.29	0.12	15.9	13.6	10.2
2007	9411	3480	15040	18.4	11.5	20.6	57	36	62	0.35	0.30	0.11	20.3	13.0	15.8
2008	11185	4270	17332	19.4	12.5	20.6	67	45	61	0.38	0.38	0.04	41.6	19.0	46.6

Source: *Calculated based on published annual reports of each bank*

Commercial funding ratio for commercial banks and MFIs

Year	Commercial Banks Mean	MFIs Mean
2001	1.23237	0.437403
2002	1.413911	0.551059
2003	1.447061	0.62598
2004	1.55415	0.673204
2005	1.505902	0.574304
2006	1.427055	0.56615
2007	1.488454	0.79268
2008	1.41881	0.692497

Appendix C

Name of Commercial Banks and MFIs included in this study

Commercial Banks

1. Awash International Bank

2. Bank of Abyssinia

3. Commercial Bank of Ethiopia (CBE)

4. Dashen Bank

5. Nib International Bank

6. United Bank

7. Wegagen Bank

Micro Finance Institutions

1. Addis Credit and Saving Institution(ADCSI)

2. Amhara Credit and Saving Institute (ACSI)

3. Buusaa Gonofa Micro finance institution (Buusaa)

4. Dedebit Credit and Saving Institute (DECSI)

5. Eshet Micro finance institution (Eshet)

6. Gasha Micro finance institution (Gasha)

7. Meklit Micro finance institution (Meklit)

8. Omo Microfinance Share Company (OMO)

9. Oromia Credit and Saving Share Company(OCSSCO)

10. Poverty Eradication and Community Empowerment (PEACE)

11. Sidama Micro finance institution (Sidama)

12. Specialised Financial and Promotional Institution (SFPI)

13. Wasasa Micro finance institution (Wasasa)

14. Wisdom Micro finance institution (Wisdom)