Assessing the Cost Efficiency of Microfinance Institutions in Ghana: An Application of Stochastic Frontier Approach

By

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DECLARATION

I hereby declare that this submission is my own work towards the Master of Arts. And that, to the best of my knowledge, it contains no material previously published by another person or material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in text.

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DEDICATION

This work is dedicated to Mr Michael Anderson for your continuous support to me in all my academic endeavours; and to you, Ms Emma Ama Saaba Ghartey, for the encouragement, love and timely assistance you have rendered to me.

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ABSTRACT

The aim of this study was therefore to assess the economic efficiency of microfinance institutions using the case of Ghana from 2007 to 2010. The use of the Stochastic Frontier Approach was employed as the main research technique to estimate efficiency. In all, 73 MFIs were sampled across the industry upon whose financial data, a Cobb-Douglas cost frontier and cost efficiency ratios were first estimated. The units were rated on levels of good financial performers, and worst financial performers. The study obtained an overall mean for economic efficiency to be 58.40% with most units having efficiency ratios falling between 51-60%. Although, efficiency scores were low, the displayed results showed an incremental increase in annual efficiency scores; indicating an improvement in technology in the financial sector. Also, it was found that the age of the microfinance institution is a significant determining factor of efficiency in Ghana due to the presence of a positive learning curve. The main conclusion extracted from the analysis was that MFIs in Ghana are operating below their optimal scale capacity as none of the sampled units was either economically or technically efficient. However, there was an evidence of a good scope of outreach. It is recommended that MFIs must invest resources and adequate time into the training of staff and clients before new programmes, credit schemes and policies are implemented.

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CHAPTER ONE
INTRODUCTION

1.0 Background of the Study

Microfinance has grown over the years to be one of the salient tools used for fighting poverty. Its establishment was justified on the grounds that it is a first-best policy strategy to capture the existing gap between the poor and the financial market.

In Ghana, the use of microfinance is not recent; history suggests that it has long been used as a means of organizing funds at the informal sector for the economically active but financially - constrained and vulnerable in society through the concept of rotatory savings (Susu). The activities of local money lenders and family loans had also been in place from time immemorial albeit at exploitative terms and conditions, (Steel and Andah, 2003)

Microfinance, a substitute for informal credit, covers a broad range of financial services including loans, savings, payment services through leases, and insurance to low-income households and microenterprises, (Ledgerwood, 1999; Morduch and Haley, 2002). Yet like most policy instruments, the road has not been smooth. Its operations have been associated with lots of pitfalls that constrain optimum impact. According to Littlefield and Rosenberg (2004), microfinance is reaching only a small fraction of the estimated demand for financial products by the poor. While a few hundred institutions have proved to be sufficiently stable, most institutions are weak and donor dependent. To this end, numerous studies have been conducted in an attempt to estimate the operational efficiency of MFIs across countries, blogs and the world at large; to find out ways with which efficiency can be enhanced and to expose best practices for the benefit

of all practitioners. Indeed the efficient functioning of MFIs is critical for long term sustainability; such is the reason why any empirical assessment (including this study) of performance is warranted.

1.1 Statement of the Problem

The evident exclusion of the poor from the banking sector has been cited, among others, as one of the most austere effects of financial market liberalization since the 1980s. Microfinance institutions were an apt response to address this market failure. To this day, MFIs are expanding their services and outreach: the total number of beneficiaries, worldwide, was estimated to be 70 million in 40 countries as at 2005 (Daley-Harris, 2005). More so, evidence exists to reinforce the idea that microfinance institutions on the whole are making significant headways in changing the status of the very poor in various countries, (Murdoch and Haley, 2002).

Yet, in spite of these pluses, data suggests that performance is woefully short of expected growth. MFIs are making subnormal profits and cannot seem to breakeven without donor support. It is estimated that only 1-2% of all microfinance institutions (MFIs) in the world are financially sustainable (Deutsche Bank, 2007, cited in Hermes et al, 2009).

In Ghana, marked strides are being made by both governments and donor agencies to make microfinance a workable intervention. Microfinance has evolved from a time where only few recognized institutions: savings and loans groups, credit unions and rural banks were being regulated to a time where most agencies even at the informal sector level are being regulated.

Nonetheless, the issue of efficiency arises; as it is believed that most of the microfinance institutions in the country are operating below their efficient capacity or better still making productivity losses. The industry cannot boast of a substantial commandeering of the informal sector: only 10% of a potential active and bankable poor are believed to be reached by microfinance institutions, (UNCDF, 2008).

There is also the growing evidence that most of the microfinance institutions are donor dependent and without such support they find it difficult to function properly. The call for an improvement in efficiency behaviour, both in functioning and capacity is therefore not misplaced. According to research, over 50% of the financial demands in the microfinance sector in Ghana are unmet by the service providers, (UNCDF, 2008).

The motivation for undertaking this research is therefore in two ways; first, microfinance institutions have gradually become central players in the country's development agenda, (Kwarteng, 2009). Their actions and inactions have therefore become sensitive variables in the discharge of the country's development agenda. The efficient administration of microfinance institutions both in the mobilization of capital resources and in their delivery of credit is key to a long term improvement in welfare and stimulation of economic growth. Yet, there are varied reports of operational inefficiencies across the scope of microfinancing in the country. For instance, it is alleged that some officials have re-channelled loanable funds to finance personal projects, (Ghanaian Journal Mobile, 2009). The Microfinance and Small Loans Center (MASLOC), for example, is reported of having difficulty redeeming a loan deficit to the tune of GHS43 million in Western region; and GHS60,000 in Dormaa Ahenkro in the Brong Ahafo region alone. Also some staff had granted loans to relatives without following the laid down

procedure. About GHS800, 000 of various loans which officials of the center had allocated to themselves are yet to be repaid. These employees alone granted to themselves between GHS2500 - GHS70, 000 to be repaid within 4 years; which was not the normal loan procedure (GNA, 2010). Other stories of some irregularities in the microfinance industry in Ghana include the Eburowaba Microfinance scheme in Cape Coast which had embezzled a huge members' savings of over GH 30,000; whilst the stories of the Amenfiman Rural Bank at Wassa Akropong in the western region and Mponua Rural Bank at Amuana Praso in the Birim North District which had both uncovered a number of malpractices and bank lapses on the part of bank officials, leading to huge debts and loss of profits. Certainly, such developments conspire against all growth-improving objectives and likewise slacks the cutting edge of the industry in terms of poverty outreach and economic development.

Second, it is identified that although extensive works have been done on economic efficiency in microfinance and the financial market, worldwide; very little work have been conducted in the case of Ghana. Most works on efficiency with respect to this country case are in the area of the commercial banking units and other aspects of the manufacturing and production sector; even though the importance of the microfinance industry to national growth cannot be denied. Thence, finding answers to the questions posed by this study will among others help to increase knowledge and understanding of the dynamics pertaining to operational efficiency in the microfinance industry of the country and help decision makers to know which policy direction to pursue.

1.2 Research Objectives

In view of the above discussion, the objective of this study has been set as to measure the economic efficiency of microfinance institutions in Ghana. Indeed, the study shall be guided by the following specific objectives in the attempt to resolve the research problem. Here the effort would be:

1. To estimate the best practice efficiency frontier of microfinance institutions in Ghana.
2. To estimate the mean efficiency scores of MFIs so as to find out the intensity of inefficiency of MFIs in Ghana.
3. To rate the MFIs based on the computed efficiency scores
4. To find out the drivers of efficiency in the microfinance industry in Ghana
5. To find out whether MFIs in Ghana are trading off objectives of outreach with the pursuit of efficiency

1.3 Research Questions

Based on the objectives, the research questions that the study would provide answers to include:

1. What best practice efficiency frontier appropriately account for the efficiency behaviour of the microfinance units using the available information?
2. What are the mean efficiency scores of the observed units and can the presence of waste be identified in the behaviour of sampled units?
3. Which MFIs can be described as best performers among the group of MFIs sampled?

4. What are the determinants of efficiency in the microfinance sector in Ghana?

5. Is there a trade-off between outreach and efficiency?

1.4 Relevance of the Study

The significance of this study is based on the score that many research works has been conducted in the area of efficiency for microfinance institutions across the globe for the progress of the programme across countries but such an undertaking has eluded the institutions in Ghana; hence the reason for this study to focus on Ghana and bring out the pressing issues that has engulfed the scheme over the years and how practioners have been performing. Invariably, improving knowledge of the linkages and drivers of efficiency will on the management policy perspective, provide a benchmarking analysis to inspire MFIs towards best practices. It will also help decision making units to know which strategies and methodologies are most efficient and can help improve their success story; this will help them reduce inefficiencies and embark on least cost activities that can better improve output levels and make their outfit self-sufficient.

Secondly, donors and the government machinery will also acquire forehand information on the performance of the scheme and how scarce resources are being put to maximum use. This is important in the area of policymaking and decisions.

Also whilst the relationship between external conditions and the economic efficiency of the microfinance institutions are discussed, it will spark good policy discourse which can further renew interest in the field for further studies.

To all practitioners in the sector, most especially the players, relative efficiency scores will provide good platform to learn from the others and compare their performances. Invariably this learning effect will improve the general performance of the units in the sector.

1.5 Scope of the Study

The scope of this study shall cover a sample of the categories of microfinance institutions across the country over a period of 2009 to 2010. The three year period is chosen not only to set analysis and understanding to current trends in the field of microfinance; but it is assumed that most of the institutions were in full operation and have consistent data for the sample periods.

1.6 Limitations

Three major constraints are exposed in this study; *viz*, time constraints, financial constraints and lack of adequate knowledge. For one, the scope of this study which is set to capture a number of observations across Ghana, demands ample time in order to construct a detailed work that is at best, more representative. However, the stretch of time available will not augur for all observations to be captured.

Secondly, financial constraints will almost certainly also reduce the extent of travelling to acquire data and or check for consistency of gathered secondary information. Again, subject to the range of this research work, requires that both secondary and primary sources of data are

combined effectively, which presses for enough finances. As a result, the sampled size will obviously be reduced, in order not to throw the budget out of gear.

1.8 Organization of the Study

The study is organized in five chapters as follows. Chapter one provides general background issues to the study. It also provides the statement of problem in terms of research questions. Again, it sets out the objectives of the study and provides justification for the objectives.

Chapter two reviews the relevant literature of the study including the theoretical and empirical issues. The method of the study will then be given concrete exposition in chapter three whilst the presentation of results will be showcased in chapter four. The fifth chapter will then entail a summary of the main findings and policy recommendations.

CHAPTER TWO
LITERATURE REVIEW

2.0 Introduction

This chapter is in three broad parts. The first part will attempt to give a concise pictorial view of the microfinance sector in Ghana; it components, successes, constraints and frameworks utilised. The second part will try to bring out some of the conceptual issues pertaining to economic efficiency. A look will also be taken on the framework for measuring economic efficiency and some of the limitations that crop up with the usage of any particular estimation technique; this will then be followed by an appraisal of some empirical studies on economic efficiency and the estimation techniques that were used in the study.

The third major section of this chapter will look at the broad concept of microfinance and its scope, and the concept of efficiency in the area of microfinance. This will then be followed by a review of research works that has been conducted in the area of microfinance and economic efficiency. The final part will then sum up the main points to provide a conclusion of the main texts in this literature.

2.1 A Brief Overview of the Microfinance Sector in Ghana

According to the World Bank (2000), the private informal sector together constitutes the largest employer of the working population in Ghana; yet, for most micro and small scale entrepreneurs, the lack of access to financial services is a critical constraint to the expansion of viable micro-enterprises, (Adjei , 2010). Accordingly, the emergence of the microfinance revolution generated

the processes needed to democratize capital and allowed micro-entrepreneurs to expand and diversify economic activities, (Robinson, 2001). By 2006, MFIs in Ghana were reaching a total of 3.5 million clients (about 15% of the total population as against the 10% of commercial banks); and by the close of 2008, total clients base had grown at an annual average of 22% with a simultaneous growth in deposits and loans of about 20-30% in real terms. The total percentage of women clients in total client base ranged between 41% in RCB's to 84% in NGOs with a national average of 45%, (GHAMFIN, 2008). According to Bank of Ghana, the microfinance sector in Ghana can be classified into four main groups: formal, semi-formal, informal and public programmes.

2.1.1 Formal Institutions

The formal institutions are mainly institutions with relatively large asset base authorized to operate as limited liability financial companies under the Companies' code 1963, the Banking Law (1989) and the Financial Institutions Law (1993). Formal microfinance institutions in Ghana include:

Rural and Community banks, established with the sole aim of mobilizing rural and community capital resources. They are considered as unit banks owned solely by the community to perform such functions as to serve small and micro enterprises, fund agricultural activities and individuals within the demarcated locality. The 2000 IFAD report shows that on the average a unit rural bank serves within a range of 53 000 km^2; however recent development show that most of the rural banks are operating outside their allotted demarcation and more or less, duplicating the

functions and structure of commercial banks. The activities of RCBs are however crucial to national development and by implication, the growth of microfinance in the country. For instance, as at the close of 2006, the total loans disburse by all rural banks stood at GHS115.10 million, (Asiama and Osei, 2007). In terms of absolute number, RCBs increased the breadth of their outreach by 61% from 2004-2006 serving a larger clientele than any other category of MFI, (GHAMFIN, 2008).

The next units which are also classified under this broad type are the commercial banks. These are made up of the traditional banking institutions including development banks. There are currently about 24 commercial banks operating in the country, (Ghana Banking Survey, 2008: Frimpong, 2010). These institutions are mainly concentrated in the urban and peri-urban communities. The main target group are predominantly the rich and the urban middle income households. The commercial banking system reaches only about 5% of households, most of which are excluded by high minimum deposit requirements. With 60% of the money supply outside the commercial banking system, the rural banks, savings and loans companies, and the semi-formal and informal financial systems play a particularly important role in Ghana's private sector development and poverty reduction strategies, (UNDCF, 2008).

Savings and Loans Companies are also differentiated as formal suppliers of microfinance services. Even though they are restricted on the number of services by which they can provide, they form a very vital component of the microfinance sector in Ghana. There are currently about 14 SnLs in Ghana, (Asiama and Osei, 2007). By the end of 2008, for example, the total assets of all savings and loans companies in the country was more than $167m, about 2% of the size of the total assets of all commercial banks. Total savings mobilized also stood at $88m whilst a total of

$96m was disbursed as credit. Studies indicate that apart from the rural banks which perform well in the microfinance sector, the savings and loans companies are equally increasing their performances: as at the close of 2008, the 14 SnLs and 128 RCBs had an outstanding loan portfolio of GHS 345.8m and a total savings deposit of GHS471.02m (totalling about 70% of the total savings portfolio), (Adjei, 2010).

2.1.2 Semi Formal Institutions

These are institutions which are registered to conduct welfare services to their members and beneficiaries but are not licensed by Bank of Ghana. They include: NGOs, and Credit Unions.

NGOs can be classified into two groups: Non-Governmental Organizations (NGOs) which provide financial services and those NGOs that provide non-financial services such as advocacy on issues of environmental protection, sanitation and rights of the vulnerable. NGOs are mainly established with the mission to reduce poverty levels; and rely mostly on donor support or external funds to perform these activities effectively since they are not allowed taking savings deposits from clients, (Steel and Andah, 2003). They are typically localized and are usually found in the northern part of Ghana where the mark of the formal banking institutions is marginal or non-existent. A few especially the financial NGOs, on the contrary, are widespread. They exercise mainly group solidarity methodologies centered on already existing Community-Based Organisations (CBOs) established on the basis of location, occupations, friendship, family ties, or gender to serve a social purpose at the community level (Chord, 2000). A very high percentage of women clients is observed in the activities of NGOs (95% in 2004; 88% in 2005; and 90% in 2006). This is as a result of their social orientation and the sourcing of their loanable

funds: the sources tend to have a high social content and target women to attain their social objectives, (GHAMFIN, 2008).

Credit Unions, on the other hand, are workplace-based where the majority of employees and membership are males. They are allowed to take deposits and can even give out loans but only to their members. Their services are also not opened to the general public unlike most forms of microfinance institutions. They are registered by the Department of Cooperatives and are governed by the apex body, Ghana Cooperative Credit Unions Associations. There were about 322 unions in Ghana as at the close of 2007, (GHAMFIN, 2008); with an observed average membership size of 900 members per credit union as at 2010.

2.1.3 Informal Sector

This sector under the microfinance industry is mainly occupied by the Susu system, the activities of money lenders, self-help groups, trade creditors and family loans (Fosu, 2008). The Susu system is made up Susu clubs, Susu associations, Susu collectors, and Susu companies.

Indeed, the Susu system is the most extensive and perceptible methodology used across the landscape of microfinance institutions in Ghana irrespective of the type of MFI. Unfortunately, it is one of the most exploited systems of microfinance delivery in Ghana. For instance numerous Susu companies and collectors have been reported to have absconded with people's savings on several occasions: a more than $65,000 of mobilized savings has been lost to embezzlement through the fraudulent practices of unregulated Susu collectors, (Microfinance Insider, 2008). Whilst this displays the need for stringent supervision and control, it also exposes the capacity of the susu collection system as an effective device for resource mobilization at the informal sector

level: susu banking in Ghana is a more than £75 million economy that operates in the informal sector with a unit's potential operational base of close to 10,000 clients, (Microfinance Insider, 2008; Steel and Andah, 2003)

Moneylenders also play important role in the business of microfinance at the informal sector. Moneylenders in Ghana according to literature are largely wealthy farmers (a large percentage being cash crop farmers) and traders who own huge assets or have easy access to bank loans. Usually, they make loans based on trust or sometimes through the witness of third parties usually family heads, friends or relatives. Credits are made against secured collateral and ordinarily have three months duration with a high interest rate.

2.1.4 Public Programmes

These are policy programmes run by the government and its development partner agencies targeted at reducing poverty and reaching the Millennium Development goals (MDGs). Some of such public programmes include the Financial Sector Improvement Project, Financial Sector Strategic Plan (FINSSP), Programme of Action to Mitigate the Social Costs of Adjustment (PAMSCAD), and Agricultural Services Investment Project (ASSIP), (Amoah, 2008; GHAMP, 2006; Steel and Andah, 2003) and a host of others. The main set back of public programmes are politicization of the programme, wrong public perception, misconduct of management and staff, and improper appraisal of projects. According to Steel and Andah (2003), of the numerous intervention schemes under the governance of the National Board for Small Scale Industries (NBSSI), only ENOWID – Enhancing Opportunities for Women in Development – under PAMSCAD was operationally successful and had recorded a more than 70% recovery rate.

Indeed, as at mid-2009, the government of Ghana's Micro and Small Loan Center (MASLOC) had only 25% repayment rate, (Quainoo, 1997; Adjei, 2010)

To sum up, it is clear that the microfinance sector in Ghana is very heterogeneous; with units that differ in structure, operations and governance. It is a thriving community with lots of potential for growth and a lucrative market for investors and organisations who seek to diversify their assets into low risk high yielding portfolios: the reason for the current commercialisation in the sector. Hence, for the sector to maintain its commercial viability and to continue to attract more investments for growth, demands that practitioners strive to minimise waste and produce efficiently.

2.2 Theoretical Review

The concept of efficiency has been defined variously in literature; for instance, according to Tahir et al., (2009), efficiency can be defined as the maximum output that can be produced from any given total number of inputs. Radam et al., (2010) utilizes the definition of Tahir et al., (2009); but goes further to state that a production firm is efficient if it cannot improve any of its inputs or outputs without worsening some of its other inputs or output. Gallacher, (1997) also provides a technical definition that exposes how the concept should be understood empirically. According to the author, it is the ratio between actual and potential output.

From the above definitions, it can be deduced that the concept of efficiency connotes the transformation of given inputs to yield the maximum attainable output at the minimum possible cost. It reflects the exclusive absence of waste to extract the cost minimizing maximum-output

levels. These definitions illustrate the concept of Pareto optimality which states that a unit is efficient if it is impossible to make one better off without making the other worse off. When it is possible to make somebody still better off by rearranging bundles of choice variables, a Pareto improvement is said to be made. There are two main forms of efficiency according to theory: technical and economic efficiency. For the purposes of this work, the literature will concentrate on the dynamics of economic efficiency.

Economic efficiency occurs when there is a least cost procedure for producing a given amount of goods or services with the available inputs. In other words, it reflects the capacity to produce a definite output at minimum cost, FØrsund, Lovell and Schmidt (1980). It evaluates the difference between the expected and the actual given income, quantity and price constraints. Obviously, economic efficiency is a derived concept from the principle of Pareto optimality. A gain in economic efficiency can be considered as equal to a Pareto improvement since it results from a condition of optimal resource use such that one unit was made better off without other units being made worse off.

The study of economic efficiency allows the relative comparison of efficiency among economic units sharing the same characteristics, (Guerrero and Negrin, 2005). Two main components of economic efficiency are also exposed in literature: technical and allocative efficiency.

2.2.1 Allocative Efficiency

This component shows the ability of a microfinance institution to combine available inputs in optimal proportions given factor prices and available technology. It is concerned with the choice

that best compare to the budget constraint among different possible combinations of input that yield the same amount of the desired output. In other words, it is the ability of economic agents to equate marginal cost with marginal benefit, (Guerrero and Negrin, 2005; Manjunatha et al., 2009). Allocative efficiency, therefore, measures how well firms combine inputs to minimize the cost of producing a given output level. (Radam et al, 2010).

An example of an empirical work on allocative efficiency is presented by (Badunenko *et al*, 2005) who proposed that allocative efficiency can be estimated using information on input and output quantities and profit. Using data from 35,000 German firms and a Cobb Douglas production function, their results showed a significant variation of allocative efficiency across the units with a mean score of 91% plus about 5 percent of firms obtaining 20% inefficiency.

2.2.2 Technical Efficiency

Technical efficiency on the other hand is defined as the ability to achieve a higher level of output given similar levels of inputs, (Ogunniyi, 2008). According to Guerrero and Negrin, (2005), technical efficiency is observed when a firm minimizes the use of inputs in the production of a good given input prices or maximizes the quantity of output given the amount of input. Radam et al. (2010) also posit that the concept of technical efficiency reflect the measurement of actual input usage relative to the minimum input usage for a given set of outputs or the ratio of actual output to the maximum potential output given the set of inputs.

To measure technical efficiency the question of how much input could be proportionally reduced without changing output produced; or how much output could be enhanced without changing the

combination of input; is unravelled. Hence when firms are able to employ less of at least one input and are still able to maintain the level of output or are able to increase at least one output using the same input, then an improvement in technical efficiency is said to be made, (Koopmans, 1951 cited in Murillo-Zamorano, 2004).

Extensive studies in the area of technical efficiency can be found in the works Tahir et al., (2009) who estimated the technical efficiency of commercial banks in Malaysia. They utilized a non-parametric estimation of the efficiency frontier for each year from 2000 to 2006. They found that the domestic banks were more technically efficient with a mean score of 88.7% than the foreign banks with a mean score of 73.3%. Mahmood, Din and Ghani, (2007) also attempted to estimate the technical efficiency of the manufacturing sector in Pakistan between two periods 1995/96 and 2000/01 using a Cobb Douglas production frontier model. Their findings showed a marginal change in mean efficiency score from 58% in 1995/96 to 65% in 2000/01; indicating a change of 11.94%. They attributed the low efficiency scores to the protective trade policy environment. Other works include: Yu, 1995; Hasan et al., 2000; Coelli, 1996 cited in Manjunatha et al., 2009.

2.3 Methodological Review

Farrell (1957) was the first in modern history to develop a means of measuring efficiency. His works, mainly non-parametric, attempted to estimate both technical and allocative efficiency assuming constant returns to scale in production. He estimated efficiency relative to a production possibility frontier. Recent extensions of his work relaxed the assumption of constant returns to include the assumption of variable returns to scale; and an application using parametric models

as well. The current existing literature on efficiency therefore reveals two broad categorical forms of estimation techniques: the parametric (the econometric approach) and the non-parametric (mathematical linear programming) techniques.

2.3.1 Econometric Techniques

Most works that uses parametric models in estimating efficiency have used Stochastic Frontier Approach (SFA) propounded by Aigner, Lovell and Schmidt (1977) cited in Martinez-Gonzalez, (2008). SFA models a cost, or a production frontier with a functional form and an assumption about the distributional form of the inefficiency error component, (Berger and Humphrey, 1997). The stochastic frontier analysis method can be performed on both cross-sectional and panel data. For cross-sectional data, the error representing statistical noise is assumed to be independently identically distributed whilst the inefficiency term is one-sided with a number of statistical distributive forms: half-normal, exponential and truncated from below at zero. Likelihood function can then be defined so long as the two error terms are assumed independent of one another and of the variable inputs; maximum likelihood technique can be used to find the input parameters. However, the use of cross sectional data to find conditional estimates of efficiency has been criticized as being not consistent although it yields unbiased estimators. As a result of this technical difficulty and the fact that the distributive assumption used under cross-sectional stochastic frontier models are too rigid and yet yield inconsistent estimates, panel data stochastic frontier models is advised. Panel data frontier models include time invariant independent variables and therefore do not require a separate assumption of the independence of the inefficiency term and the input variables. More so, it does not require any rigorous estimation

technique, the simple traditional estimation procedures for assessing panel data can be applied to yield consistent estimators of the inefficiency parameters as modeling does not entail any distribution assumption on inefficiency effect, (Schmidt and Sickles, 1984:Murillo-Zamorano, 2004). The use of fixed effect and random effect procedures in measuring estimates of a panel data are therefore useful. The fixed effect method applies OLS after the data has been transformed into a deviation form. Researchers on the other hand prefer the use of random effect procedure since it allows for time invariant regressors in the model as it assumes a randomized error term rather than a fixed one. With a two-stage generalized least squares parameters can be found using the random effect procedure.

Even though, the need for a distribution assumption on the inefficient effect is curtailed in panel data models, it is shown that if the form of inefficiency distribution is known maximum likelihood techniques or corrected ordinary least squares can be applied to attain more efficient estimates of the parameter vector and the inefficiency scores for each productive unit. Literature suggest either a normal-half-normal or a normal-truncated distributive forms. (Yu, 1995; Murillo-Zamorano, 2004).

With the use of either a cost or a production function under the application of the duality theorem, most contemporary empirical works states their stochastic frontier functions using a Cobb Douglas, a fourier flexible or a translog function. Translog functions are nonetheless the most used. The snag is the correct choice of objective function in modelling; that is whether to utilize a cost function or a production function as instruments of measuring efficiency scores. However, researchers are guided by such factors as data obtainability, the nature of production

sets and exogeneity assumptions to decide on which objective function to employ, (Murillo-Zamorano, 2004).

Empirical studies utilizing the basic model of SFA include the works of Kumbhakar, McGuckin and Ghosh (1991) on technical and allocative efficiency of US dairy farms. They assumed that the inefficiency is a truncated normal distribution and found that the educational level of farmers and the farm size are significantly related to technical efficiency. Huang and Liu (1992) uses SFA to analyse technical efficiency of the electronics industry in Taiwan using cross-sectional data. They also assume that the error term follows a truncated normal distribution dependent on the characteristics of firms (cited in Battese and Coelli, 1993: pp 2-3). Battese and Coelli (1993) follows Huang and Liu (1992) model but extends it on panel data to allow time variant data characteristics in the function. Using a translog function, the authors attempted to find maximum likelihood estimates of parameters of the data from paddy farmers in India. They found considerable variation in levels of technical efficiency over time. Hermes et al., (2009a, 2009b) also uses SFA frontier model to find maximum likelihood estimates using data obtained from 435 MFIs. They found indicators of financial development, poverty goals, experience, and type of loan as important drivers of efficiency. Other studies utilizing SFA are Schmidt and Lovell (1980), Kumbhakar (1989), Ferrier and Lovell (1990), Atkinson and Cornwell (1994), Kumbhakar and Lovell (2000), Mbanasor and Kalu, (2008), and Chen (2009)

2.3.2 Mathematical Programming Technique:

This technique differs in structure and use from the parametric models. It assumes a zero absolute value for randomness, so that all unexplained variations are treated as inefficiency. The non-parametric approaches are simple and easy to use since it does not involve specification of functional form, (Coelli, 2004). Hence, in contrast to the econometric approaches which attempt to determine the absolute efficiency of firms against a formulated standard, the mathematical programming approach seeks to evaluate the efficiency of units relative to other entities in the same industry.

Data Envelopment Approach (DEA), the most widely used non-parametric technique involves linear programming estimation of the observed data sets to construct a piece wise, quasi convex hull around data points in an input space to create frontier surface that can be used to evaluate the relative efficiency of firms by comparing output and input ratios relative to the surface. The underpinning premise is that there exists an idealized production point that all producers aspire to reach. With heterogeneity across sets, the firms will position themselves at varying distances from the efficient frontier: the closest becomes the most efficient. (Murillo-Zamorano, 2004; Coelli, 2004)

DEA can be applied under both assumptions of constant and variable inputs of production. There are two forms: oriented and unoriented approaches. In oriented models, either the inputs or the output will be assumed as given whilst measuring the full optimal scalability of the other as a means of estimating the efficient frontier. That is, how much of input can be reduced given output or how much output can be increased given the inputs. Hence in input oriented model, a minimization concept is assumed whilst in the output oriented concept, an expansion motif is

intended. In unoriented models; the assumption of fixed variables is relaxed (Murillo-Zamorano, 2004; Martinez-Gonzalez, 2008)

DEA is ideal for analysing the public service sector including non-profit organisations where the objective of profit maximization and cost minimization may not be considered a vital issue. It also gives useful peer information about identical units working under similar environmental conditions. This is captured by controlling for environmental factors during the estimation, (Izah, Sudin and Nor Mazlina, 2009; Charnes, Cooper and Rhoades, 1978; Hassan, Vivas, and Pastor, 2000). The main strength of DEA estimation is that it does not require any theoretical imposition of the form of which the economic behaviour of observed units should take. Nonetheless, it is criticized on the grounds that it does not provide for the possibility of accounting for statistical noise or measurement errors in the model; more so, efficiency results are very sensitive to outliers and shocks. Not providing for the possibility of making statistical noise implies estimates cannot be used for any statistical inference, (Mester, 1997; Murillo-Zamorano, 2004).

The lack of statistical inference has been solved in latest empirical literature through the technique of bootstrapping. The method of bootstrapping uses the efficiency scores produced by DEA as an a priori for inefficiency in a hierarchical Bayes estimation of a stochastic frontier, (Simar and Wilson, 1998: Green, 1993). The basic idea is that the estimated bootstrap distribution will simulate the unknown distribution of the efficiency parameters, (Worthington, 1999; Annim, 2010). It must however be stated that it is difficult to use any the non-parametric methods to calculate efficiency index for single units since it only produces indices that encapsulates all the attribute of firms being observed. Hence, when the sample data displays

greater heterogeneity between observed units, scores of inefficiency is expected to be higher, and may not show true representation (Mester, 1997).

There a number of empirical studies on efficiency that have utilized DEA technique. Examples of such studies include McAllister and McManus, (1993), Berger et al. (1993), Favero and Papi, (1995). In the UK, Field (1990) and Drake and Weman-Jones (1992) calculated respective mean efficiencies of 93 and 98 percent for building societies. Cebenoyan (1993a) and Cebenoyan et al. (1993b) used almost identical data on US saving and loans companies to calculate mean efficiencies of between 77 and 83 percent in the first instance and between 86 and 87 percent in the second. In Australia, Worthington's (2000) analysis of Australian credit unions found mean cost efficiencies of 70 percent and technical efficiencies of 95 percent.

2.4 Microfinance – Definition and Scope

Microfinance is the provision of a broad range of financial services such as credit, savings, insurance and money transfer for low-income individuals or households, ADB (2000). Armendariz de Aghion and Morduch, (2005) also defines microfinance as "a collection of banking practices built around providing small loans (typically without collateral) and accepting tiny savings deposits." According to the United Nations, therefore, the microfinance model encompasses the provision of financial services and the management of small amounts of money through a range of products and a system of intermediary functions that are targeted at low income clients, UN (2005).

From the above definitions, it is clear that microfinance is a multi-dimensional development approach that is targeted at the poor as a means of providing demand driven, well-structured financial services meant to improve their living standards.

Microfinance institutions (MFIs), which covers a wide range of providers that vary in legal structure, mission, and methodology, offer these financial services to clients who do not have access to mainstream banks or other formal financial service providers (Brown et al., 2005). The nature of microfinance institutions is dissimilar to the traditional banks; even though, they are all involved in financial intermediation: MFIs are relatively small in size, limit their services towards poor households and often provide small collateral free group loans. Gropper et al. (2006) also distinguishes MFIs from the other financial institutions by indicating that many aspects of the operations of microfinance units are characterized by subsidies and in-kind transfers from international donors, governments and international networks.

The largest group of microfinance organisations is found in Asia which is arguably the region with the most efficient institutions due to large population densities, lower wages, strong outreach and preservation of low operating expenses, (Microbanking bulletin, 2004, cited in Hag et al., 2010). MFIs pursue a double bottom line objective of outreach and sustainability: on one hand, MFIs fulfil an outreach mission by providing financial services to the poor whilst operating like other financial institutions, lending to creditworthy clients and earning positive returns on their loan portfolios, whilst on the other hand; working sedulously to sustain and expand their operations – sustainability, (Gropper et al., 2006).

Although microfinance units are on the whole contributing to the goal of alleviating poverty across the globe, the movement on this expansion path is very marginal. According to Brown *et*

al., (2005), globally some 30 million families had access to microfinance services by end-December 2000. Of these, around 19 million were classified as amongst the poorest families around the globe. This represents barely 8% of the total of 235 million poorest families in the world. Although, Asia alone, accounts for three-quarters of the poorest families covered by micro-financial services, only 9.3% of the poorest families were reached. In Latin America and Africa 6% of the poorest families have access to microfinance, whereas in India, which alone accounts for around a quarter of the world's poorest families, even on the most optimistic assumptions barely 5% of the population had access to microfinance. Also, as indicated earlier in section 1.1, only 10% of a potential active and bankable poor are believed to be reached by MFIs in Ghana; whilst an estimated 50% of excess financial demand for service is projected to exist within the microfinance sector in Ghana, (UNCDF, 2008). These figures vindicate the growing concerns for microfinance institutions to pursue best practices and efficiency.

2.4.1 Microfinance and Best Practices

Staicu, (2010) expresses microfinance best practice as "to identify the current systems, tools, procedures pertaining to the mainstream banking that could be easily applied (maybe with slight amendments/adjustments) to the micro finance institutions with emphasis on the mission, vision, product size and the target group. Best practices are not limited to microfinance institutions alone but also the government, donor agencies and the entire client group are all encouraged to pursue best practices.

To begin with successful institutions are motivated to reach large numbers of clients (outreach) and also become financially self-sufficient. The aim of outreach is to improve the breadth (that is the number of active clients served), the depth (the poverty level of clients), the length (the time span of service delivery) and the scope (the flexibility and the diversity of products); while at the same time increasing the number of women borrowers who have access to the credit. Since poor customers generally have no credit history and little collateral, MFIs must use innovative lending practices to reduce the costs of information asymmetry. The use of innovative products dovetailed to local settings is advised. Literature suggests that microfinance initiatives that recognize and build upon local knowledge and tradition are more culturally compatible and sustainable. Examples are cited of such products as Ekub in Ethiopia, Tontines in Cameroon and Niger, Esusu in Nigeria, Susu in Ghana, Gameya in Egypt, and Sanduk in Tunisia which are built on traditional systems.

In India, Brown et al., (2005) also cites an example of microfinance institutions that have moved away from the traditional approaches and have introduced considerable amount of innovations in not only in the design of financial products and delivery systems but also in other operational practices as governance and institutional arrangements, operational strategies (designed for client promotion), management information systems (to encourage client feedback and reporting) and financial management and accounting systems (for transparency and auditing).

The issue of financial self-sufficiency also requires institutions to strive to cover full cost of operations, and other costs including depreciation, interest on loans and fees and costs imposed by inflations. This just does not require conducting strict feasibility studies on clients and huge collateral for loans but demands giving clients strong motivation to repay loans. This will reduce

loan delinquency (late payment of loans) and loan default (non-payment of loans). Best practice requires microfinance institutions to keep delinquency rate below 10% and default rate also below 5% which implies having a sustained loan repayment rate of between 95-100%.

Literature also suggests that for clients, the cost to obtain loans may sometimes be very high as compared to the cost of interest and fees. Best practice firms keep their costs low through efficient operations such as highly simplified and decentralized loan application, approval and collection processes, (Zielder, 2006). It is suggested that the number of days for loans to be granted should not exceed 3 days.

To achieve significant outreach and financial self-sufficiency, institutions must cover the higher costs they incur in providing small-scale financial services. Fully self-sufficient programmes charge an effective real interest rate that is appropriate enough to cover all their costs, (Essentials, 1999).

Other principles of crucial mentioning is the object of savings mobilization, market research, training of staff, development of monitoring and assessment tools and the avoidance of external dependency. Saving mobilization has the advantage of building financial assets for clients, improve the capacity of the institution, and enhance the commitment of members. Savings products intended for asset building must provide attractive returns in addition to flexibility and easy accessibility.

Also, the government is encouraged to pursue policies that facilitate the efficient functioning of these microfinance institutions. Microfinance institutions thrive under good and stable macroeconomic environment- especially inflation and exchange rates (MFIs who depend on

international donors for concessionary loans). Other practices of government important for the thriving of microfinancing in any set up are: the removal of bottlenecks in the legal system, good regulatory system for microfinance institutions, liberalizing of interest rates, investing in supervisory capacity, and the elimination of direct government credit programmes, (Zielder, 2006). In cases, where clients refuse to repay loans, microfinance institutions need a good legal system that will ensure not only fairness but will be able to help them recover loans taken.

The government must also create avenues for the self-regulation of microfinance institutions to ensure good standards both in operations, reporting, and monitoring; through the establishment of supra-governing bodies which will also be mandated to build the capacity of institutions across time. Regulation motivates the MFIs to pursue efficiency and reduce wastes. In Ghana, the Bank of Ghana, GHAMFIN and ARB Apex Bank are important regulatory bodies.

Zielder, (2006) also reiterates the opinion of eliminating direct government credit programmes from the system of microfinancing. For one, public programmes have generally been associated with low-efficiencies with respect to operations and repayment. This is because of over-politicization, and low motivation to pursue efficiency by staff and management. Secondly, it has crowding-out effects on microfinance institutions that have the same mission or are involved with the same target group. The government, at best, is to facilitate, liaise and improve the capacity of microfinance institutions and not be involved in direct service delivery; if not scarce public resources will continually go waste.

Furthermore, donors are important players in the microfinance sector and are therefore encouraged to pursue best practices. It is submitted that microfinance institutions tend to be more donor-dependent especially during the early years of operations. Donor supports are important

for MFIs who want to improve on not only the poverty goals but improve their general levels of outreach. However, in spite of increased donor support for most microfinance institutions worldwide, there is evidence to show a substantial amount of waste, stifled growth, and unfairness associated with the linkages between most donors and MFIs. CGAP (2002) argues that in most cases donors have been slow in adapting the flexibility of their instruments and decision making process to the needs of the sector since funding is not most likely geared to the needs of the sector. The result is bad practice, wrong targeting, and lower results. The best practice for donors is therefore to focus support on institutions with potential for scale and sustainability, harmonize process and procedures to improve efficiency, clarify role of subsidies, promote innovations in the sector, and ensure donor collaboration. (Zielder, 2006)

Last but not least, pertaining to the clients who utilise microfinance services, the only and most crucial best practice for clients, according to literature is to ensure prompt and full repayment of services rendered by the microfinance institutions. For most of these programmes, the scheme is run as a revolving fund and therefore any default by clients stifles the smooth implementation and sustainability of the programmes. The prompt repayment of loans ensures not only sustainability, but will heighten the efforts of reaching the poor, Zielder, 2006).

2.4.2 Microfinance Institutions and Efficiency

Efficiency in microfinance is a question of how well an MFI allocates inputs such as staff, assets and subsidies to produce the maximum output such as number of loans, financial self-sufficiency and poverty outreach. The level of efficiency can be established on the basis of inputs and output

variables: number of clients, number of loan officers, number of staff members, administrative expenses, number of loans, loan sizes and composition of overall loan portfolio and so on, (Balkenhol, 2007). The pursuance of best practice connotes the pursuance of efficiency; as a matter of fact, best practice and efficiency has been used interchangeably in literature. According to Nghiem et al., (2006), Brau and Woller (2004) and Essential (1999), an efficient microfinance institution, and for that matter, a best practice MFI, is the one that is able to meet both objectives of poverty reduction and financial sustainability requirements.

Literature attests to the fact that the pursuit of efficiency has become more imperative due to recent competition in the microfinance sector. Whilst the debate ensues as to whether a focus on efficiency may or may not result in mission drift which could spell doom for the poor and the disadvantaged; this study follows the path of others who toll the middle contours to assert that efficiency should rather enhance mission, (Brau and Woller, 2004). For most that are not in agreement with the pursuit of economic efficiency, the focus on efficiency will almost certainly crowd out scarce means from the less privileged and will only shift resources into the hands of the well-to-do. In effect, the focus on economic efficiency is most certainly income bias (Tariq et al., 2008; Hermes, 2009). Even though, the trade-off between equity and efficiency is widely recognized, the argument is that its pursuit (cost efficiency) in microfinance should rather make resources readily available to the overall society. This is because inefficient microfinance institutions either engage in incorrect methods that does not yield the needed result, serve loans to very risky clients, take high interest charges on loans served (which discourages further borrowing), or engage in inappropriate management practices such as embezzlement, and or simply do not monitor activities to ensure full scale impact. These bring about high transactionary costs which are borne mostly by the active clients.

For instance, Gonzalez Vega, (2003) cited in Martinez-Gonzalez (2008) suggest that because there are potentially few technically trained staff in the field of microfinance, available funds may be misapplied. The lack of incentive packages could also influence the behaviour of staff and managers while, lapses in decision making and policy implementation, incorrect regulation and inappropriate intervention by donors, incorrect product designs and methodologies all create massive wastes. Inefficiency can also come as either, through misappropriation of inputs or when large firms engage in operations best suited for smaller firms and vice versa, and or when there is favouritism in the choices of market agents, (Baumol and Blinder, 1994). The improvement of the microfinance sector will not be made possible when wastes persist, Martinez-Gonzalez, (2008).

Indeed, in order not to fall into the trap of labelling MFIs who perform only well on financial goals as best practice units, the study proposes a comparative study (a two-tier objective assessment procedure) where cost share performances are compared to the progress made on poverty goals or outreach and vice versa; to remove the tendencies of leaning towards only one side to analyse MFIs. The reason is that the double bottom-line objective of microfinancing cannot be disintegrated: this is what isolates MFOs from other systems of financial intermediation.

2.4.3 Empirical Review on Efficiency

Quayyum and Ahmad (2006) used DEA to estimate the efficiency and sustainability of microfinance institution working in the South Asian countries of Bangladesh, Pakistan and India. They considered both inputs oriented and output oriented methods by assuming both constant returns and variable returns to scale technologies. The variables selected were divided into different groups based on location, basic characteristics – age and size, financial management and performance to estimate variants of efficiency – technical efficiency, pure technical efficiency and scale efficiency. They assumed that the large and more experienced firms may perform better than those having less experience and with smaller size whilst higher debt-equity ratio (as a proxy for financial management) represented a reduction in firms' efficiency.

An output-oriented model implied that the efficiency was estimated by the output of the firm relative to the best-practice level of output for a given level of inputs. The Inputs were denoted by x_{jk} (j=1,…,n) and the outputs were represented by y_{ik} (i=1,..,m) for each MFI k (k=1,…..,K).

The maximization problem was given as:

Max TE_k,

subject to: $\sum_{i=1}^{m} u_i y_{ir} - x_{jr} + w \leq 0; \;\; r = 1, ..., K$

$$v_j x_{jr} - \sum_{i=1}^{m} u_j x_{jk} \quad and \; u_i and \; v_j \geq 0 \qquad \text{---------- (2.9)}$$

Where y_{ik} is the quantity of the *ith* output produced by the *kth* DMU firm, x_{jk} is the quantity of *jth* input used by the *kth* firm, and u_i and v_j are the output and input weights respectively.

The Input oriented linear programming method was used in order to obtain the minimal inputs through the specified equation below:

Min TE_K

Subject to: $\sum_{i=1}^{m} u_i y_{ik} - y_{iF} + w \geq 0$

$$x_{jr} - \sum_{j=1}^{m} u_j x_{jk} \geq 0 \qquad \text{---------- (2.10)}$$

$$and\ u_i and\ v_j \geq 0$$

Assuming both constant returns to scale (to measure technical efficiency) and variable returns to scale to estimate pure technical efficiency, the authors applied both correlation and regression analysis in the study and the result showed that the size of the MFI is significant in determining both Technical and Pure Technical Efficiency levels. Some other interesting findings were made concerning intra and inter-country comparisons. In Pakistan, for instance the results showed that three MFIs were efficient when constant returns to scale was assumed whilst estimating under the assumption of variable returns to scaled showed that eight MFIs were efficient frontier. The average input oriented efficiency scores were technical efficiency, 39.5%, pure technical efficiency 82.3% and scale efficiency 51.8%. For the output oriented measures, 39.5% was estimated for technical efficiency, 71.3% for pure technical efficiency and 56.8% for scale efficiency. In Bangladesh estimates show that the average input oriented and output oriented measures were equal for the technical efficiency, 8.7% which implies that the microfinance units were operating under constant returns to scale. In India, average input and output oriented measures were also close. It was also concluded that Bangladesh could best minimized the use of input without affecting the existing output level of loan portfolio followed by India and Pakistan. However, under the output oriented measures the Indian MFIs could improve their output level

more than those in Bangladesh and Pakistan (58.7%, 44.5 and 28.7 % respectively) with the existing level of input.

Mokhtar, Abdullah and Habshi (2006) empirically investigated the efficiency of Islamic banking institutions in Malaysia from 1997-2003. The study measured the technical and cost efficiencies of the units using stochastic frontier technique. The authors formulated two separate models to estimate efficiency; a production function- to estimate technical efficiency; and a cost function to estimate cost efficiency. The cost function was stated as follows:

$$\ln TC = \alpha_0 + \sum_{i=1}^{n} \alpha_1 \ln Y_i + \sum_{j=1}^{n} \beta_j \ln w_j + \frac{1}{2}\left[\sum_{i=1}^{n}\sum_{j=1}^{n} \delta_{ij} \ln Y_i \ln Y_j + \sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij} \ln w_i \ln w_j \right]$$

$$+ \sum_{i=1}^{n}\sum_{j=1}^{n} \rho_{ij} \ln Y_i \ln w_j + E_i \qquad \text{---------- (2.4)}$$

Where TC = Total cost; Y = output; X_i = vector of quantities of variable inputs; Y_i = vector of quantities of variable outputs; w_j = vector of prices of variable inputs; E_i = stochastic error term; and $\alpha, \beta, \delta, \gamma, \rho$ are parameters to be estimated. The parameter estimates were measured using maximum likelihood estimation technique.

The results of the study show that the average technical and cost efficiencies of the conventional banks were higher than those of the Islamic banking system. Also, the average technical efficiency base on the bank type ranged from 78.9% for Islamic windows of the commercial banks to 83.8% of the full-fledge Islamic banks whilst the average cost efficiency ranged from 85.4% to 87.7% respectively.

Tariq and Ahmed (2008) also present empirical findings on the case of 40 MFIs in India by applying a stochastic frontier approach for unbalanced data. The objective was to attempt to estimate the technical efficiency level and efficiency drivers of the microfinance institutions. .

The empirical specification of the model employed in the survey was:

$$LGLP_{it} = \beta 0 + \beta 1\ LPRSNL_{it} + \beta 2 LCPB_{it} + V_{it} - U_{it} \quad \text{---------- (2.11)}$$

where $LGLP_{it}$ represents all outstanding principals due for all outstanding client loans of *i- th* microfinance institutions at time period *t*. $LPRSNL_{it}$ represents logarithm of number of personnel (Total number of staff members) of *i- th* microfinance institutions at time period *t*. $LCPB_{it}$ represents logarithm of cost per borrower (operating expense / Number of active borrowers) measured in Rupees of *i-th* microfinance institutions at time period *t*.

The technical inefficiency effect model was also stated as:

$$\mu_{it} = \delta_0 + \delta_1 ASSETS_{it} + \delta_2 AGE_{it} + \delta_3 DER_{it} + \delta_4 NAB_{it} + \delta_5 D_{1_{it}} + \delta_6 D_{2_{it}} + W_{it} \quad \text{---------- (2.12)}$$

Where, $ASSETS_{it}$ - total of all net asset account of the *i-th* microfinance institutions at *t-th* time period measured in Rupees. AGE_{it} - Age of the *i-th* microfinance institutions at *t-th* time period measured in number of years. DER_{it} - Debt equity ratio of the *i-th* microfinance institutions at *t-th* time period. NAB_{it} - represents total number of active borrowers (The number of individuals or entities who currently have an outstanding loan balance with the MFIs or are primarily responsible for repaying any portion of the loan portfolio, gross) of *i-th* microfinance institutions at time period *t*.

D_{1it} is location dummy = 1, if Microfinance Institutions is located in South India, otherwise.

D_{2it} is dummy variable = 1, if Microfinance institution is Regulated, 0 otherwise.

δ_i parameters to be estimated.

Maximum likelihood estimates of the parameters of the Cobb Douglas stochastic frontier production function and the technical inefficiency effects models were estimated.

The findings showed that the mean efficiency scores was low about one-third even though it was increasing over the sampling period, 2005 – 2008. This indicated that the observed units could increase output levels by as many as three times the same amount of input and technology. There were also evidences of strong efficiency variations across regions. The southern microfinance units were found to be more efficient than the others; also of the total observed units, about 14 microfinance institutions had their efficiency level below one-half whilst a total of only 5 institutions had their efficiency score above 50%.Their findings also showed no trade-off between efficiency and outreach. The age of the institution representing the level of experience gained; location and regulation were estimated as the significant determinants of the efficiency level

Mbanasor and Kalu, (2008) also conducted a study which applied a translog stochastic frontier cost function to measure the level of economic efficiency and its determinants in commercial vegetable production systems in Akwa Ibom State, Nigeria. The authors used a multi-stage random sampling technique to select 150 farmers from whom input-output data and information on prices were obtained.

In their study, the stochastic frontier translog cost function was estimated for commercial vegetable farmers using the maximum likelihood method. Using a translog function, total cost was modelled on such variables as land rent in naira per hectare, price of planting materials in naira per kg, average daily wage rate per man-day, price of agro chemical (fertilizer) in naira per kg, price of other inputs (pesticides and herbicides) in naira per litter, capital input in naira made up of depreciation charges on farm tools and equipment, interest on borrowed capital, and output of vegetable in kg adjusted for statistical noise. The determinants of economic efficiency were also estimated in terms of socio-economic variables of the farmers and other factors: the age of the farmer in years, farmers level of education, gender, farmer's farming experience in years, number of times visited by an extension agent, credit availability access, membership of cooperative societies, Household size in number, production system and farm size in hectare.

The results of the study showed that 99% of the variations in the total production cost are due to differences in cost efficiencies. Economic efficiencies also ranged from as low as 13% to as high as 99% with a mean efficiency of 61%; indicative of the fact that on the average, by operating at full economic efficiency farmers could reduce cost by 38.88%. The study also found the level of education and household size to be negative and significant whilst age, farm experience, extension visits and access to credit were significant and directly related to economic efficiency.

Chen (2009) uses bank level data to study the efficiency of the banking sectors of 10 sub-Saharan African middle-income countries. The major purpose of the study was to find common factors that could help explain the differences in efficiency among banks in the region. The author focused on the cost efficiency of the banks utilizing aggregate influence rather than bank

or country specific levels. Stochastic frontier approach was used to compute the efficiency scores. Using the intermediate approach, the banks total cost function was modelled as follows:

$$\ln C_{it} = f(w_{it}, y_{it}, z_{it}) + \varepsilon_{it} \quad \text{---------- (2.5)}$$

The cost function represents the bank's desire to minimize its cost with respect to its input and output (all in logarithm terms). C_{it} is the total cost bank i incurs at time t, w_{it} is the vector of input prices bank i faces at time t, y_{it} is the vector of outputs, and z_{it} is a vector of semi-fixed input, such as physical capital and equity.

The translog cost function was specified as:

$$\ln\left(C_{i,t}/z_{i,t}w_{i,3t}\right) = \alpha_0 + \sum_l \beta_l \ln\left(y_{i,lt}/z_{i,t}\right) + \frac{1}{2}\sum_m\sum_n \beta_{mn} \ln\left(y_{i,mt}/z_{i,t}\right)\ln\left(y_{i,nt}/z_{i,t}\right)$$
$$+\sum_j \gamma_j \ln\left(w_{i,jt}/w_{i,3t}\right) + \frac{1}{2}\sum_h\sum_k \gamma_{hk} \ln\left(w_{i,ht}/w_{i,3t}\right)\ln\left(w_{i,kt}/w_{i,3t}\right)$$
$$+\frac{1}{2}\sum_l\sum_j \delta_{lj} \ln\left(y_{i,lt}/z_{i,t}\right)\ln\left(w_{i,jt}/w_{i,3t}\right) + u_i + v_{it} \quad \text{---------- (2.6)}$$

The total cost (C_{it}) includes both interest and operating expenses. Outputs (y_{it}) are measured by all the products the bank offers: (1) various types of loans (y_1); (2) other earning assets, such as securities investments (y_2); and (3) total deposit (y_3). Inputs include deposits and other borrowed funds, labour, and fixed capital. The price of deposits and other borrowed funds (w_1) is calculated by total interest expense divided by total deposit and other borrowed funds. The price of labour (w_2) is measured by personnel expenses divided by total assets. The price of fixed capital (w_3) is calculated as total expenditures on these assets divided by total fixed assets. To control for scale biases in the estimation, the study used fixed equity capital (z) to normalize cost and output quantities. The input prices were also normalized by the price of fixed capital (w_3) to control for homogeneity of the model.

The next step of the estimation was to investigate what factors could influence the efficiency levels of the banking institutions; and the model were specified as follows:

$$\cos tEFF_{i,t} = \eta_0 + \eta M_{i,t} + \varepsilon_{i,t} \quad \text{---------- (2.7)}$$

Where $CostEFF_{it}$, is the bank level cost efficiency score from the SFA analysis, and M_{it} , includes the variables that could have potential impact on the cost efficiency levels of the banks. Two groups of variables were chosen: bank specific factors and external factors

The result of the study indicated a possible 20-30% reduction of total cost by the banks if they operated on the efficient frontier. It was also found that the foreign-owned and private banks were more efficient than the public banks. Among the factors that affected efficiency levels, the authors found that macroeconomic stability, depth of financial development; competition and strong legal framework were important drivers of efficiency. The policy implication was therefore to encourage programs that facilitated strong competition, improvement in governance and stronger institutions.

Hermes et al (2009) also conducted a study to find out whether the extent to which domestic financial market are developed has an impact on the efficiency of microfinance institutions. Using of data of 435 MFIs over the period 1997-2007 with the application of SFA estimation procedure, the researchers investigated whether the country level financial systems could influence how microfinance institutions have to operate. Their argument was that, on one hand was the possibility that MFI could do well and expand their operations due to competition as a result of commercialization, stringent regulatory and supervisory roles of apex institutions, learning curve effects and external economies of scale; whilst on the other hand lies the possibility of substitutability effects as formal banks expand and take advantage of new viable,

less risky investment opportunities that exist in the microfinance sector. This phenomenon, they postulates will crowd out MFIs, thereby contracting their operations since they may not have the requisite resources and the tenacity to compete with the formal banks.

To analyse the relationship between efficiency and domestic financial development, the authors specified an inefficiency model with a number of proxies for financial development plus other control variables that affect the existence of wastes in the industry.

The specification of the inefficiency equation was as follows:

$$m_{i,t} = \delta_0 + \delta_{k=1...3} FINDEV_{k,t} + \delta_4 \ln\left(ALB_{i,t}\right) + \delta_5 \ln\left(ASB_{i,t}\right) + \delta_6 WOMAN_{i,t} + \delta_7 YEAR + \delta_{m=8...11} LOANTYPE_{i,m,t}$$

$$+ \ \delta_{12} AGE_{i,t} + \delta_{13} \ln BORROWER + \delta_{n=14,15} REGION_{n,t} \qquad \text{---------- (2.15)}$$

m represent the first moment of inefficiency distribution for MFI ì at time *t*. *FINDEV* represent *k* variables of proxies for financial development which include total liquid liabilities (measured in M3) to GDP ratio, spread, total domestic credit provided by banks as a fraction of GDP and also total domestic credit to private sector to GDP ratio. The control variables included are average loan balances per borrower (ALB), average saving balances per saver (ASB), number of female borrowers (women), a dummy for type of loans (loan type), age of the institution (age), year, number of active borrowers (borrowers) and region which represent a vector of n dummies for regional location.

The results of the findings showed that evidences exist for a case of positive relationship between financial development and the efficiency of microfinance institutions. That is the external conditions in which MFIs work strongly influences their functionality. The authors

therefore argued that better developed financial systems culminate into cost reducing activities of microfinance institutions since they foresee an imminent strong competition in the market.

Some empirical works on Ghana can also be found in the works of Mohammed and Alorvor (2004) and Frimpong (2010); which have also been reviewed below.

Mohammed and Alorvor (2004) examined the role of foreign human and physical capital in the productive efficiency of manufacturing firms in Ghana. The objective was to compare efficiency scores of two groups of firms- firms with foreign presence and local firms- that have heterogeneous technology. Surrogate aims of the study were also to compare technological gaps of firms with and without foreign human capital; and to identify the determinants of technical efficiency of the manufacturing units. A stochastic metafrontier production function which accommodates differences in technology was used in the studies. The data was selected from a sample of 200 firms located within the four major cities of Ghana: Accra, Kumasi, Takoradi and Cape Coast.

The authors specified a translog stochastic production function for the two groups of firms as follows:

$$y_{git} = \alpha_g + \beta_{1g} k_{git} + \beta_{2g} l_{git} + \beta_{3g} l^2_{git} + \beta_{4g} k^2_{git} + \beta_{5g} l_{git} k_{git} + v_{git} - u_{git} \quad \text{---------- (2.8)}$$

Where all the variables are in natural logarithm; y = Y_F. Y_W is value added (output less cost of raw materials and indirect inputs); g = F, W; F denotes firms with foreign presence and W denotes local firms. k = K_F, K_w denotes physical capital for firms with foreign presence and firms without foreign presence; *l* = L_F, L_W denotes labour for firms with foreign presence and firms without foreign presence respectively. *i* = firms, *t* = time; v = V_F, V_W is a two-sided error

term assumed to be independently and identically distributed; u = U_F, U_W is a non-negative technical inefficiency components of the error term. α, β are the parameters to be estimated.

The study also employed the minimum sum of absolute deviations in the construction of the metafrontier which involves the solving linear programming problem:

$$\min L^* = \bar{X}_{it}\beta^*$$

$$\text{s.t. } X_{it}\beta^* \geq X_{it} \quad \text{---------- (2.9)}$$

where $\bar{X}$ is a row vector of means of the elements of the X_{it} vectors for all observations of the data set. $\hat{\beta}_{(j)}$'s are the estimated coefficients of the group stochastic frontiers and β^* are the parameters of the metafrontier function. The results of the research indicated that the manufacturing firms in Ghana are generally less efficient – the maximum efficiency score for the different firms were less than 45% and micro and small firms with foreign presence had very low maximum efficiency scores of 11.3% and 13.4% respectively; indicating that local firms were more efficient. The authors also found technical efficiency to be influenced by such factors like firm size, food producing firms, profits and location. For instance, pertaining to location, it was found out that firms located in the Accra had generally better efficiency scores than the other three cities. They also found physical capital to be more productive in the local firms, which implies that foreign physical capital to local manufacturing firms in Ghana is more important than the foreign human capital.

Frimpong, (2010) also examined the relative efficiency of banks in Ghana during the year 2007 using input oriented intermediation-based approach of DEA estimation technique. The author

employed the Charnes, Cooper and Rhodes (CCR) model to highlight average efficiencies across the surveyed Ghanaian banks; both overall and by group. The results of the survey showed that only four out of a total of 22 banks were efficient, implying 18% of the banks studied; of which three were relatively new and small domestic private banks and the other being a foreign entity. The study found the overall mean technical efficiency score to be 74% whilst domestic private banks were portrayed to be the most efficient group of banks with an average of 87% efficiency score followed by the 72% of foreign banks. The overall average technical inefficiencies, according to the author, ranged between 12.36 and 90 percent, implying that average banks consumed 12.36 - 90 percent more resources than was needed to get to the same levels of output if they had been efficient. The lowest performing banks were found to be state-owned banks which according to the author can be attributed to lower tendencies of achieving efficiency by management of state-owned banks.

CHAPTER THREE
RESEARCH METHODOLOGY

3.0 Introduction

This chapter focus on how the various questions posed by the study are going to be answered: the method of estimation, the procedure for measuring scores of efficiency and the mode of analysis are considered in this section. A look will also be taken on the source of data collection and the sample period that will be captured by the study.

3.1 Theoretical Model

The stochastic frontier approach will be employed to specify the empirical relationship between the observed variables. As stated earlier in chapter 2 section 2, the purpose for the selection is because of its ability to control for statistical noise whilst at the same time capturing for pure wastes effects being generated as a result of misapplication in resource utilization. Also, as it should be expected, there is a significant heterogeneity between units in the microfinance industry in Ghana and therefore SFA seems to be a better estimation technique for such a study unlike other techniques especially DEA which may not show true representation of inefficiency scores under such a case, (Mester, 1997).

This work uses the Battese and Coelli (1995) model specification for panel data generally specified as:

$$\ln C_{i,t} = C\left(y_{i,t}, x_{i,t}; \beta\right) + \varepsilon_{i,t} \quad \text{---------- (3.1)}$$

Where $C_{i,t}$ is the total cost MFI *i* faces at time *t* and $C\left(y_{i,t}, x_{i,t}; \beta\right)$ is the cost frontier. $y_{i,t}$ is the logarithm of output of MFI *i* at time *t*. $x_{i,t}$ is the vector of logarithm of inputs of MFI *i* at time *t*. $\varepsilon_{i,t}$ is the composed error term which is decomposed as $\varepsilon_{i,t} = (v_{i,t} + u_{i,t})$. The term $u_{i,t}$ captures cost inefficiency and is independent and identically distributed with a variance of σ_u^2 whilst $v_{i,t}$ captures random effects, and is distributed as a standard normal variable, such that:

$$v_{i,t} \rightarrow iidN\left(0, \sigma_v^2\right)$$
$$u_{i,t} \rightarrow N^{+}\left(0, \sigma_u^2\right)$$

The stochastic inefficiency term is defined as

$$u_{i,t} = \delta_0 + \sum_n \delta_n z_{n,i,t} \quad \text{---------- (3.2)}$$

Where, *z* represents the vector of *n* variables that determine the inefficiency of MFI *i* at time *t*. $\delta's$ represent the coefficients to be estimated. The inefficiency term is posited generally as having either a half normal distribution, truncated normal, exponential or a gamma distribution, (Murillo-Zamorano, 2004 Hermes, et al. 2009). In this study, it is assumed that the inefficiency term follows a half normal distribution as typified in most econometric works. The expected value of the u_i*'s* conditional on the composed error term is measured as follows:

$$E\left[U_i \middle/ \varepsilon_i\right] = \frac{\sigma\lambda}{1+\lambda^2}\left[\frac{f_s\left(\varepsilon_i\lambda \middle/ \sigma\right)}{F_c\left(-\varepsilon_i\lambda \middle/ \sigma\right)} - \frac{\varepsilon_i\lambda}{\sigma}\right] \quad \text{---------- (3.3)}$$

Where f_s (.) is the density of the standard normal distribution and F_c (.) is the cumulative density function, (Murillo-Zamorano, 2004). To yield consistent parameters of the above equations, the maximum likelihood estimation procedure will be used as it is also typified in most research

works. The restrictions imposed by the model leads to various interesting results; such as the value of $\sigma = \left(\sigma_u^2 + \sigma_v^2\right)^{1/2}$; $\lambda = \sigma_u / \sigma_v$ and $\gamma = \frac{\sigma_u^2}{\left(\sigma_u^2 + \sigma_v^2\right)}$.

Where;

σ = total variation

σ_u^2 = variation due to inefficiency

σ_v^2 = variation due to noise

λ = the ratio of the standard deviation of the inefficiency component to that of the noise component. How high the value of lambda is, expresses how strong the evidence of the presence of inefficiency in the data is.

γ = specifies the ratio of the variation due to inefficiency to the total variation. With a parametric restriction between 0 and 1, a high gamma also represents the explanatory power of inefficiency in total variation. (Radam et al, 2010; Shanmughan et al, 2004). Additionally, a log-likelihood ratio test is also conducted to ascertain whether the estimated frontier model is robust. This is a test to show the significance or otherwise of the inefficiency component. The null hypothesis; which states that there is no inefficiency (H_0: $\mu=0$) is tested against the alternative hypothesis; H_1: $\mu>0$. If the null hypothesis is true the stochastic frontier model reduces to an OLS model with normal errors, (Stata 10, user tutorial).

3.2 Selection of Variables

Variables to be selected for this survey have been grouped into three; namely, input variable, output variables, and control variables. The intermediation approach suggested by Sealey and

Lindley (1977) (cited in Hermes et al., 2009a, 2009b) will guide the selection of variables to be included in the model. The premise is that an MFI acts as an intermediary between its creditors and borrowers, Hermes et al., (2009*)*

3.2.1 Input Variables

The input variables selected for the model include:

Salary – measured as the total annual salary per unit of labour employed. *Interest expenses* – measured as the interest expenses per unit of deposit held. Other inputs are *Personnel* – measured as the total number of staff members and *Cost per Borrower* – measured as the operating expenses (personnel and administrative) divided by number of active borrowers. This is an indicator that shows how much the microfinance unit spends on borrowers. It is therefore a proxy for good service delivery. Others include *Savings* - total annual savings, and *Productivity per staff* **–** calculated as the total number of active borrowers per number of staff

3.2.2 Output Variables

The output variables selected for this study are as follows:

Gross Loan Portfolio – all outstanding principals for all client loans including current and delinquent loans but not those loans which are written-off. The number of active borrowers and the number of active women are indicators of *outreach.*

3.2.3 Control Variables

The control variables selected for this study are mainly micro-institutional based variables (firm specific variables). The micro-institutional variables include: the age of firms which is an

indicator of experience, operational self -sufficiency (calculated as revenue/expenses), location, average saving balance and average loan balance as indicators of outreach

3.3 The Empirical Model

The cost function will be specified using a Cobb-Douglas function although the translog function is widely used in literature. Despite its known limitations, the Cobb-Douglas function is chosen because there is the tendency of the large number of parameters in a translog model to exhibit near-multicollinearity, especially given that different output variables are used, (Farsi and Filippini, 2004). Indeed, Ahmad and Bravo-Ureta (1996) concludes that functional form has a discernible, but rather small impact on estimated efficiency.

Cost efficiency, here, is measured in terms of how close the actual costs of the lending activities of an MFI are to what the costs of a best-practice MFI would have been in case it produces identical output under the same conditions, Hermes et al., (2009). Using the intermediation approach, the cost function is then specified as:

$$\ln\left(TC_{i,t}\right) = \beta_0 + \beta_1 \ln\left(Salary_{i,t}\right) + \beta_2 \ln\left(R_{i,t}\right) + \beta_3 \ln\left(Brw_{i,t}\right) + \beta_4 \ln\left(GLP_{i,t}\right) \quad \text{---------- (3.4)}$$

$TC_{i,t}$ represents total costs MFI *i* faces at time *t*, *Salary* represents the price of one unit of labour for one year, *R* is the interest payment per deposits held, *Brw* is the number of active borrowers, *GLP* is the gross loan portfolio. *TC* is measured as the total expenses of an MFI. It is from this

cost function that the cost frontier model is going to be estimated including the cost efficiency ratios for the observed units.

Cost Efficiency is computed using the following steps:

1. Estimate equation (3.4) to obtain the best practice frontier, Y_cap
2. Use the equation in step 1 to generate residuals; which is the composed error term (ε = Y - Y_cap)
3. Calculate the standard deviation (σ) and lambda (λ)
4. Use results from steps 2 and 3 to calculate the conditional error (equation 3.3). This series is the U-term of the composed error term
5. Calculate the cost ratios based on the U series using the formula $E = exp(-\mu)$; where E is the cost efficiency ratio, assuming a half normal distribution.
6. To check whether U series are correct: Y - v = Y_cap + u

To follow the footsteps of most micro econometric researchers on efficiency, the ratios computed using both the cost frontier and production frontier functions will be regressed on other control and firm-specific variables to aid in determining the factors that affect efficiency in Ghana. Typically, the use of ANOVA, ANCOVA, General method of moments, Seemingly Unrelated Regression, Maximum Likelihood Estimation or a Two Limit Tobit estimation procedure is used. This study will utilize Seemingly Unrelated Regression technique to ascertain the effects.

The specification of the model is as follows:

EE = (Age, Year, ASB, ALB, Region) ---------- (3.6)

This is then transformed mathematically as:

$$EE = \delta_0 + \delta_1 Age + \delta_2 ASB + \delta_3 ALB + \delta_4 \text{Re}\,gion \quad \text{---------- (3.7)}$$

EE represents the log of the efficiency distribution for MFI *i* at time *t*. *ALB* is the average loan balance per borrower (in GHS). It is calculated as total loans divided by the number of active borrowers. Higher values of *ALB* indicate that MFOs involve relatively rich clients (middle income earners). A positive (negative) sign of the coefficient indicates that granting huge (small) loans to clients improves efficiency, Hermes et al., (2009a, 2009b)

ASB, on the other hand, is the average savings balance per saver of the MFI (in GHS) calculated as the total deposit divided by the number of savers. Again, higher values for this variable indicate that the clients of the MFIs are rich. A positive (negative) sign for the coefficient also indicates that collecting huge (small) savings from clients improves on the efficiency of microfinance units. *ALB* and *ASB*, as indicators of outreach, measure the socioeconomic level of the clients that patronize the services of the microfinance organisation (MFO).

The inclusion of these two indicators of outreach in the model is critical to the study as it illustrates not only the operational methods of the MFIs in Ghana, but also shows whether there is an existence of trade-off between outreach and efficiency.

Age is a measure of the experience of the MFI, i.e. the number of years since its establishment. Again, the sign the parameter assumes is critical: a positive sign shows that experience counts in the microfinance sector; whereas, a negative sign indicate that younger firms are more efficient

than the older firms. All the exogenous variables are in logs except *Region* which is a dummy variable.

The dummy variable, ***Region*****,** will control for the effect of location on efficiency.

1 = if the MFI is located in the southern part of Ghana (Greater Accra, Central, Western, Eastern and Volta regions)

0 = if the MFI is located in the northern part of Ghana (Northern, Ashanti, Brong Ahafo, Upper East and Upper West)

3.3.1 A priori Signs and Expectations

With respect to the cost function, the coefficients of the explanatory variables (Salary, Interest expenses, and Gross loan portfolio) are expected to be positive and significant; since a rise in any of the above variables is expected to cause an increase in total expenditure of the microfinance institution. Also, β_0 representing cost of fixed inputs is expected to be positive.

Yet again, all the parameters of the production function are expected to be positive and significant. The signs and expectations of the variables in the efficiency functions are as follows:

It is expected that the coefficient of the indicators outreach, *ALB* and *ASB*, will alternate in signs.

It is also expected that the parameters for *Age* and *Region* will be negative and significant.

3.4 Mode of Analysis

Descriptive statistics and maximum likelihood estimates of the parameters of the cost and production frontiers were obtained using the computer software programme STATA 10, Eviews and SPSS 6. STATA was used to obtain estimates of the technical efficiency from the production frontier model as well as the cost efficiency from the estimated cost frontier. The application

software SPSS was then be used to obtain descriptive statistics of the observed data as well as other useful parameters that will come in handy for the study, according to literature. EVIEWS was used to estimate the drivers of efficiency using the Seemingly Unrelated Regression approach (SUR).

The estimation of results and analysis proceeded in this format: to facilitate the computation of the annual and overall mean efficiency index for the sampled microfinance institutions, efficiency indices was computed per annually across the different sets of microfinance institutions. Based on the computed ratios, benchmarking of the MFIs was conducted. A list of top three performers was then be formed based on the gauges of: top financial performers, top social performers; and lastly, top financial cum social performers. The average efficiency indices were finally regressed on the control variables selected to determine the factors that affect efficiency in the industry.

3.5 Data Sources

One hundred and thirty-five sampled units will be included in the study from the broad spectrum of microfinance institutions in Ghana. Data will be mainly sourced from Ghana Microfinance Information Network (GHAMFIN), Association of Credit Unions (CUA), Bank of Ghana (BOG) and other identifiable microfinance institutions across the country. The sample period considered was between the financial years of 2007-2010.

CHAPTER FOUR
EMPIRICAL ANALYSIS AND DISCUSSION OF RESULTS

4.0 Introduction

Given the premise of the study, this chapter will give a presentation of the results and then analyses the estimated results on the variants of efficiency. The general aim of this study is to assess the economic efficiency of microfinance institutions in Ghana; and to do this, 135 microfinance units were selected. The full sample observation is 510 units. The results are generated by the use of the statistical packages STATA 10, EVIEWS, and SPSS 16. The presentation of the results is as follows: first, the results of the cost model will be presented which will then be followed by that of the production frontier model. The two estimated results will help give a fair idea of the operational performance of the MFIs which will be useful for benchmarking. The final part of the chapter will investigate the drivers of efficiency and discuss the results. Table 4.1 contains a summary statistics of the variables used in the study. Huge variability is observed in the variables used in the study in the cost function. All the financial figures are in new Ghana cedis.

Table 4.1 Summary Statistics

Variables	Minimum	Maximum	Mean	Std. Deviation	Coefficient of Variation
Salary	110	250290	13645.08	21884.37	1.603828633
GLP	3404	1.10e+07	721159.4	1200090	1.664111984
Interest on savings	150.00	3066370	30314.76	159414.3	5.258636387
Personnel	2	29	6.797647	4.846366	
Operating Cost	2346.00	1611827	56906.35	118385.1	0.712947583
Borrowers	0	715365	2185.513	35854.75	2.080349557
Savers	2	10276	902.4731	1161.884	16.40564481
Total savings	3678	3.90e+07	410248.5	1885278	1.287444468
Age	4	43	17.23226	10.9793	4.595453731
Fin. Income	553	4490151	89632.29	257284.1	0.637136394
% of Women	.026	100	40.35114	17.50583	2.870439883

Source: field Studies 2011

From the table it can be shown that the cost on personnel and interest payment on member savings constitutes a greater share of the operating cost of firms, although the average number of staff per MFI is small. It is also evident that the numbers of borrowers that access the services of the microfinance institutions are greater than the number of savers. This represents a case of

excess demand for microcredit in Ghana. It is therefore crucial that the institutions increase their mechanisms of encouraging savings across their clientele. One other striking phenomenon evident from the tabular display is the low percentage of women in total active borrowers.

4.1 The Cost Frontier Model

The results of the maximum likelihood estimates of the parameters of the Cobb –Douglas Stochastic Cost frontier function indicate that all the parameters are positive and significant at 95% confidence interval. The sum of the elasticities of the input variables to cost (1.030) shows a constant cost to size. The likelihood ratio test result also shows that the null hypothesis is to be rejected for the alternative hypothesis of the existence of inefficiency in the observed behaviour of units sampled. The $\chi^2 = 13.28$ with a probability of 0.00 shows the strength of the cost frontier model to estimate the relationship between observed variables in the industry. Table 4.2 gives the report of the coefficient of the estimated model.

Table 4.2 Maximum Likelihood Estimates of the Cost Function

Coefficient	Parameter estimate	Standard error	Z - values	P-values
ln Glp	.2975237	.0386824	7.69	0.000
ln Salary	.4154607	.0328936	12.63	0.000
ln R	.1849503	.0337918	5.47	0.000
ln Borrow	.132414	.038758	3.42	0.001
Constant	3.172176	.3967053	8.00	0.000
σ_v	.5086646	.042525		
σ_u	.7683274	.0874075		
σ^2	.8490666	.1122605		
λ	1.510479	.1188459		

Log likelihood = -309.52761 Wald chi2(4) = 755.2 Prob > chi2 = 0.0000 Nos. of iterations = 6
Source: Field Survey 2011

Table 4.2 shows that all the variables are statistically significant at 95% confidence interval. The value of $\sigma^2 = 0.849$ indicates that a significant variation in cost is due to differences in cost efficiencies. This therefore illustrates the goodness of fit and the correctness of the distributional assumption about the error term. Based on $\lambda = 1.5105$, the estimate of gamma can be derived which measures the effect of cost inefficiency in the variation of in the observed unit [$\lambda^2/(1+\lambda^2)$]. The estimated value of 0.6953 implies 69.53% of the total variation in the level of total cost is due to the presence of inefficiency.

4.1.1 Average Economic Efficiency over Time

Overall, the distribution of economic efficiency scores show that efficiency ranges from 24.29% to 78.99% across the sampled units between 2009 -2010 with an average of 58.40%. The microfinance units therefore exhibited significant differences in inefficiency from 21.01% to 75.71%. The average economic efficiency score indicate that on the whole, the average microfinance unit can reduce cost by 41.60% and still produce the same output by improving on its technical and allocative efficiency performances. Nonetheless, if the average microfinance unit were to attain the level of the most cost efficient unit within the sampled units then the average MFI could experience cost savings of 26.07% [1- (58.40/78.99)]. The same computation for the most economically inefficient firm reveals cost savings of 65.25%. The mean annual efficiency scores from 2009-2010 are 56.10% and 60.69% respectively.

A frequency distribution of the economic efficiency scores of the MFIs calculated over the 2year sample period is presented on the following frequency table. Analysis shows that the majority of the sampled units had efficiency ratio falling between the efficiency level of 0.51 and 0.60.

Table 4.3 Frequency Distribution of Economic Efficiency of MFIs for 2009 -2010

Efficiency levels	Frequency	Percentage	Cumulative Frequency
EE ≤ 30	01	1	1
31 < EE ≤40	2	2	3
41 < EE ≤50	12	16.	15
51 < EE≤60	27	35	42
61 < EE≤ 70	23	36	65
71<EE≤80	08	10	73

Source: Field Survey 2011. Mean Score: 58.40%. Minimum Score: 24.29%. Maximum Score: 78.99%

Table 4.3 portrays generally low levels of cost efficiencies across the MFIs in the combination of inputs to produce expected output.

4.2 Performance Benchmarking of MFIs

The efficiency ratios derived from the cost frontier function is compared in this section with the technical ratios of the microfinance units in order to identify best performers within the sampled period. The results are displayed on table 4.4 below.

Table 4.4 Top Financial Performers

Institutions	*Cost Efficiency*
Minesco Employees CU	*78*
Abosomaketere	*76*
St Peters	*74*
GCR Fan	*74*

Source: Field study 2011

The presentation on table 4.4 is indicative of the high level of inefficiencies across the group of sampled microfinance units. A benchmarking of worst performers is also presented on table 4.5 below.

Table 4.5 Worst Financial Performers

Institutions	*Cost Efficiency*
University of Ghana Agric Inst	*24*
Kwashieman Motoway	*39*
Mustard Seed	*39*

Source: Field study 2011

4.3 Drivers of Efficiency

It is useful, at this juncture, to investigate the sources of these inefficiencies across the group of microfinance institutions. This is done by regressing the firm-specific variables on the efficiency indices through what is known in literature as "second-step" estimation, (Bravo-Ureta and Pinheiro, 1997). Analysing the association between cost efficiency and the independent variables; SUR estimates showed that the coefficients for *AGE*, and *ALB* were significant. *ASB* was negative and significant; which agrees with apriori expectation. The coefficient for *Region*

was also positive and significant but at only15% significance level. This is an indication that microfinance units in the southern sector are slightly cost efficient than their counterparts in the northern sector.

The SUR results of the drivers of efficiency are displayed on table 4.6 below. The positive coefficient of *AGE* implies that inefficiency deteriorates as the microfinance institutions grow; this is consistent with the findings of Tariq et al (2008).

Table 4.6 Seemingly Unrelated Regression (SUR) results of Drivers of Efficiency

Variant	Coefficient	Std. Error	t-Statistic	Prob.
Economic Efficiency				
Constant	-0.573836	0.084973	-6.753183	0.0000***
Age	0.101630	0.019287	5.269454	0.0000***
ALB	0.046706	0.015525	3.008436	0.0027***
ASB	-0.040691	0.022523	-1.806654	0.0713**
Region	0.016259	0.015545	1.045937	0.2960*

Source: Field Study 2011 *** 1% significance level ** 5% significance level * 15% significance level

The implication (from the signs of *ALB* and *ASB* on table 4.6) is that the microfinance institutions are dealing with both poor and relatively rich households. This may describe a good scope of outreach. It could also mean that MFIs are rewarding the small regular savings of clients with huge loans; and not that they target the relatively rich per se. Average loans per

savings index presented on table 4.7 shows that on the average the MFIs grant loans of about 4 times higher than the savings amount of the clients.

Table 4.7: Loans per Savings Ratio of MFOs

Variable	Mean	Std Err	Min	Max
Loans per Savings	3.70068	6.4919	0.759375	63.47647

Source: field studies, 2011

It will not be erroneous, from the results displayed on tables 4.6 and 4.7, to conclude that the operational objective of MFOs in Ghana may not necessarily be to target the ultra-poor per se; but to capture the non-banked sector of the economy; both the relatively rich and the poor alike. Based on this, the researcher can boldly express the view that the pursuit of efficiency and goals of alleviating poverty can be complementary.

4.4 Conclusions

By using Cobb-Douglas stochastic frontier analysis on both the cost and production functions of the microfinance institutions, the study has been able to establish some important findings. For one, the increasing mean efficiency scores over the years for both cost and technical efficiency lend credence to improvements in the strategies of microfinance institutions in Ghana. This supports the findings of Annim et al (2010) and Hag et al (2010) who also find an improvement in the management decisions of MFIs. It is also evident that the maturity of firms affects efficiency. According to Gonzalez (2008), MFI efficiency is strongly related to age through a positive learning curve. However, unlike the findings of Hermes et al (2009a, 2009b) which established a significant trade-off between cost efficiency and outreach, the current results

indicate that efficiency and outreach are complementary. Martinez-Gonzalez (2008) also found a diminishing trade-off between outreach and efficiency.

Evidence is also given of a strong presence of inefficiency in the choice behaviour of the MFIs in Ghana. Computed cost efficiency scores were generally low. The mean scores of 58.40% is a strong indication that the microfinance units are operating below their optimal possibility curve; hence not efficient. This conclusion is also consistent with the results of Frimpong (2010) who also saw evidences of strong presence of inefficiencies across the universal banking institutions in Ghana between 33-89%.

From all indication, the microfinance institutions must enhance their capacities in the area of training, logistics, market surveys and strategies in order to improve on efficiency. Indeed this view is confirmed with the result obtained for AGE which is a proxy for the experience of MFIs.

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents a summary of the main work, conclusions drawn, recommendations and limitation of the study.

5.1 Summary

The purpose for this thesis has been to assess the economic efficiency of microfinance institutions in Ghana using the stochastic frontier approach. The use of SFA was justified based on the argument that it controls for both noise and inefficiency in the available data. The motivation for this study is two-fold: first, microfinance is a fast growing industry in Ghana; even more so, when it is the main policy tool of government to fight poverty. Secondly, there are widespread reports of malpractices among various sections of the microfinance industry especially the informal and the public sector. This thesis contributes to the body of literature on efficiency analysis by performing an empirical study on dataset from Ghana.

To resolve the questions posed in the study, a stochastic cost frontier was first estimated from which the economic efficiency ratios were calculated. To be able to fairly rate the MFIs based on the calculated ratios whilst holding on to the primal objectives of microfinance institutions, it was thought prudent to also estimate a production frontier model fixed on social goals. This resulted in the generation of technical efficiency ratios which were compared to the cost

efficiency indices to identify the best performers in the industry. The last procedure involved exploring the drivers of efficiency. This was based on the premise that explanations on the differences in efficiency scores among the group of sampled microfinance institutions illustrated the general issues that pertained in Ghana and that results submit suppositions on how to increase efficiency.

5.2 Conclusions

The main conclusions drawn from the study include:

1. The groups of microfinance units in Ghana are operating below their optimal scale capacity: none of the sampled MFOs was identified as cost efficient, but there was evidence to suggest a high scope of outreach.

2. Although there is a strong presence of inefficiency across the industry economically, there is evidence of improvement in efficiency across the years. This is sign of technological improvement in the financial sector.

3. Matured MFIs are more efficient than younger MFIs. This is possible because the older units are able to reduce waste through learning-by-doing over time.

4. The impact of the location of the MFI on cost efficiency is stronger (significant) than its effects on technical efficiency. Results seem to submit that units in the northern sector are good social performers whilst those in the southern sector are good financial performers.

5. The operational objective of microfinance organisations in Ghana is not necessarily to target the ultra-poor, but to serve the market with innovative services and products where the formal financial system has failed; and that may include services to both the rich and poor clients.

6. There is no evidence of trade-off between outreach and efficiency; evidence suggests that the two objectives are complementary: the comparison of technical and cost efficiency scores indicate that on the average firms are balancing goals of attaining cost efficiency with goals of maximizing social efficiency.

7. There is a possibility of enjoying economies of scale in lending, so long as the microfinance units institute and or heighten savings mobilization strategies in their operations. However this will only take effect if there are well-motivated and well-equipped staffs who are set to offer good quality services to clients at low or no cost to clients.

5.3 Recommendations

This section examines the policy implications of results obtained. Recommendations are grouped into three main levels: micro-institution (what the individual firms can do to internally improve on performance); macro-institution (policies the regulatory bodies can implement to ensure a thriving and sustainable industry) and macroeconomic (what the government and donor partners can do to facilitate the growth of microfinance industry in Ghana).

5.3.1 Micro-institutional level

1. MFIs must invest resources and adequate time into the training of staff and clients before new programmes, credit schemes and policies are implemented. Lots of constraints are encountered because of short time in training both staff and clients.

2. Management must explore opportunities of economies of scale in lending through innovative products in savings and credit. .

5.3.2 Macro-institutional

1. New entrants must be cajoled to register with the appropriate apex institutions and be taken through rigorous training and assessment procedures whilst offering enough technical support to them before they are left to operate on their own. This will reduce the high initial wastes that are associated with younger microfinance institutions.

5.3.3 Macroeconomic

1. The government is also encouraged to invest in the supervisory capacity of the regulatory bodies to expand activities and branches for a decentralized system.

2. Donor agencies must focus funding on institutions which maintain standards of efficiency and or establishing procedures that improve efficiency.

3. Donors must clear up the mission and objectives of subsidies, promote innovations in the sector, and ensure regular performance assessment of MFIs.

5.4 Limitations and Future Research

There was the difficulty of obtaining data useful for the study. Some institutions were reluctant in giving out information mostly because the institutions do not obtain regular reports of their operations. Secondly most of the sampled institutions did not have information for the required years although they had been in operations over the periods. This affected computations of average scores.

It is recommended that the scope of future works on efficiency in Ghana must incorporate a variable that captures financial development, subsidies or economic growth as a driver of efficiency to be able to grasp at first-hand whether these variables do have any impact on the performance on microfinance institutions; and if so what is the direction of impact.

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APPENDIX A – COST FRONTIER MODEL RESULTS

Output - STATA 10

Frontier Lntc Lnglp Lnr_1 Lnsalary_1 Lnbrw

Iteration 0: log likelihood = -345.21751
Iteration 1: log likelihood = -316.16972
Iteration 2: log likelihood = -309.80479
Iteration 3: log likelihood = -309.52827
Iteration 4: log likelihood = -309.52761
Iteration 5: log likelihood = -309.52761

Stochastic frontier normal/half-normal model — Number of obs = 299
Wald chi2 (4) = 755.21
Log likelihood = -309.52761 — Prob > chi2 = 0.0000

lntc |	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Glp |	.2975237	.0386824	7.69	0.000	.2217076	.3733398
Brw |	.132414	.038758	3.42	0.001	.0564497	.2083782
lnr_1 |	.1849503	.0337918	5.47	0.000	.1187195	.2511811
lnsalary_1 |	.4154607	.0328936	12.63	0.000	.3509905	.4799309
_cons |	3.172176	.3967053	8.00	0.000	2.394648	3.949704
/lnsig2v |	-1.351933	.1672025	-8.09	0.000	-1.679644	-1.024222
/lnsig2u |	-.5270788	.2275268	-2.32	0.021	-.9730231	-.0811344
sigma_v |	.5086646	.042525			.4317875	.5992293
sigma_u |	.7683274	.0874075			.6147672	.9602446
sigma2 |	.8490666	.1122605			.62904	1.069093
lambda |	1.510479	.1188459			1.277546	1.743413

Likelihood-ratio test of sigma_u = 0: chibar2 (01) = 13.28 Prob > = chibar2 = 0.000

APPENDIX B - SEEMINGLY UNRELATED REGRESSION RESULTS ON DRIVERS OF EFFICIENCY

System: UNTITLED
Estimation Method: Seemingly Unrelated Regression
Sample: 2 510
Included observations: 321
Total system (unbalanced) observations 607
Linear estimation after one-step weighting matrix

	Coefficient	Std. Error	t-Statistic	Prob.
Economic Efficiency				
Constant	-0.573836	0.084973	-6.753183	0.0000
Age	0.101630	0.019287	5.269454	0.0000
ALB	0.046706	0.015525	3.008436	0.0027
ASB	-0.040691	0.022523	-1.806654	0.0713
Region	0.016259	0.015545	1.045937	0.2960

Determinant residual covariance	0.000413

Equation: LCOST=C(1)+C(2)*LAGE+C(3)*LALB+C(4)*LASB+C(5)*REGION
Observations: 296

R-squared	0.116196	Mean dependent var	-0.257411
Adjusted R-squared	0.104047	S.D. dependent var	0.138075
S.E. of regression	0.130695	Sum squared resid	4.970617
Durbin-Watson stat	1.911220		

Appendix C: Cost Efficiency Ratios of Sample MFIs in Ghana, 2009-2010

NAME OF MFI	2009	2010	MEAN
ACCRA CHAPEL	0.280927	0.569355	0.425141
ANIMAL RESEARCH	0.518803	0.644799	0.581801
APOSTOLIC CHURCH	0.703618	0.809293	0.756456
BROADCASTING TRS'	0.710287	0.522216	0.616252
CHURCH OF PENTECOST	0.59693	0.577085	0.587008
GH. BREWERIES	0.639976	0.522352	0.581164
GHANA REG MIDWI	0.392179	0.556209	0.474194
GHANA STANDARD BOARD	0.663502	0.507008	0.585255
KAMCCU	0.749867	0.640438	0.695153
KWASHIEMAN MOTORWAY	0.410844	0.384148	0.397496
LOTTO RECEIVERS	0.531841	0.549507	0.540674
MAIL FINANCE	0.572304	0.662522	0.617413
NAFTI	0.529625	0.522566	0.526096
REVIVAL RESTORATION	0.668774	0.639691	0.654233
SALEM	0.436022	0.489676	0.462849
STATISTICAL SERV	0.457406	0.417881	0.437644
TUC NATIONAL	0.432096	0.440595	0.436346
AGOGO HOSPITAL	0.320123	0.600197	0.460160
AME ZION CHURCH	0.46626	0.452182	0.459221
CHRIST APOSTOLIC	0.572965	0.533077	0.553021
CROP RESEARCH	0.486767	0.770604	0.628686
DUNWELL	0.72146	0.689899	0.705680
EMML ASSEMBLIES	0.654489	0.64439	0.649440
FOUNDATION OF GOD	0.450445	0.760926	0.605686
GCR FAN	0.748617	0.751084	0.749851
GRACE BAPTIST	0.543171	0.592343	0.567757
ST PETERS	0.701935	0.787119	0.744527
RIIS PRESBY	0.367999	0.473906	0.420953
BIRIM SOUTH TRS'	0.6795	0.717541	0.698521
BUNSO CRIG WORKERS	0.730924	0.590822	0.660873
NEW TAFO CRIG	0.613168	0.556713	0.584941
NKAWKAW	0.442506	0.722059	0.582283
OIL PALM PLANTATION	0.515313	0.587722	0.551518
UNIV OF GH. AGRIC INST.	0.163573	0.322279	0.242926
ABOSOMKETERE	0.874866	0.660963	0.767915
ADABOMAN COMM	0.687905	0.644086	0.665996
BADU COMM	0.577654	0.604704	0.591179
DORMAA AREA TRS	0.577018	0.680582	0.628800

DORMAA CHANCE	0.565676	0.686369	0.626023
EBENEZER	0.673017	0.756984	0.715001
NKORANZA ARE TRS'	0.547867	0.578722	0.563295
NSOATRE COMM	0.5739778	0.600604	0.587291
SUNYANI AREA TRS'	0.6078	0.658007	0.632904
TECHIMAN ARE TRS'	0.689344	0.667973	0.678659
TECHIMAN TRINITY	0.689531	0.652695	0.671113
CAPE COAST MONUMENTS	0.499809	0.592369	0.546089
DUNKWA AREA TRS	0.541166	0.628426	0.584796
DUNKWA TRADERS	0.579333	0.585114	0.582224
KEEA WORKERS	0.488049	0.653342	0.570696
MUSTARD SEED	0.21148	0.570164	0.390822
OGUA TRS	0.600764	0.588642	0.594703
PROGRESSIVE WOMEN	0.553484	0.684834	0.619159
ANAJI CHRIST THE KING	0.584923	0.730859	0.657891
ATOBIASE COMM	0.516032	0.391112	0.453572
AXIM ROAD	0.684077	0.748847	0.716462
GESRO	0.642067	0.62586	0.633964
GPHA - TDA	0.642067	0.660918	0.651493
MINESCO EMP	0.782805	0.797176	0.789991
GPRTU	0.665395	0.743408	0.704402
NZIMA EAST	0.560282	0.691508	0.625895
SAMATEX WORKERS	0.530312	0.641517	0.585915
SEFWI COMMUNITY	0.657299	0.57313	0.615215
BIMBILLA	0.686228	0.658978	0.672603
CHAMBA COMM	0.598095	0.62726	0.612678
KPANDAI	0.2551	0.665578	0.460339
SALAGA FARMERS	0.585116	0.480773	0.532945
TAMALE COMM	0.765095	0.443846	0.604471
BAWKU COMM	0.498804	0.584296	0.541550
BAWKU HOSPITAL	0.32988	0.564886	0.447383
BOLGA PT EMPLOYEES	0.491039	0.539589	0.515314
NAVRONGO TRS	0.565654	0.621505	0.593580
WEST MAMPRUSI	0.483073	0.566215	0.524644
HOHOE COMM	0.554474	0.52961	0.542042
MORKPORKPOR	0.454877	0.500328	0.477603
SITSOFE COMM	0.530168	0.630375	0.580272
MAXIMUM	0.874866	0.809293	0.789991
MINIMUM	0.163573	0.322279	0.242926
MEAN	0.561011	0.606938	0.583975