THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF FINANCE

ASSESSING THE SUSTAINABILITY/EFFICIENCY OF SUB-SAHARAN AFRICA'S MICROFINANCE INSTITUTIONS AS IT RELATES TO SOLVING POVERTY & STIMULATING ECONOMIC GROWTH

ARIEL PROCHOWSKI
SPRING 2015

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree
in Finance
with honors in Finance

Reviewed and approved* by the following:

Orie Barron
Professor of Accounting, PricewaterhouseCoopers, LLP Research Fellow in Accounting,
Director of Smeal College Schreyer Honors Program
Thesis Supervisor

Brian Davis
Clinical Associate Professor of Finance
Honors Adviser and Faculty Reader

* Signatures are on file in the Schreyer Honors College.

ABSTRACT

My dissertation reviews a plethora of microfinance institutions (MFIs) in countries all over Sub-Saharan Africa to investigate their sustainability. I find my paper to be particularly relevant and crucial as MFIs need to function proficiently to satisfy their dual mandate of aiding the underprivileged and being sustainable. My belief is that MFIs are not reaching their goals of delivering microfinance services (e.g. mediating monies between lenders and borrowers) that leave their clients better off in the long-run.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

I would like to sincerely thank professors Dr. Orie Barron and Dr. Brian Davis for taking the time out of their busy schedules to review and assist with my thesis. This paper would not be possible without their careful due diligence and guidance. Next, I would like to acknowledge the business librarians, especially Lauren Reiter who showed me how to navigate the library databases. Finally, I would like to thank my parents, Marek Prochowski and Malgorzata Prochowska, Schreyer Honors College and Smeal College of Business for funding my microfinance trip to Ghana, which served as my inspiration for this project.

Chapter 1

Introduction to Microfinance

The one thing we know for certain is that formal financial institutions in developing countries are unable to serve the poorest populations, the people that need the access to loans and other financial services the most (Mosley and Hulme 1996). It is believed that economic growth is owed to the ability to interact with financial intermediaries for services like savings, insurance and credit. Scholars quarrel about the fact that these formal financial institutions are unable to provide credit to the most financially defied people who do not have the resources to submit the types of collaterals that these institutions require. However, these poor people do, in fact, have realistic and favorable ideas that can prove to be quite profitable if given the opportunity (Hollis and Sweetman 1998). This segregation has been further discussed by Littlefield and others (2003), saying that the commercial banking area refuses to even consider the poor due to the poor being incapable of meeting credit eligibility criteria, which includes collateral. This, in turn, has diminished the poor's ability to access credit in a timely manner from these formal financial institutions. The World Bank Rural Finance Access Survey (World Bank 2003) even admits that banks in rural areas also only serve wealthier rural borrowers in developing nations. The survey states that while 66 percent of large farmers have deposit accounts, only 44 percent have access to microcredit. The poor in these rural areas continue to face issues with finding ways to obtain credit and access savings. The survey also says that 70 percent of the poorest households, which includes farmers with no land of their own, do not even have a bank account;

87 percent do not have access to credit. More specifically in Africa, only 20 percent of households have access to formal financial institutions and the demand for these services is incredibly high (African Union 2009). This high demand and low supply brought birth to a hunt for unconventional policies, systems and procedures, savings and loans products and other relevant aid that would help meet the poor's demand. Thus, microfinance/microlending/microcredit has become the most convenient and sensible substitute to the orthodox banking system in aiding the underserved poor population.

This thesis measures the effectiveness and sustainability of microfinance institutions (MFIs) in Sub-Saharan Africa. Microfinance has picked up credibility as a legitimate basis for providing financial services to the underprivileged via microfinance institutions' ability to match lenders and borrowers with microcredit. However, the whole concept of microfinance can only be deemed successful if these intermediaries are fruitful. Consequently, it is important to understand how these MFIs work and whether their dual mandate goals are being met. The goal of my thesis is to see whether these MFI are being efficient and sustainable. The study of the effectiveness of MFIs in Sub-Saharan Africa is especially important for several reasons. One of them is that there has been a very small amount of work done on the productivity of MFIs in this part of the world. The other major reason is that these MFIs need to be studied to figure out whether it is worth putting funding into them (Mersland and Strom 2008, Freixas and Rochet 2008). If they are not leaving their users better off in the long-run, why bother even having them? This brings up another question. If these microfinance institutions are currently being inefficient and unsustainable, how do we make them become efficient? My research and analysis will recognize and report on the elements that determine whether an MFI is efficient in

meeting its dual mandate and also inform MFI advocates of where improvements can be made to increase efficiency of MFIs.

Effectiveness of MFIs has been tested and measured in a variety of ways in microfinance journals. Farrell (1957) breaks down effectiveness into two components: (1) technical efficiency, which measures the institution's success in generating the highest output (e.g. number of loans outstanding at the end of each financial year) with a fixed set of inputs (e.g. labor, machines and materials) and (2) allocative price efficiency, which evaluates the institution's success in selecting a prime mix of inputs, provided their certain prices. When Farrell added up these two efficiencies, he came up with the total economic efficiency of an MFI. These efficiency measurements include Data Envelopment Analysis and Stochastic Frontiers, which entail mathematical programming and econometrics. My paper will be testing efficiency through the Data Envelopment Analysis (DEA), utilizing a set of data taken from the Microfinance Information Exchange (MIX – www.mixmarket.org) covering 70 MFIs in 25 countries over a three-year period. The elements that will help me conclude whether an MFI is efficient or not will be tested through a regression analysis. In order to account for the procedural issues that come with this method of estimation, we will be (1) using a Tobit Regression and (2) right-censoring the efficient MFIs.

Here is an overview of the structure of my paper. I will begin by talking about what sparked my interest in MFI efficiency, while offering a first-hand account that I have had with an MFI during my microfinance internship in Ghana. Then, I will be overviewing microfinance in Sub-Saharan Africa. Next, I'll be discussing MFI selection problems and providing a description of the data and the empirical analysis. I will finally follow-up with the outcomes and host a conversation about them. Lastly, I will present the analysis's deductions and suggestions.

Chapter 2

Thesis Background

My Microfinance Internship with NGO, Global Brigades, Inc. in Anomabu, Ghana

So you may be asking, why do I care about MFI efficiency in Africa of all places? Well, in the summer of 2012, the Penn State Schreyer Honors College and Smeal College of Business provided me with the opportunity to travel to Africa for my microfinance internship with the NGO, Global Brigades Ghana. The microfinance program was designed to provide rural community members in Ghana with a community banking system with access to loans, financial literacy programs and education to increase production and foster a culture of savings and growth. The goal for the 2012 summer internship was to enrich the program's current model and to address bank and financial needs within the communities. As an intern, I assessed the needs of the community I worked in and then I implemented my own project. I personally worked in the Ekumfi-Ebuakwa community in Anomabu, Ghana, just a few hours away from the capital of Accra. I assisted with the expansion and diversification of a Community Development Fund (a very basic version of a bank or MFI), where I developed new loan policies and provided savings education to the community members. The goal of my project was to foster a culture of savings, increase the number of savings accounts in the Fund and to pilot an investing activity to pilot a loans program.

Amongst other needs, many community members showed strong interest in obtaining loans to expand their businesses and to send their children off to college. However, since the

Fund was still in its developing stages and had barely any capital to work with, these desires were not feasible.

Thus, I started a project where I rewarded consistent savers with a savings certificate, which would become beneficial to them when applying for loans in the community. However, in order for the Fund to be able to give out the loans, the floating of shares had to be initiated beforehand, so the Fund could have capital on-hand. Therefore, I made sure that the participants of my project were not able to withdraw any money during a 10-day period. The act of locking-in the money mirrored the way a share works. After the ten days were over, I performed a follow-up, where I went to the participants and asked them if they were able to live comfortably without having the power to withdraw their funds. Most community members claimed to have had no problems locking in their money and seemed rather excited to replicate the project in the future for a longer period of time, in hopes of also obtaining a loan down the line. A larger sample-size of dates would more accurately show if this community is, indeed, ready for shares, and eventually, loans.

Overall, I believe my project was a success as I was able to increase the number of bank accounts in the community from 12 to 69. Further, I was able to improve the total Fund balance from 1,044 cedis ($522 USD) to 7,130 cedis ($3,565 USD).

My plan for this thesis was to travel back to Ebuakwa to check-up on the Fund and see its progress. However, due to a lack of time, funding and resources, I was never able to make the trip back. So instead, I decided that I would study other MFIs in the Sub-Saharan area (including those in Ghana) and see how efficient the MFIs are being with their functions.

Below, are a few photographs from my microfinance trip to Ghana:

Figure 1 Standing with a Loan Officer

My colleague and I meeting with and training a loan officer of the Ekumfi-Ebuakwa's Community Development Fund.

Figure 2 Example of a Ledger

An example of a ledger at the Community Development Fund. It is here that the Fund leaders would record the MFI's deposits and withdrawals.

Figure 3 Family Applying for a Loan

Here we have a husband and a wife applying for a loan at the Community Development Fund.

Figure 4 Fund President

This is the Fund's President at work.

Figure 5 Savings Certificate Ceremony

This is the savings certificate ceremony, where we recognized the most consistent savers in the community.

Figure 6 Savings Certificate Winner

Here is one of our savings certificate winners. He is very proud of his achievement, as it will help him in his process in applying for a loan.

Overview of Microfinance in Sub-Saharan Africa

Scholars say that contrary to common belief, microfinance has been around in Sub-Saharan Africa for centuries (African Development Bank 2006, Ouedraogo and Gentil 2008). There is proof throughout the history of microfinance initiatives in many different forms dating back to the 15th century in Nigeria. In the 18th century, there were "tontines," small-scale savings and loans clubs in South Africa, Ethiopia and Cote d'Ivoire. In the 19th century, "tontines" were developed into savings and credit cooperatives in places like Kenya. However, it was not until the late 1990s that the name "microfinance" became popular and people began to finally recognize it as a formal financial segment in Africa.

Microfinance actually went through four major developmental stages in Sub-Saharan Africa. It all started in the 1950s with direct funding of subsidized credit for people who were unable to repay loans of any kind. The assumption behind this model was that the lack of money prevents us from eliminating poverty. This held true until the 1970s when the second stage started with non-profit government organizations (NGOs) facilitating the microcredit world, very similar to the organization I worked with in Ghana. This movement, of course, was started with the Grameen Bank in Bangladesh and was then followed suit by the NGOs with their microlending. The issue with NGOs, however, is that they are neither self-sufficient nor sustainable. They are also not to blame for this as they receive their resources from other development organizations and agencies. An NGO plays the role of an intermediary, often playing more of a social role in transferring funds than actually serving as a financial intermediary. The third stage came in the 1990s with the formalization of MFIs in Sub-Saharan Africa. As MFIs grew in prominence and popularity, they began to offer more financial services

like insurance and savings programs. Microfinance was seen as a great method of ameliorating the socioeconomic welfare of its advocates and their families. When microfinance became accepted as a formal financial sector, the fourth stage commenced. In this stage, it was especially important to remember that though MFIs were growing in popularity, it was still very important to remain focused on serving the people that inspired the creating of MFIs in the first place: the poor. As of December 31, 2010, there are 22,900 MFIs in operation in Sub-Saharan Africa with a total of 4.5 million borrowers and loans in excess of $ 14.9 billion USD (MIX and CGAP 2012).

The data that I will use in this dissertation will include MFI income statement and balance sheet information, which I can pull up from the MIX. The MIX is a business information provider that seeks to improve the area of microfinance through the database that it maintains. The MIX looks to help scholars like myself, who are looking to improve the efficiency of MFIs. The organization provides a plethora of information and analysis on these microfinance vendors. By providing this financial transparency to us, we are able to track the progress of MFIs over time in these developing economies. My study will use average data from 2008 through 2010 for the analysis.

Choosing MFIs for Analysis

For the purposes of this thesis, I went through a variety of sequential steps to come up with my final list of MFIs to be analyzed. MIX provides data for 508 microfinance institutions, but much of the data for a majority of these MFIs was incomplete, leaving me with 147 Sub-Saharan African MFIs. Since years 2008, 2009 and 2010 contain the most amounts of data, I went with these three years. MIX also rates the clearness and quality of the information pulled from the MFIs, ranking it from one to five diamonds. A five signifies that the MFI goes so far as to have its financial statements audited. Thus, I chose the MFIs that received either four or five diamonds, so that I could analyze the most accurate data available. A four-diamond MFI makes available the following: general information about the institution, data on outreach, financial indicators and audited financial documents. A five-diamond MFI shares all the characteristics of a four-diamond MFI, but it is also rated by a variety of rating agencies, certifying the validity of the data even further. From this point, I put four-diamond MFIs and five-diamond MFI on a common ground with the assumption that they are equal in terms of the validity of their reported information. With this diamond filter, my number of MFIs dropped from 147 to 111, 71 of which were at the level of four diamonds and 40 of which were at the level of five diamonds.

With one final survey of my remaining MFIs, I was able to cut down the number to 70. I cut out 41 MFIs, as I found them also to be lacking some information. My final list of 70 MFIs is a comprehensive list, as all 70 MFIs have complete information for the years 2008, 2009 and 2010; this list can be found in my Appendix.

Data Envelopment Analysis (DEA)

Like most MFI studies, my paper will use the Data Envelopment Analysis, also referred to as DEA to assess how efficient these MFIs are. The DEA looks at an organization's ability to get full output from a certain set of inputs. I focused only on how technically efficient the MFIs are due to my limited scope of data. If I wanted to look into allocative efficiency or economic efficiency, I would need to look at prices. However, my data does not provide such information. A majority of these MFIs did not acquire their inputs at market terms anyway. Most global MFIs work like a production company where in order to put together their outputs and sell their outputs in the market, they first need to buy their inputs at market prices, just like the other players in the industry (Leon 2001). Sub-Saharan Africa is different as many MFI inputs, such as funds, are received from non-market sources. Other inputs are very unique, making it very difficult to price them. Thus, the Output-Oriented Model and the Input-Oriented Model measure the DEA technical efficiency.

An Output-Oriented Model (OOM) says that technical efficiency is calculated by the actual output of the MFIs, as compared to the maximum level of output for a certain quantity of inputs.

Let's get into the mathematical formula of the OOM. Let's assume that we have K decision-making units (DMU) using N inputs to create M outputs. Inputs are represented by x_{jk} (j = 1,…,n). Outputs are represented by y_{ik} (i = 1,…,m) for each MFI k, where k = 1,…,K). The efficiency of the DMU is measured by the following (Coelli 1998):

$$TEk = \sum_{i=1}^{m} (u_i y_{ik}) \div \sum_{j=1}^{n} (v_j x_{jk})$$

Where y_{ik} is the amount of the i-th output created by the k-th DMU, x_{jk} is the amount of j-th input used by the k-th DMU and u_i and v_j are the output and input weights.

The DMU maximizes the technical efficiency TE_k with the following restrictions:

$$\text{TEk} = \sum_{i=1}^{m}(u_i y_{ik}) \div \sum_{j=1}^{n}(v_j x_{jk}) \leq 1 \text{ where, } u_i \text{ and } v_j \geq 0$$

Our equation above is saying that the technical efficiency measure of a decision-making unit cannot surpass 1 and that the input and output weights are positive. These weights were chosen to make the DMU maximize its own technical efficiency. Here is how the weights were established using linear programming (Output-Oriented) (Coelli 1998):

$MaxTE_k$

Subject to:

$$\sum_{i=1}^{m}(u_i y_{ik} - x_{jk} + w) \leq 0 \text{ where, } k = 1, \dots, k$$

$$v_j x_{jk} - \sum_{j=1}^{n}(u_j x_{jk}) \geq 0 \text{ and } u_i \text{ and } v_j \geq 0$$

We use the Input-Oriented model (IOM) to get the certain level of output by minimizing input. Thus, we get this mathematical programming model (Coelli 1998):

$MinTE_k$

Subject to:

$$\sum_{i=1}^{m}(u_i y_{ik} - y_{jk} + w) \geq 0 \text{ where, } k = 1, \dots, K$$

$$x_{jk} - \sum_{j=1}^{n}(u_j x_{jk}) \geq 0 \text{ and } u_i \text{ and } v_j \geq 0$$

The IOM explains technical efficiency as a relative decrease in input usage while the OEM explains technical efficiency as a relative increase in output production. Coelli (1998) says that the IOM and OEM assess the same limits and thus, provide the same efficient DMUs. The only difference between the two models is how they may assess the efficiencies of the inefficient DMUs, which barely affects the final results (Coelli and Perelman 1996). Some scholars only use the IOM since the DMUs have certain orders to satisfy (i.e. generating electricity and total payroll), making these few inputs the main variables. Specifically in the microfinance sector, microfinance managers focus on their total personnel expenses, the amount of credit officers and the cost incurred per borrower. In our situation, each one of the MFIs that we chose will be its own DMU and we will use the IOM to assess how efficient these MFIs actually are.

Our IOM equation above shows technical efficiency (TE) under the assumption that w = 0, so we have constant returns to scale (CRS). If we do not constrain w, then we have variable returns to scale instead (VRS). With the first scenario, we get technical efficiency, while in the second, we are measuring pure technical efficiency (PTE). Our CRS assumption is valid only when all the DMUs are working at the optimal scale as imperfect competition or opportunity to fund may not necessarily permit all the DMUs to work at their best (Coelli 1998). According to Banker et al. (1984), the CRS DEA technical efficiency (TE_{CRS}) has been broken down into two parts: technical efficiency under the VRS assumption (TE_{VRS}) and scale efficiency (SE) where, $TE_{CRS} = TE_{VRS} \times SE$. It can also be written as TE = PTE x SE (Coelli 1998).

Calculating scale efficiency still does not tell us everything, as we do not know whether the decision-making unit has increasing returns to scale or decreasing returns to scale. However, running another Data Envelopment Analysis with non-increasing returns to scale (NIRS) can help us with this problem. For any certain DMU, we can analyze its scale efficiency by

comparing the TE_{NIRS} to the TE_{VRS}. If the TEs do not match, that means that the DMU has increasing returns to scale. If they are equal, however, this means that the DMU has decreasing returns to scale. In order to analyze our data using the DEA, we use the free DEA Online Software (https://www.deaos.com/login.aspx?ReturnUrl=%2f), which allows us to evaluate the relative efficiencies of our DMUs without a deep understanding of the math behind them.

In order to assess the technical efficiency of a financial institution, we first need to figure out which model we will use for it. There are a variety of models that cater to different financial institutions depending on what the institution does exactly and what sort of efficiency we are looking for (Berger and Mester 1997). The two most common models used to assess financial institutions are the intermediation approach and the production approach (Athanassoupoulos 1997).

The production approach best serves financial institutions that produce services for their clients. The amount and types of financial transactions or the number of participants would measure output over a certain time period. However, since information on transaction history is limited, we use the number of deposit accounts, loan account, and/or outstanding insurance policies instead (Fried et al. 2008).

The intermediation approach best serves financial institutions that mainly work as intermediaries between lenders and borrowers. Intermediaries exist as they help shift purchasing power from those that have too much to those that have too little, which ameliorates how our resources are utilized in the economy (Gonzalez-Vega 1986). The amount of "financial deepening" tells us the amount of funds moved between the two parties. In literature, "financial deepening" refers to "a process of expansion of financial transactions through markets at a pace faster than the growth of non-financial activities" (Gonzalez-Vega 2003). The amount of

intermediation can be measured as a flow or a stock. The scale of flows is contingent on contract maturity and the types of lending technologies available. We prefer to use stocks, as it is difficult to acquire flow data from intermediaries. Output is measured by the stock of financial worth in the accounts, including outstanding value of loans, deposits or insurance (Fried et al. 2008).

There are several MFIs in Sub-Saharan Africa that do not collect deposits, but they do all hand out loans. Thus, the assumption that the only value microenterprises, particularly in Sub-Saharan Africa find in MFIs is access to loans is incorrect (Adams et al. 1984). Thankfully, we have access to our MFIs' data on both the value of their outstanding loan portfolios, in addition to the amount of outstanding loans offered by the institutions. Both of these are crucial in our use of the production approach and intermediation approach to assessing MFI efficiency.

One major question in this analysis is over what we consider to be an input and what we consider to be an output, particularly in the banking sector. According to Mlima and Hjalmarsoon (2002), inputs and outputs in the production approach are defined in terms of labor, machines and materials. With our model, output is synonymous with outreach, and in this case, we use the amount of loans outstanding at the end of each financial year. As an MFI increases the number of loans outstanding to poor people, the better contributions the MFI is making to the development goals set out by the microfinance world. Thus, we use the mean number of loans outstanding from 2008-2010 to measure output under the production approach.

According to scholars, labor (e.g. a loan officer's overall effort) is the most crucial input in microfinance. In order to assess labor's efficiency, we need to assess the support services that loan officers use in their daily tasks, including the amount of gasoline they use in addition to other transportation costs. Some other items to look at include computer services, materials (e.g.

office supplies), security and utilities (e.g. electricity and phone). In addition to labor, the other most important input used by MFIs to create output is capital (services) in support of functions. Labor and services used for these MFI functions are non-financial resources that MFIs use to go on with their daily activities. The services provided by MFIs are very labor intensive. This is because MFIs typically dispense loans to clients with very little income and few assets. Thus, in order to ramp up the security and assure repayment, MFIs are tasked with finding appropriate collateral from their clients. One solution to this is holding an entire group of people (e.g. a family) liable for one loan. Further, MFIs also have to use their loan officers to screen borrowers before administering them the loans. Lastly, because microlending is considered to be "character-based lending," MFIs need to monitor the borrowers to keep them on track and make sure that they do not flee with the funds. They do this via making recurrent trips to the borrower's home and/or business. Instead of taking legal action against the borrower, MFIs hope that continual reminders and visits will incentivize borrowers to repay their dues and live up to their contracts in order to avoid embarrassment in front of friends and family (Joshi 2005). These trips between loan officer and clients also help both parties create respect and trust for one another through implicit contracts. They also help clarify the contents of the loan contract, such as the amount, time to maturity and frequency of payments (Ledgerwood 1999). For our analysis, we use the total amount of employees at the end of each year (in 2008, 2009 and 2010) as a basis for our labor inputs. A second input is "services in support of operations." These "services" tell us a lot in terms of efficiency because an MFI does not need to own a building or a computer to be able to dispense loans. Instead, they require the services of a location, calculation and office materials. Additionally, in order to properly function, MFIs need their loan officers to have human capital support, including credit bureau reports, evaluations and/or

safety services from beyond the MFI. Without this support and these services, MFIs would be unable to complete their duties efficiently. In this thesis, we refer to "services in support of operations" as total personnel expenses.

Since access to credit is still the most crucial service that MFIs provide to their clients, loans/portfolio outstanding is an indicator for the amount of outreach under the intermediation approach. In this thesis, the mean portfolio outstanding for years 2008-2010 is considered to be an output variable. Norman and Stocker (1991) believe that the main inputs necessary to make loans are labor and expenditure. They find the two inputs in the intermediation approach to be the amount of loan officers (labor) and the cost per borrower (expenditure).

According to Microrate and Bank (2003), loan officers are MFI employees that directly manage a part of the loan portfolio. They also directly work with the clients to identify them, screen them and provide follow-up and monitoring. Since loan officers are constantly working on developing loan portfolios and improving their quality, it is considered to be a form of labor. Cost per client (cost per borrower) tells us the mean cost of serving a client that needs a loan (Microrate and Bank 2003). The cost per borrower also reflects operating expenses (e.g. personnel expenses, depreciation, amortization and administrative expenses per borrower). Table one shows a summary of the statistics of inputs and outputs using both the intermediation approach and the production approach.

Table 1 Summary Statistics of Inputs and Outputs

Table One: Summary Statistics of Inputs and Outputs Averaged Over 2008-2010						
Approach	**Input vs. Output**	**Variable**	**Minimum**	**Maximum**	**Average**	**Standard Deviation**
Intermediation	Output	Gross Loan Portfolio (USD)	34832.7	871,068,039	39,171,267	137,500,515
Intermediation	Input	Loan Officers (#)	2	2,636.3	166.7	367.7
Intermediation	Input	Cost Per Borrower (USD)	10.33	797	186.3548	160.1
Production	Output	Loans Outstanding (#)	765.33	625,926.3	46,170.2	96,102.7
Production	Input	Employees (#)	4.33	4,384.7	379.8	760.4
Production	Input	Personnel Expenses (USD)	69.3	601,087.7	35,141.4	94,976.5

Under the intermediation approach, the average gross loan portfolio is $39,171,267 USD, the average amount of credit officers is 167 and the average cost per client is $186 USD. Under the production approach, the average amount of outstanding loans is 46,170, the average amount of employees is 380 and the average personnel expenses come out to be $35,141 USD. Because there are large disparities between the minimum and maximum values for all the variables, the standard deviation for each variable (i.e. amount of gross loan portfolio, amount of loan officers, cost per borrower, amount of loans outstanding, employee expenses and personnel expenses) is very high.

Tobit Analysis

Several elements impact an MFI's efficiency in executing its functions. My major goal, via this thesis, is to assess which factors make an MFI efficient. Since the Data Envelopment Analysis scores sit between 0 and 1, the dependent variable is limited. Previous studies conducted by scholars tell us that calculating a Tobit Regression, a multivariable statistical model, is useful when assessing efficiency measures. It can help us figure out how we can improve efficiency (Grosskopf 1996).

In the Tobit Regression, there is an irregularity between observations with positive dependent variables and observations with negative dependent variables. Here is the generic Tobit Regression:

$$Y_t = \alpha + \beta X_t + u_t \quad \text{if } Y_t > 0 \quad \text{or } u_t > -\alpha - \beta X_t$$

$$Y_t = 0 \quad \text{if } Y_t \leq 0 \quad \text{or } u_t \leq -\alpha - \beta X_t$$

where Y_t = Efficiency score of an MFI, X_t = Vector of Factors of Efficiency of an MFI

The underlying premise behind the Tobit Regression is that each MFI has its own index function, $Y_t = \alpha + \beta X_t + u_t$. When $Y_t \leq 0$, the dependent variable is set at zero. When $Y_t > 0$, the dependent variable is set at I_t (representing a number between 0 and 1). Assuming a normal distribution for u_t with a mean of zero and a variance σ^2, the standard normal random variable is represented by $Z = u_t / \sigma$. The probability density function of the standard normal variable Z is represented by f(z) and its cumulative density function by F(z). Thus, the probability density function for MFIs with efficiency scores greater than zero is:

$$P_1 = \prod_{i=1}^{i=m} \frac{1}{\sigma} f\left[(Y_i - \alpha - \beta X_i) / \sigma\right]$$

where Π = product, m = amount of MFIs in a sub-sample for which efficiency scores are above 0

In the second sub-sample of MFIs of size n, where efficiency scores are below zero, $Y_t = 0$, the probability density function for the random variable, $u_t \leq -\alpha - \beta X_t$ is:

$$P_2 = \prod_{j=1}^{j=n} F\left[-\alpha - \beta X_j\right) / \sigma\right]$$

The maximum likelihood for the whole MFI sample is:

$$L = P_1 P_2$$

The method for figuring out α and β is to maximize L with respect to the parameters.

Since we used the DEA to estimate the efficiency of our MFIs, we now just the Tobit Regression to assess what are the elements that affect an MFI's efficiency. We use the dependent variable, the maximum value of the efficiency scores because all efficient MFIs are considered to be the same. We complete the Tobit analysis twice; once for the efficiency scores from the intermediation approach and another time for the efficiency scores from the production approach (Segun 2013).

The factors of MFI efficiency can encompass features of the operating environment and features of the manager, such as human capital endowments (Fried et al. 2008). Through this thesis, we attempt to cluster all the variables that we think will affect an MFI's efficiency in governance, presence and outreach and financial organization and outcome.

Rock et al. (1998) describe MFI governance as being the practice that directors and managers put into leading an institution to meet its purpose while maintaining the quality of its assets and resources. Leon (2001), on the other hand, argues that governance has to do with rules and regulations created by the owner of a company with both internal and external agents

that work to achieve the original economic goals. Governance rules vary depending on MFI legal status: Anonymous Stocks Corporation (S.A.), Civil Association (A.C.) and Civil Society (S.C.). S.A. is ruled by a group of shareholders who get to vote based on how much stock they own. This creates strong incentives in trying to be efficient as they are all owners of the MFI. It is the shareholders who select a manager or two to represent the shareholder interests and to run daily operations of the MFI. Because a manager can be fired at any time, it is in their best interest as well to run the MFI as efficiently as possible. If there are two or more managers, a management board is established. In order to run in accordance with the law, at least 50% of the members need to attend board meetings and the majority gets to make the decisions. In the event of a tie, the president gets to make the final decision. Each individual country's government in Sub-Saharan Africa runs the A.C.. In many of these nations, the general assembly is typically given the power to oversee the MFIs. Unlike S.A., where more voting power is given to individuals with more shares, A.C. tends to have a one vote per person policy. This gives everyone equal say in how to develop the MFI moving forward. However, this also means that individual interests can sometimes overshadow the interests of what would be best and most efficient for the MFI. One or more members run S.C. and each member is entitled to leading and managing the business. Final decisions are based on a majority vote. In order to account for governance in this thesis, we created a variable for for-profit MFIs (S.A. or S.C.) and one for not-for-profit MFIs (A.C.). Because MFIs are always worrying about not being able to meet the poor's massive demand for loans, borrowers per staff/loan officer productivity is used for our study. We expect that the amount of borrowers per staff is having a positive impact on MFI efficiency. Lastly, portfolio at risk 30 days covers the level of asset quality.

Within presence and outreach, we look at how long the MFI has been around in addition to its size. According to Hartarska et al. (2006), MFIs have generally become more efficient over time. Using this assumption, we analyze the number of years an MFI has been in existence from the day it was founded to December 31, 2010. Going along with Hartarska, the older the MFI, the more efficient it should be. To also take an MFI's size into account for our study, we use the mean value of total assets for years 2008-2010. In theory, big, well-established MFIs should perform better than the small, new MFIs on the block.

Financial organization and outcomes are also very important for MFIs in order to assure their organization's sustainability (Hulme and Mosley 1996). In this study we used the following financial indicators to assess the MFIs: debt-to-equity ratio, return on assets, return on equity, operational self-sufficiency, yield on gross portfolio and financial expenses per asset. We expect a higher debt-to-equity ratio to reduce MFI efficiency, as it shows that the organization is reliant on other institutions for funds. However, a high return on assets and high return on equity should both improve an MFI's efficiency. Operational self-sufficiency refers to an MFI's ability to cover its operating costs using its income. This shows us whether an MFI's revenues can cover all of its expenses, including financial expenses, operating expenses and any other losses. A high operational self-sufficiency means that an MFI is financially stable. Yield on gross portfolio and financial expenses per asset represent the interest rates that MFIs charge their borrowers and the MFIs' cost of borrowing. Total assets include the loan portfolio and financial expenses per asset include the financial expenses that come with building an asset. The greater the difference between revenues and expenses, the higher the possibility of the MFI becoming financially self-sustainable. There is a positive correlation between yield on gross portfolio and

MFI efficiency. However, there is a negative correlation between financial expenses per asset and efficiency.

We have measured output solely in terms of financial servicing of loans, so when MFIs use their resources for other typical of services that they may provide, efficiency will be lowered. Only will efficiency increase in this case if these other services also improve loan payback. A majority of MFIs only offer financial services, but some others also offer non-financial services like social intermediation, enterprise development, health, nutrition, education and literacy training (Ledgerwood 1999). In order to differentiate between an MFI that provides only financial services and one that provides both financial and non-financial services, we had to make another variable. If the MFI offers training or education workshops to microenterprises or if it does health care training or helps with commercial networks or provides insurance, the MFI received a 1. If an MFI does not offer any of the above and solely provides financial services, it received a 0. The assumption is that an MFI that provides more than just financial services is less efficient at working toward its main goal.

Table two shows a summary of the statistics of the variables discussed in the Tobit Regression. Our findings show that the standard deviation of each variable, except for MFI age, borrowers per staff and return on equity was very low, meaning that they do not differ much from the average. This is also evident when looking at the small disparity between the minimum and maximum values.

Table 2 Summary Statistics of Variables Used in Tobit Regression

Table Two: Summary Statistics of Variables Used in Tobit Regression Averaged Over 2008-2010					
Variable	**Minimum**	**Maximum**	**Average**	**Standard Deviation**	**Skewness**
Non-Financial Services	0	1	0.5	0.5	-0.02
Not-for-Profit	0	1	0.66	0.48	-0.68
Borrowers Per Staff	22	704.6	143.4	126.4	2.52
Age	3	45	12.75	8.10	1.51
Portfolio at Risk 30 Days	0	0.52	0.08	0.08	3.12
Financial Expenses / Assets	0	0.17	0.06	0.03	1.83
Total Assets	5.01	9.12	6.94	0.81	0.24
Debt-to-Equity Ratio	-1.70	1.84	0.37	0.52	-0.54
Return on Assets	-0.39	0.21	-0.014	0.097	-1.73
Return on Equity	-354.43	1.32	-5.1	42.36	-8.36
Operational Self-Sufficiency	-0.47	0.39	0.006	0.13	-0.75
Yield on Gross Portfolio	0.11	1.05	0.42	0.21	0.55

The skewness of non-financial services, not-for-profit MFIs, total assets, borrowers per staff, MFI age, financial expenses/assets, debt-to-equity ratio, return on assets, operational self-sufficiency and yield on gross portfolio are all sitting around 0, meaning that these variables have a normal distribution. The skewness of portfolio at risk 30 days and return on equity show that neither variable has a normal distribution and may thus, influence the Tobit analysis results.

Chapter 3

Findings and Analysis

Technical Efficiency of MFIs under the Intermediation Approach

The Data Envelopment Analysis (DEA) technical efficiency of 70 MFIs is assessed by using the intermediation method under the assumptions of Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS). Table three shows our observed findings of technical efficiency, pure technical efficiency and scale efficiency of each and every MFI using our DEA method. As we can see from the table, only two MFIs lay on the technical efficiency frontier when we assume constant returns to scale. When variable returns to scale is assumed, we see six MFIs on the efficiency frontier. With the variable returns to scale, we see that the efficiency scores are significantly higher for the MFIs because the MFIs under the constant returns assumption may include new efficient MFIs that might be functioning under either increasing returns to scale or decreasing returns to scale. The two MFIs that are technically efficient under both CRS and VRS are *Alliance de Credit et d'Epargne pour la Production (ACEP Senegal)* and *Equity Bank. ACEP Senegal* is a Credit Union in Senegal that has 30,503 active borrowers and a gross loan portfolio of $60.8 million USD. *ACEP Senegal* considers itself to be a pure MFI that participates in only MFI activities, solely financial services. *Equity Bank* is a Kenyan bank with 524,902 active borrowers and a gross loan portfolio of $925 million USD. *Equity Bank* also considers itself to be a pure MFI that provides not only financial services but also non-financial services.

Table 3 DEA Technical Efficiency under Intermediation Approach

Table Three: DEA Technical Efficiency under Intermediation Approach					
MFI #	**Name**	**Technical Efficiency**	**Pure Technical Efficiency**	**Scale Efficiency**	**Returns to Scale**
1	ACEP Cameroon	0.663	0.704	0.942	Increasing
2	**ACEP Senegal**	**1.000**	**1.000**	**1.000**	-
3	AfricaWorks	0.052	0.218	0.241	Increasing
4	Akiba	0.340	0.35	0.972	Increasing
5	Alida	0.123	0.401	0.306	Increasing
6	AMfB	0.082	0.117	0.705	Increasing
7	APED	0.031	0.171	0.183	Increasing
8	BIMAS	0.074	0.203	0.362	Increasing
9	BOM	0.037	0.100	0.372	Increasing
10	BRAC - UGA	0.062	0.280	0.220	Increasing
11	*Capitec Bank*	*0.932*	*1.000*	*0.932*	*Decreasing*
12	CAPPED	0.129	0.248	0.519	Increasing
13	CAURIE Micro Finance	0.222	0.393	0.565	Increasing
14	CDS	0.803	0.953	0.843	Increasing
15	CEDEF	0.012	1.000	0.012	Increasing
16	CFF	0.071	0.91	0.078	Increasing
17	CMMB	0.148	0.588	0.252	Increasing
18	*CMS*	*0.839*	*0.893*	*0.940*	*Decreasing*
19	CRG	0.084	0.228	0.370	Increasing
20	CUMO	0.018	0.305	0.060	Increasing
21	Faulu - KEN	0.093	0.149	0.624	Increasing
22	FDM	0.042	0.228	0.184	Increasing
23	FINCA - DRC	0.077	0.110	0.697	Increasing
24	FINCA - MWI	0.035	0.098	0.352	Increasing
25	FINCA - UGA	0.082	0.116	0.703	Increasing
26	FINCA - ZMB	0.031	0.105	0.296	Increasing
27	FUCEC Togo	0.424	0.446	0.951	Increasing
28	CVECA Kita	0.024	0.405	0.059	Increasing
29	ECLOF-KEN	0.075	0.169	0.445	Increasing
30	Hluvuku	0.140	0.362	0.388	Increasing
31	GGEM Micro S.	0.036	0.557	0.064	Increasing
32	K-Rep	0.557	0.573	0.973	Increasing
33	Kafo Jiginew	0.381	0.429	0.889	Increasing
34	KixiCredito	0.094	0.122	0.770	Increasing
35	KSF	0.176	1.000	0.176	Increasing
36	KWFT	0.363	0.465	0.781	Increasing
37	**Equity Bank**	**1.000**	**1.000**	**1.000**	-

38	ED-Ghana	0.027	0.296	0.090	Increasing
39	LAPO	0.140	0.303	0.460	Increasing
40	Madfa SACCO	0.025	1.000	0.025	Increasing
41	MED-Net	0.050	0.159	0.317	Increasing
42	MECREF	0.274	0.521	0.525	Increasing
43	MEC FEPRODES	0.201	0.66	0.305	Increasing
44	MGPCC DEKAWOWO	0.300	0.941	0.319	Increasing
45	Micro Africa	0.126	0.223	0.564	Increasing
46	MicroCred - MDG	0.127	0.174	0.730	Increasing
47	MUL	0.220	0.492	0.448	Increasing
48	NovoBanco - MOZ	0.166	0.182	0.911	Increasing
49	OI - TZA	0.022	0.107	0.204	Increasing
50	OIBM	0.267	0.298	0.897	Increasing
51	OISL	0.089	0.116	0.770	Increasing
52	Opportunity Finance	0.247	0.353	0.698	Increasing
53	Otiv Diana	0.085	0.215	0.398	Increasing
54	PAIDEK	0.099	0.366	0.272	Increasing
55	PAPME	0.183	0.225	0.814	Increasing
56	ProCredit - GHA	0.166	0.176	0.946	Increasing
57	RCPB	0.721	0.738	0.976	Increasing
58	SEAP	0.202	0.733	0.276	Increasing
59	SAT	0.155	0.203	0.764	Increasing
60	SEDA	0.052	0.155	0.332	Increasing
61	Soro Yiriwaso	0.112	0.555	0.201	Increasing
62	Reliance	0.097	0.159	0.612	Increasing
63	RML	0.106	0.218	0.488	Increasing
64	TIAVO	0.04	0.095	0.423	Increasing
65	U-Trust	0.143	0.186	0.769	Increasing
66	U-IMCEC	0.271	0.383	0.708	Increasing
67	UCEC/MK	0.149	0.249	0.597	Increasing
68	UNION DES COOPECs	0.084	0.313	0.269	Increasing
69	UOB	0.073	0.137	0.53	Increasing
70	WAGES	0.268	0.326	0.822	Increasing
	Average	**0.209**	**0.395**	**0.524**	

The average technical efficiency is 20.9%, the average pure technical efficiency is 39.5% and the average scale efficiency is 52.4%. This shows that MFIs under our the CRS assumption could decrease a whopping 79.1% of their inputs without directly impacting their current output level (e.g. gross loan portfolio). The average VRS efficiency result tells us that 60.5% of inputs could be diminished without impacting the current gross loan portfolio. The average scale efficiency result shows that MFIs are indeed, working under their maximum potential.

When we look at the returns to scale, we see that most MFIs have economies of scale. 89% of the MFIs have increasing returns to scale, meaning that MFI managers must work to use their inputs more efficiently, so that their overall efficiency improves in offering and providing loans to people in Sub-Saharan Africa.

Technical Efficiency of MFIs under the Production Approach

The Data Envelopment Analysis (DEA) technical efficiency of 70 MFIs is assessed by using the production method under the assumptions of Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS). Table four shows our observed findings of technical efficiency, pure technical efficiency and scale efficiency of each and every MFI using our DEA method. When we analyze the table, we see that solely one MFI is on the technical efficient frontier under the assumption of CRS. However, under VRS, eight MFIs are present on the efficiency frontier. We have higher efficiency numbers for all MFIs under the VRS assumption because the MFIs working under CRS are complemented by new, efficient MFIs that might work under either increasing or decreasing returns to scale. The MFI that is technically efficient under both CRS and VRS is *Kraban Support Foundation (KSF),* an NGO in my beloved Ghana, which has 8,017 active borrowers and a gross loan portfolio of $1.2 million USD. KSF considers itself to be a pure MFI that provides not only financial services, but also non-financial services.

Table 4 DEA Technical Efficiency under Production Approach

Table Four: DEA Technical Efficiency under Production Approach					
MFI #	**Name**	**Technical Efficiency**	**Pure Technical Efficiency**	**Scale Efficiency**	**Returns to Scale**
1	ACEP Cameroon	0.106	0.110	0.968	Increasing
2	ACEP Senegal	0.215	0.298	0.721	Decreasing
3	AfricaWorks	0.104	0.133	0.785	Increasing
4	Akiba	0.082	0.103	0.797	Decreasing
5	Alida	0.313	0.366	0.856	Decreasing
6	AMfB	0.69	0.070	0.991	Decreasing
7	APED	0.259	0.308	0.841	Decreasing
8	BIMAS	0.261	0.306	0.853	Decreasing
9	BOM	0.075	0.076	0.991	Increasing
10	BRAC - UGA	0.188	0.47	0.400	Decreasing
11	Capitec Bank	0.121	0.301	0.403	Decreasing
12	CAPPED	0.069	0.101	0.679	Increasing
13	CAURIE Micro Finance	0.652	0.904	0.722	Decreasing
14	CDS	0.317	0.445	0.713	Decreasing
15	CEDEF	0.516	1.000	0.516	Increasing
16	CFF	0.594	0.789	0.753	Increasing
17	CMMB	0.177	0.294	0.604	Increasing
18	CMS	0.196	0.414	0.474	Decreasing
19	CRG	0.474	0.944	0.503	Decreasing
20	CUMO	0.389	0.546	0.711	Decreasing
21	Faulu - KEN	0.194	0.446	0.434	Decreasing
22	FDM	0.130	0.203	0.641	Increasing
23	FINCA - DRC	0.206	0.296	0.697	Decreasing
24	FINCA - MWI	0.161	0.201	0.798	Decreasing
25	FINCA - UGA	0.154	0.220	0.701	Decreasing
26	FINCA - ZMB	0.116	0.134	0.867	Decreasing
27	FUCEC Togo	0.134	0.291	0.462	Decreasing
28	CVECA Kita	0.918	0.931	0.986	Increasing
29	ECLOF-KEN	0.219	0.277	0.790	Decreasing
30	Hluvuku	0.155	0.198	0.782	Increasing
31	GGEM Micro S.	0.262	0.367	0.712	Increasing
32	K-Rep	0.196	0.356	0.550	Decreasing
33	Kafo Jiginew	0.161	0.301	0.534	Decreasing
34	KixiCredito	0.081	0.084	0.972	Decreasing
35	KSF	1.000	1.000	1.000	-
36	KWFT	0.403	1.000	0.403	Decreasing
37	Equity Bank	0.219	1.000	0.219	Decreasing

38	ED-Ghana	0.136	0.178	0.766	Increasing
39	LAPO	0.199	1.000	0.199	Decreasing
40	Madfa SACCO	0.417	1.000	0.417	Increasing
41	MED-Net	0.143	0.146	0.981	Increasing
42	MECREF	0.177	0.261	0.679	Increasing
43	MEC FEPRODES	0.243	0.312	0.78	Increasing
44	MGPCC DEKAWOWO	0.111	0.205	0.543	Increasing
45	Micro Africa	0.160	0.208	0.767	Increasing
46	MicroCred - MDG	0.093	0.112	0.833	Decreasing
47	MUL	0.185	0.318	0.583	Increasing
48	NovoBanco - MOZ	0.064	0.087	0.735	Decreasing
49	OI - TZA	0.088	0.110	0.800	Increasing
50	OIBM	0.181	0.257	0.702	Decreasing
51	OISL	0.120	0.172	0.698	Decreasing
52	Opportunity Finance	0.160	0.202	0.793	Increasing
53	Otiv Diana	0.060	0.090	0.673	Increasing
54	PAIDEK	0.469	0.531	0.883	Decreasing
55	PAPME	0.092	0.109	0.840	Decreasing
56	ProCredit - GHA	0.044	0.055	0.797	Decreasing
57	RCPB	0.171	0.399	0.427	Decreasing
58	SEAP	0.568	1.000	0.568	Decreasing
59	SAT	0.464	0.918	0.506	Decreasing
60	SEDA	0.176	0.212	0.830	Decreasing
61	Soro Yiriwaso	0.696	1.000	0.696	Decreasing
62	Reliance	0.035	0.052	0.676	Increasing
63	RML	0.108	0.186	0.580	Increasing
64	TIAVO	0.064	0.064	0.995	-
65	U-Trust	0.107	0.140	0.765	Decreasing
66	U-IMCEC	0.230	0.280	0.820	Decreasing
67	UCEC/MK	0.145	0.239	0.607	Decreasing
68	UNION DES COOPECs	0.102	0.203	0.502	Increasing
69	UOB	0.236	0.329	0.718	Decreasing
70	WAGES	0.076	0.105	0.719	Decreasing
	Average	**0.232**	**0.368**	**0.696**	

The average technical efficiency is 23.2%, the pure technical efficiency is 36.8% and the scale efficiency is 69.6%. This shows that MFIs under CRS could potentially diminish 76.8% of their inputs without impacting their current output amount (e.g. quantity of outstanding loans). The average VRS efficiency result says that 63.2% of input can be diminished without impacting the current number of outstanding loans. The average scale efficiency result shows that MFIs are working beneath their maximum potential.

Looking at the returns to scale, we see that most MFIs go through diseconomies of scale. In fact, 61% of them are experiencing decreasing returns to scale. This shows that MFIs could ameliorate their efficiencies by diminishing their inputs to increase their overall efficiency in offering and providing loans to people in Sub-Saharan Africa.

Factors of MFI Efficiency under the Intermediation Approach

Our results in table 5 show the factors of MFI efficiency using the intermediation method. Analyzing the table, we see that our dummy variables in the form of MFIs offering non-financial services, not-for-profit MFIs, portfolio at risk 30 days, total assets, return on assets, operational self-sufficiency and yield on gross portfolio are statistically significant on the efficiency of MFIs.

Table 5 Factors of Efficiency under Intermediation Approach

Table Five: Factors of Efficiency under Intermediation Approach						
	Technical Efficiency		Pure Technical Efficiency		Scale Efficiency	
Variable	Coefficient	T-Ratio	Coefficient	T-Ratio	Coefficient	T-Ratio
Constant	-1.15	-5.11	0.41	1.02	-1.19	-5.93
Non-Financial Services	-0.08	-2.18	-0.09	-1.4	-0.04	-1.09
Non-For-Profit MFIs	0.04	0.85	0.06	0.79	-0.10	-2.52
Borrowers Per Staff	0.00	-0.35	0.00	1.97	0.00	-3.77
MFI Age	0.00	-0.37	0.00	-0.51	0.00	-0.75
Portfolio at Risk 30 Days	0.50	1.73	0.42	0.78	0.31	1.13
Financial Expenses/Assets	0.42	0.58	0.36	0.28	-0.28	-0.36
Total Assets	0.22	7.10	0.02	0.44	0.29	10.65
Debt-Equity Ratio	-0.07	-1.55	-0.05	-0.57	-0.01	-0.35
Return on Assets	-1.10	-1.77	-0.02	-0.02	0.35	0.61
Return on Equity	0.00	-0.63	0.00	-0.67	0.00	-0.49
Operational Self-Sufficiency	1.00	2.08	0.38	0.45	-0.11	-0.25
Gross Portfolio Yield	-0.36	-3.04	-0.59	-2.82	-0.24	-2.33

The dummy variable representing MFIs providing non-financial services is significant at 5% and affects the technical efficiencies of the MFIs negatively. Thus, MFIs that provide non-financial services in additional to financial services have a smaller technical efficiency. The portfolio at risk 30 days is significant at 10% and positively affects the technical efficiency, which is contrary to what I had originally assumed. If we were to increase the proportion of portfolio at risk 30 days by 1%, we could also improve technical efficiency by 0.50% percent.

Total assets is significant at 1% and positively affects the technical efficiency of the MFIs. An increase of 1% in the proportion of total assets would improve technical efficiency by 0.22%. Return on assets is significant at 10% and negatively affects the technical efficiency of MFIs, which is contrary to my original thought that a higher ROA would automatically increase the long-run sustainability of the microcredit process since any surplus would be reinvested back into the MFI. This expectation, of course, came with my biases that I pick-up from my business classes that focus on American corporations that pay dividends. Instead, we see that increasing the proportion of ROA would decrease technical efficiency by 1.10%. Operational self-sufficiency is significant at 5% and positively affects technical efficiency. Increasing the proportion of operational self-sufficiency by 1% would also increase technical efficiency by 1%. Yield on gross portfolio is significant at 1% and negatively affects technical efficiency, contrary to my assumption that a larger deviation between an MFI's revenues and expenses would automatically increase the long-run sustainability of the microcredit process. An increase of the proportion of yield on gross portfolio by 1% would diminish technical efficiency by 0.36%

Yield on gross portfolio is statistically significant at 1% and negatively affects the Pure Technical Efficiency of MFIs. An increase in the proportion of yield on gross portfolio by 1% would diminish the pure technical efficiency of MFIs by 0.6%.

The dummy variable representing not-for-profit MFIs is significant at 5% and negatively affects MFI scale efficiency. This shows that non-profit MFIs lessen their scale efficiency. Total assets is significant at 1% and positively affects the scale efficiency of MFIs. Increasing the proportion of total assets by 1% would increase the scale efficiency by 0.29%. Yield on gross portfolio is significant at 5% and negatively affects the scale efficiency of MFIs. An

increase in proportion of yield on gross portfolio by 1% would diminish scale efficiency by 0.24%.

Factors of MFI Efficiency under the Production Approach

Table 6 shows the factors of efficiency of MFIs using the production approach. We see that our dummy variable representing not-for-profit MFIs, financial expenses/assets, total assets, return on assets and operational self-sufficiency are statistically significant on the efficiency of MFIs.

Table 6 Factors of Efficiency under Production Approach

Table Six: Factors of Efficiency under Production Approach						
	Technical Efficiency		Pure Technical Efficiency		Scale Efficiency	
Variable	**Coefficient**	**T-Ratio**	**Coefficient**	**T-Ratio**	**Coefficient**	**T-Ratio**
Constant	0.34	4.51	0.09	0.26	1.19	4.80
Non-Financial Services	0.00	-0.35	0.02	0.33	-0.03	-0.72
Non-For-Profit MFIs	-0.01	-0.42	0.02	0.32	-0.09	-1.69
Borrowers Per Staff	0.00	24.41	0.00	7.54	0.00	1.75
MFI Age	0.00	0.88	0.01	1.33	0.00	-1.48
Portfolio at Risk 30 Days	-0.07	-0.69	-0.28	-0.61	0.34	0.10
Financial Expenses/Assets	-0.34	-1.40	-0.08	-0.07	-1.51	-1.89
Total Assets	-0.04	3.98	-0.01	-0.23	-0.06	-1.90
Debt-Equity Ratio	0.02	1.30	0.04	0.63	0.02	0.42
Return on Assets	0.51	2.45	1.12	1.21	-0.84	-1.23
Return on Equity	0.00	-0.15	0.00	-0.20	0.00	1.04
Operational Self-Sufficiency	-0.35	-2.21	-0.61	-0.86	0.42	0.80
Gross Portfolio Yield	-0.05	-1.37	0.03	0.17	0.07	0.56

Total assets are significant at 1% and negatively impact technical efficiency. A 1% increase in the proportion of total assets would diminish technical efficiency by 0.04%. Return on assets is significant at 5% and positively affects technical efficiency, like I had thought. A 1% increase in the proportion of return on assets would improve technical efficiency by 0.51%. Operational self-sufficiency is significant at 5% and negatively affects technical efficiency. A

1% increase in the proportion of operational self-sufficiency would diminish technical efficiency by 0.35%.

The dummy variable representing non-for-profit MFIs is significant at 10% and negatively affects scale efficiency. In other words, non-for-profit MFIs lessen their scale efficiency. Financial expenses/assets are significant at 10% and negatively impact the scale efficiency of MFIs. A 1% increase in the proportion of financial expenses/assets would diminish scale efficiency by 1.51%. Total assets are significant at 10% and negatively impact scale efficiency. A 1% increase in the proportion of total assets would diminish scale efficiency of MFIs by 0.06%.

Chapter 4

Conclusion

My analysis utilized data from seventy microfinance institutions across twenty-five Sub-Saharan African nations to assess how efficient MFIs are and what precisely makes MFIs efficient in the first place. There is value in a study like this because MFIs need to function efficiently in order to achieve their twofold purpose of assisting the underprivileged while being economically sustainable. This brings us to another, perhaps even more important question: how do we get MFIs to function even more efficiently? By analyzing the features that define an MFI's efficiency, people who wish to make a further impact on these MFIs can better equip themselves with an understanding of where to increase their resources to, in turn, improve efficiency. I wanted to particularly learn more about the MFIs in Sub-Saharan Africa after spending three months with an MFI in Anomabu, Ghana in the summer of 2012. In order to assess the efficiency of our chosen MFIs, we used the widely recognized Data Envelopment Analysis (DEA) under both the intermediation and production approaches. We then used the Tobit Regression to test the factors of efficiency for these MFIs. The DEA under both approaches and the Tobit Regression have been used in a variety of MFI sustainability papers, so I figured it would only be fair and most reliable if we used the same for MFIs in Sub-Saharan Africa.

When we rival the two approaches, we see that the results are practically identical: Sub-Saharan MFIs are inefficient in satisfying the objectives of delivering microfinance aid to their clients and/or intermediating monies between savers and borrowers. However, under the intermediation approach, most of the MFIs are functioning with increasing returns to scale (output is increasing by more than the proportional change in inputs). In other words, these

MFIs can ameliorate their efficiencies by further increasing their inputs, such as their labor or capital. Under the production approach, however, these same MFIs are functioning with decreasing returns to scale (output increases by less than the proportional change in inputs). This is saying that the MFIs can ameliorate their efficiencies by actually decreasing their level of inputs. Because the intermediation and production approaches are providing us with contrary results, this means that MFIs are inefficient in meeting either goal. Because Sub-Saharan MFIs still attempt to practice these two goals concurrently, it is quite possible that they are already working at their highest potentials. Therefore, asking these MFIs to be more efficient means that we are looking for them to learn how to prioritize and utilize their resources better. This may perhaps mean that they should lessen the importance of one goal and increase the importance of another. This is precisely why the microfinance regulation agencies in Sub-Saharan Africa should specifically narrow down the microfinance market. They can have MFIs with an intermediation goal, MFIs with a production goal and MFIs that do both. It is just important to be transparent with the MFIs on this matter.

Under the intermediation approach, our examination of the factors of efficiency showed that the following are the best determinants of MFI efficiency: MFIs providing non-financial services, non-for-profit MFIs, portfolio at risk 30 days, total assets, return on assets, operational self-sufficiency and gross-portfolio.

Under the production approach, our examination of the factors of efficiency showed that the following are the best determinants of MFI efficiency: total assets, return on assets, operational self-sufficiency, non-for-profit MFIs and financial expenses/assets.

These results found above are very important for not only the microfinance business, but also for policy makers. Because a majority of the Sub-Saharan MFIs is inefficient in their

functions, some changes must be implemented. One drastic area for improvement can be of the managerial skills of the employees and credit officers. If we can better prepare these managers to improve their own output with the gross lean portfolios or with the amount of loans their MFIs provide, then the overall efficiencies of the MFIs can improve. One big way to do this is to use other successful MFIs as models. These "models" can differ based on the goal of the MFI, whether it is more intermediation-based or more production-based.

Under the intermediation approach, Senegal's *ACEP* and Kenya's *Equity Bank* are efficient. Therefore, MFIs that are looking to serve as financial intermediaries should follow the systems that these two institutions currently have set in place. As it turns out, the MFIs can become efficient if they attain a medium level of outreach in borrowers and savers, provide access to credit to a minimum forty percent of women, have under ten percent of gross loan portfolio at risk and be under regulation within the country of operation.

Under the production approach, Ghana's *KSF* is efficient. Therefore, MFIs that are looking to serve as providers of microfinance services should follow the system that *KSF* has currently set in place. As it turns out, the MFIs can become efficient if they attain a smaller level of outreach in borrowers and savers, provide access to credit to a minimum eighty percent of women, have under ten percent of gross portfolio at risk and be under regulation within the country of operation.

Much more research is needed in this microfinance field of study, particularly in assessing the efficiency and sustainability drivers of microfinance institutions in Sub-Saharan Africa. Since this thesis works with "incomplete" data over only a span of three years, there is plenty of opportunity for improvement. It would be helpful to be able to compare many more individual MFIs side-by-side and then to group them up by country or region. Tracking these

MFIs over time would be interesting as well and it would serve as a good measuring stick for managers. MFIs and regulators would be able to assess which managers are operating most efficiently. As a Finance major, I would certainly enjoy looking at a few graphs displaying the cyclical efficiency nature of these MFIs. Of course, I would also love to be able to travel back to Global Brigades in Ghana and see how the MFI I personally worked on is doing right now. Another deficiency I worked with was also not having information on the borrowers' side, any microeconomic activities or developments taken by the MFIs during the time, average duration of loans and loan installments. All of these factors could have manipulated the results of the Tobit Regression. Lastly, it would be useful to divide all the MFIs into banks, credit unions and cooperatives, non-banking financial institutions and NGOs. Regardless, a study like this is a start and it is certainly good to know that there are so many willing organizations out there actively looking to help those in need. Now, we just have to make sure that they are helping the poor as optimally and as efficiently as they possibly could.

Appendix

List of MFIs Analyzed for the Thesis

MFI No.	Name of MFIs	Country
1	ACEP Cameroon	Cameroon
2	CAPPED	Congo
3	CDS	Cameroon
4	CRG	Guinea
5	FINCA - DRC	Congo
6	PAIDEK	Congo
7	UCEC/MK	Chad
8	Akiba	Tanzania
9	BIMAS	Kenya
10	BRAC - UGA	Uganda
11	Faulu - KEN	Kenya
12	FINCA - UGA	Uganda
13	ECLOF - KEN	Kenya
14	K-Rep	Kenya
15	KWFT	Kenya
16	Equity Bank	Kenya
17	Madfa SACCO	Uganda
18	MED-Net	Uganda
19	Micro Africa	Kenya
20	MUL	Uganda
21	OI - TZA	Tanzania
22	SEDA	Tanzania
23	RML	Rwanda
24	U-Trust	Uganda
25	UNION DES COOPECs U.	Rwanda
26	UOB	Rwanda
27	AfricaWorks	Mozambique
28	BOM	Mozambique
29	Capitec Bank	South Africa
30	CUMO	Malawi
31	FDM	Mozambique

32	FINCA - MWI	Malawi
33	FINCA - ZMB	Zambia
34	Hluvuku	Mozambique
35	KixiCredito	Angola
36	MicroCred - MDG	Madagascar
37	NovoBanco - MOZ	Mozambiqu
38	OIBM	Malawi
39	Opportunity Finance	South Africa
40	Otiv Diana	Madagascar
41	TIAVO	Madagascar
42	ACEP Senegal	Senegal
43	Alida	Benin
44	AMfB	Nigeria
45	APED	Ghana
46	CAURIE Micro Finance	Senegal
47	CEDEF	Ghana
48	CFF	Ghana
49	CMMB	Benin
50	CMS	Senegal
51	FUCEC Togo	Togo
52	CVECA Kita/Bafoulab	Mali
53	GGEM Microfinance Services Ltd.	Sierra Leone
54	Kafo Jiginew	Mali
55	KSF	Ghana
56	ID-Ghana	Ghana
57	LAPO	Nigeria
58	MECREF	Niger
59	MEC FEPRODES	Senegal
60	MGPCC DEKAWOWO	Togo
61	OISL	Ghana
62	PAPME	Benin
63	ProCredit - GHA	Ghana
64	RCPB	Burkina Faso
65	SEAP	Nigeria
66	SAT	Ghana
67	Soro Yiriwaso	Mali
68	Reliance	Gambia
69	U-IMCEC	Senegal
70	WAGES	Togo

BIBLIOGRAPHY

Adams D. W., Graham D. H. and Von Pischke J. D., 1984, *Undermining Rural Development with Cheap Credit*. Boulder, Co: Westview Press.

Afrane, S., 2002, 'Impact Assessment of Microfinance Interventions in Ghana and South Africa: A Synthesis of Major Impacts and Lessons', *Journal of Microfinance / ESR Review*, 4(1).

African Development Bank, 2006, *Microfinance Policy and Strategy for the Bank Group*. Operation Policies and Review Department. Adb.

African Union, 2009, *Advancing the African Microfinance Sector, Follow-Up to the African Microfinance Roadmap*. Paper Presented At The Extraordinary Conference Of African Ministers Of Economy And Finance, Camef, Addis Ababa, Ethiopia, December 2009.

Anane, G. And Cobbinah, P., and Manu, J., 2013, 'Sustainability of Small and Medium Scale Enterprises in Rural Ghana: The Role of Microfinance Institutions', *Asian Economic and Financial Review*, 3(8).

Annim, S., 2012, 'Targeting the Poor versus Financial Stability and External Funding: Evidence of Microfinance Institutions in Ghana'. *Journal of Developmental Entrepreneurship*, 17(3).

Athanassopoulos A., 1997, 'Service Quality And Operating Efficiency Synergies For Management Control In The Provision Of Financial Services: Evidence From Greek Bank Branches', *European Journal Of Operational Research*, 98(2), 300–313.

Banker R. D., Charnes A. And Cooper W. W., 1984, 'Some Models For Estimating Technical And Scale Inefficiencies In Data Envelopment Analysis' *Management Science*, 30, 1078–1092.

Basu, A., And Blavy, R., 2004, 'Microfinance in Africa: Experience and Lessons from Selected African Countries', Washington D.C., International Monetary Fund.

Bateman, M., 2010, 'Why Doesn't Microfinance Work?: The Destructive Rise of Local Neoliberalism', London, Zed Books.

Berger A. N. And Mester L. J., 1997, 'Inside the Black Box: What Explains Differences in the Efficiencies of Financial Institutions?' *Journal of Banking and Finance*, 21, 895– 947.

Biekpe, N., 2004, 'Financing Small Businesses in Sub-Saharan Africa', *Journal of African Business*, 5:1, 29-44.

Buckley, G., 1997, 'Microfinance in Africa: Is It either the Problem or the Solution', Great

Britain, Elsevier Science Ltd.

Coelli T. J. And Perelman S., 1996, 'A Comparison of Parametric and Non- Parametric Distance Functions: With Application to European Railways', Crepp Discussion Paper, University Of Liege, Liege.

Coelli T., 1998, 'A Guide to Deap Version 2.1: A Data Envelopment Analysis (Computer) Program', Cepa Working Paper 96/08, University Of New England, Australia.

Epstein, M., 2005, 'Alleviating Global Poverty through Microfinance: Factors and Measures of Financial, Economic, and Social Performance', Houston, Rice University.

Farrell M. J., 1957, 'The Measurement of Productive Efficiency'. *Journal of the Royal Statistical Society,* A Cxx, Part 3: 253–290.

Freixas X. And Rochet J. C., 2008, *Microeconomics of Banking*, Cambridge, Ma: Mit Press, 2nd Ed.

Fried H. O., Knox Lovell C. A. And Schmidt S. S., 2008, *The Measurement of Productive Efficiency and Productivity Change*, New York: Oxford University Press, Doi: Oxford Scholarship Online. 3–91.

Gallardo, J., 2005, 'Comparative Review of Microfinance Regulatory Framework Issues in Benin, Ghana, and Tanzania', Washington, D.C., World Bank, Africa Region Financial Sector Group, Financial Sector Operations and Policy Department.

Gonzalez-Vega C., 2003, 'Deepening Rural Financial Markets: Macroeconomic, Policy and Political Dimensions', Paving The Way Forward For Rural Finance: An International Conference On Best Practices, Washington, D.C.

Grosskopf S. 1996, 'Statistical Inference and Nonparametric Efficiency Analysis, In Fried Lovel C. A. K. And Schmidt S. S., 2008, *The Measurement of Productive Efficiency and Application*. New York, Oxford University Press.

Haq, M. And Skully, M. And Pathan, S., 2010, 'Efficiency of Microfinance Institutions: A Data Envelopment Analysis', *Asia-Pacific Finance Markets*, 17:63-97.

Hartarska V., Caudill S. B. And Gropper D. M., 2006, 'The Cost Structure of Microfinance Institutions in Eastern Europe and Central Asia. Williamson Davidson Institute Working Paper 809.

Hollis A. And Sweetman A., 1998, 'Microcredit: What Can We Learn From The Past?' *World Development*, 26(10).

Hulme D. And Mosley P., 1996, *Finance Against Poverty*. London: Routledge.

Joshi M., 2005, 'Access to Credit by Hawkers: What Is Missing? Theory And Evidence From

India', Unpublished Ph.D. Thesis Submitted To The Ohio State University, Columbus, Ohio, USA.

Ledgerwood J., 1999, *Microfinance Handbook: An Institutional and Financial Perspective*. The World Bank/Sustainable Banking with the Poor (Sbp), Washington, D.C.

Leo N J. V., 2001, 'Cost Frontier Analysis Of Efficiency: An Application To The Peruvian Municipal Banks, Unpublished Ph.D. Thesis Submitted To The Ohio State University, Columbus, Ohio, USA.

Littlefield E., Murduch J. And Hashemi S., 2003, 'Is Microfinance An Effective Strategy To Reach The Millennium Development Goals?, Cgap Retrieved, November 2008.

Mersland R. And Strom R., 2008, 'Microfinance Mission Drift', Working Paper, Kristiansand 2008.

Microrate and Bank I. A. D., 2003, *Performance Indicators for Microfinance Institutions*. Technical Guide, 3rd Ed., Washington, Dc.

Mix and Cap, 2012, *2011 Sub-Saharan Africa Regional Snapshot*. February 2012. Mlima P. A. And Hjalmarsson L., 2002, 'Measurement of Inputs and Outputs in the Banking Industry', *Tanzanet Journal*, 3(1), 12–22. Norman M. And Stocker B., 1991, *Data Envelopment Analysis: The Assessment of Performance*. John Wiley and Sons, New York, 9–16.

Morduch, J., 1998, 'The Microfinance Schism', Cambridge, Harvard Institute for International Development.

Mosley, P. And Hulme, D., 1996, 'Microenterprise Finance: Is There a Conflict between Growth and Poverty Alleviation?' Reading, University Of Reading, Department Of Economics and Department of Agricultural Economics and Management.

Rock R., Otero M. And Saltzman S., 1998, 'Principles And Practices Of Microfinance Governance', Accion International, Retrieved 2 December 2008.

Segun, K. And Anjugam, M., 2013, 'Measuring the Efficiency of Sub-Saharan Africa's Microfinance Institutions and Its Drivers', *Annals Of Public And Cooperative Economics,* 84:4.

World Bank, 2003, *Microfinance in India: Issues, Challenges and Policy Options*. The World Bank, Washington D.C.

ACADEMIC VITA

ARIEL PROCHOWSKI

CURRENT ADDRESS:
220 Brill Hall
University Park, PA 16802

APROCHOWSKI22@GMAIL.COM
347.276.9094

PERMANENT ADDRESS:
656 Leonard Str., Apt. 1L
Brooklyn, NY 11222

EDUCATION

The Pennsylvania State University: Smeal College of Business — **University Park, PA**
Schreyer Honors College — *Expected Graduation: May 2015*
Bachelor of Science in Finance — Dean's List 7/7
Concentration in Macroeconomics, Money & Banking
Minor in Information Systems Management

RELEVANT EXPERIENCE

Apple, Inc. — **Cupertino, CA**
Global Commodity Procurement Intern — *May 2014 – Aug 2014*
- Evaluated new and existing suppliers from a financial, technical and operations standpoint to reduce the company's $3B+ in annual spend for LCD/display related technologies
- Engaged in cross-functional teams in execution of product/technology development, assessment of advanced technologies and mass production readiness to support new product launches

Verizon Communications, Inc. — **Plainview, NY**
Supply Chain Management Intern — *May 2013 – Aug 2013*
- Collaborated with management to oversee 34 union workers, perform analysis of supplier shipments, and identify vendor deficiencies resulting in significantly improved vendor compliance
- Improved new cross dock scanning procedure to raise performance by 16.12% and recommended process improvements for sustainability and compliance
- Completed 10 hours of training courses including Lean Six Sigma and Toastmasters International
- Analyzed nationwide transportation routes to identify systematic shipment issues
- Recommended viable carrier solutions to save the firm $180,000 annually

Global Brigades, Inc. — **Anomabu, Ghana**
Microfinance Intern — *July 2012 – Aug 2012*
- Assisted in a 475% expansion and diversification of a rural bank in the Ekumfi-Abuakwa community
- Developed a savings competition to foster a culture of savings increasing the total Fund balance by 583%
- Expanded an investing activity to pilot the floating of shares
- Fostered relationships with families in the community through cultural activities and house visits
- Created financial reports analyzing the developing condition of the community bank

Ernst & Young LLP — **New York, NY**
Emerging Leaders Program Extern — *June 2013 – June 2013*
- Selected to participate in a highly competitive program offering exposure to the firm, its services, and its clients
- Competed and placed 2nd in a 'Shark Tank' exercise judged by EY partners and associates

LEADERSHIP EXPERIENCE

Penn State International Business Association — **University Park, PA**
Co-Founder and President — *Aug 2011 – Jan 2015*
- Co-founded a new club, recruited candidates for echelon positions, and improved attendance by 250%
- Hosted a panel discussion with high ranking executives in Fortune 500 companies
- Developed a currency trading game to expose members to fluctuations and patterns in global currencies
- Lead extensive market update reports covering Europe, Asia, and the Americas
- Actively participated in Business Roundtable discussions with leaders of other business organizations on campus

Penn State Homecoming — **University Park, PA**
Funds Management Finance Captain — *Jan 2014 – Dec 2014*
- Oversaw, negotiated and approved 14 budgets for varying Homecoming committees, managing over $100,000

Penn State Residence Life — **University Park, PA**
Resident Assistant — *Jan 2013 – Present*
- Facilitated educational, social, and cultural programs for a building of 110 students to stimulate community
- Developed genuine relationships with students and assisted with personal and social matters
- Administered a residential disciplinary system for over 800 students in 7 coed residence halls

Penn State Dance Marathon (THON) — **University Park, PA**
Dancer and Finance Committee Fundraising Chair — *Aug 2011 – Present*
- Established and maintained relationships with individual, small business, corporate, and foundation donors raising $13.3 million for the Four Diamonds Fund's fight against pediatric cancer

SKILLS, HONORS & INTERESTS

- **Languages:** Bilingual Proficiency in English and Polish; Limited Working Proficiency in Spanish; Elementary Proficiency in Latin and Mandarin Chinese
- **Computer Programs:** Microsoft Excel, Access, PowerPoint, Outlook, Visio, SQL, Photoshop, HTML, SPSS Modeler
- **Scholarships:** Charles and Marjorie Ochroch Scholarship for Excellence, Polish and Slavic Federal Credit Union Scholarship, Penn State Academic Scholarship, George H. Deike Memorial Scholarship, Vito J. Pitta Scholarship
- **Interests:** Travel, Current Events, Community Service, Personal Investing, Clarinet, Piano, Judo, Soccer, Volleyball