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Abstract

The paper aims at measuring the performance of MFIs in MENA region with reference to all the MFIs around the world. The efficiency scores are derived using the nonparametric Data Envelopment Analysis (DEA) technique in order to calculate both Pure Technical Efficiency and Scale Efficiency. Bootstrapping is used in order to correct the Efficiency scores from their bias and to retrieve the correct inference when it comes to perform the second stage estimation. Data used are a non-balanced panel of 1179 MFIs from 103 countries covering the period from 2006 to 2012. The main aim of taking all the operating MFIs, for which, data are available is to produce a sound benchmark and evaluate the real performance of the MFIs in the MENA region compared to the rest of the world. In a second stage, a double censored multilevel regression is performed to assess the determinants of scale efficiency in the MFIs. The results show, among others, that financial performances enhance the possibility to operate under the optimal scale weather the MFI is too small or too big while social performances are reached more by too large MFIs.

Keywords: Microfinance Institutions, Bootstrapped DEA, Scale Efficiency

JEL Classifications: G21, C61, D61

ملخص

تهدف الورقة إلى قياس أداء مؤسسات التمويل المتناهى الصغر في منطقة الشرق الأوسط وشمال إفريقيا في إطار جميع مؤسسات التمويل الأصغر حول العالم. يتم اشتقاق درجات الكفاءة باستخدام تقنية تحليل تغلف البيانات اللامعلمية من أجل حساب الكفاءة التقنية البحتة وكفاءة الحجم. يستخدم وضع علامات تحديد من أجل تصحيح درجات الكفاءة من تحيزها والتوصل إلى الاستدلال الصحيح عند إجراء تقييم المرحلة الثانية. البيانات المستخدمة هي مجموعة غير متوازنة من 1179 مؤسسة تمويل أصغر من 103 دولة تغطي الفترة من 2006 إلى 2012. والهدف الرئيسي من أخذ جميع المؤسسات المتناهية الصغر العاملة ، والتي تتوفر بيانات عنها ، هو إنتاج معيار سليم وتقييم حقيقي للأداء الحقيقي لهّذه المؤسسات في منطقة الشرق الأوسط وشمال إفريقيا مقارنة ببقية دول العالم. وفي المرحلة الثانية ، يتم إجراء انحدار متعدد المستويات للرقابة المزدوجة لتقييم محددات كفاءة الحجم في مؤسسات التمويل الأصغر. تظهر النتائج ، من بين أمور أخرى ، أن الأداء المالي يعزز إمكانية العمل في ظل الحجم الأمثل ، سواء كانت مؤسسة التمويل الأصغر صغيرة جدًا أو كبيرة جدًا ، في حين يتم الوصول إلى الأداء الاجتماعي بواسطة مؤسسات التمويل الأصغر الكبيرة جدًا.

1. Introduction

In order to reach a national prosperity and achieve wealth, the poor and low income households must contribute to « the pursuit of happiness ». However, the lack of finance prevents the poor from achieving such ambitions. One of the goals of the MFI is to empower the most economically vulnerable people (jobless and the have-not's) by making financial resources available for them so they become active in the economy and therefore self-sufficient.

Supportive of MFIs say that their institutions aim at combating poverty. Their methods of target is the provision of micro credits, a kind of credits that enable people short of liquidity to setup small projects known these days as start up. MFIs become a creditor dealing with individuals and communities that want to change their life for the better. As a consequence, a higher income, thanks to the microfinance lending policy, people in precarious economic conditions can have access to education, decent housing and a better food diet and infrastructure. While ordinary banks deliberately exclude poor people from their services, because of the shortage of collateral requirements to secure their loan, MFIs enable those marginalized people to access credit, savings and insurance. This would help them to lead a more comfortable life. To sum up this, the microfinance oil clogged the miner human machine ignored by the ordinary banks.

However, MFI's role does not only consist in boosting the poor's standard of living but also in making financial profits. Despite the claim that microfinance institutions aim at salvaging the poor from poverty and loss, their seeking of profit cannot be denied.

Microfinance institutions concepts and practices are at the center of a controversy among contending the economic schools. In his article, Nzongang (2011) defined microfinance as the essence of financial services offered to those cannot access the conventional borrowing market. It has the aim of accomplishing a social mission but not at the expense of its basic mission, which is no different from traditional banks.

Two structures are depicted: Large MFIs whose efficiency depends on the cost and scale, and a small ones whose strength lies in the flexibility it offers. The large size structure has the advantage of obtaining a minimized cost that leads to a maximized gain at the expense of the quality of services it provides. Large size-institutions demand longer periods to process the client's documents and to fulfill their needs. The large size MFI has a low pace quality service. Besides, a small size MFI bears important costs which minimize the profits, but provide a better service quality.

The fact that both structures have strong points and shortcomings explains the controversy opposing issue. However, no paper has had clearly focalized this dilemma. Some papers dealt with the MFI's efficiency, social efficiency and scale but none was written about the system in its self. This is why in this article we will have to look more closely at the optimal size of the institution and how this factor contributes to its efficiency.

The methods of frontiers have become one of the most sophisticated tools, and more powerful for comparing companies (Berger et Humphrey, 1997). The SFA and DEA are considered to be the most used frontier, techniques that allow the measurement of productive efficiency. In our research, we are using an approach for a sample of MFIs working around the world, and to put the light on the MENA region from 2006 to 2012 using 3 inputs: number of employees,

operating costs and assets and four outputs: the portfolio of gross financial loans and income, financial revenues, the number of women borrowers and one an indicator that measures the weight in which the activities of the MFI institution can benefit the poorest, operating under the production approach.

The remainder of this article is structured as follows: The second section is a brief literature review on efficiency, scale and the application of non-parametric method to measure the efficiency of MFI's. Section 4 is dedicated to the methodology. Section 5 discusses the empirical results. Section 6 concludes.

2. Brief review of the literature on efficiency and scale efficiency measurement of microfinance institutions

Microfinance is a relatively new concept in the economic jargon, and has emerged to fill a gap in the economic space. It is considered as an efficient means to reduce poverty and support people who are economically active but lack the financial resources that would enable them to reap the best returns from their force of work (Morduch et al. 2002; Japonica Intersectoral 2003). Microfinance refers to as several financial services including deposits, loans and insurance to assist poor households in setting in motion their microenterprise.

It should be noted that it is in developing countries that MFIs have particularly proliferated. They have so proliferated as non-lucrative organizations with the primary aim to provide with access to financial services those people traditionally banned from ordinary banks. They are said to have a social face since their funds come from deposits and donations. Donors are special people with an acute sense of altruism; one may call them "Socio-economic Samaritans". The twin orientation financial and social of MFIs wins it the nickname ''The double bottom line''. This topic has engendered a debate called by Morduch (2000) ''The schism of microfinance''. This term refers to two large axes of microfinance called approaches .There is the welfarists' approach (Caroll 1979, Servet 2007). It is an approach that insures to eradicate poverty in order to achieve social welfare and well-being. The second approach sets itself an exclusively financial target, viability and perennity. MFIs are recognized by MIX Market into five categories: Non-Governmental Organization, Non-Bank Financial Institution (NBFI), Commercial Bank, Rural Bank, Coopertaive. NGOs are defined and classified as non-governmental organizations with non-lucrative objectives. Their basic activity is the granting of credits to the poor so as they have a better purchasing power and a minimum of well-being. Some NGOs provide credits, in addition to basic health and education services like literacy programs. ONGs are not subject to authorities' reglementation or to bank supervision. Yet they have to abide by the civil and commercial laws of the country where they are based (United Nations, 2006).

According to Koopmans (1951), efficiency is a fundamental concept in the economic theory. Also, total efficiency is defined as the achievement or the accomplishment of Parito's Optimum. The efficiency returns the quality degree with which the economic unities accomplish their goals. This causes problems with efficiency rate. These questions have been discussed and there has been an agreement throughout literature (Charnes & Cooper, 1978) that the economic efficiency as a modern and numerical measurement of performance is due to Farell (1957) and Koopmans (1951) who defined a simple measurement of "radial efficiency". Mouzas (2006) argued that the success of an organization is characterized by

efficiency rather than effectiveness. Hence, efficiency is not a measure of success and market success, but rather a measure of productivity as well as operational excellence, which ultimately proves that efficiency, is linked to cost reduction and the consolidation of operating margins.

In the context of efficiency, several previous works have been mentioned by several researchers. Ben Soltane (2008) argued that an MFI is considered as efficient only if it manages optimizing the resources available to it in order to meet simultaneously both social financial objectives. Several studies have analyzed efficiency in several countries. Among these studies we mention Nghiem (2004), Gutierrez-Nieto et al. (2005), Abdul Qayyum Ahmad (2006), and Sufian (2006) who used data from Vietnam, Latin America, South Asia, and Malaysia respectively. Gutierrez-Nieto et al. (2005) Attempted to assess the main factors that may affect technical efficiency using 30 Latin American MFIs. They found that, among others, MFIs performance is affected by the its geographical localization and its legal status. Following the same fashin, Ben Abdelkader et al. (2015) prove also in their study that the status of MFI is one of the determinants of efficiency.

In their article, Mahindra et al. (2017) analyzed the efficiency of MFIs and more specifically they studied the impact of age and size on the financial and social efficiency of MFIs. They found that older MFIs behave better than young ones in terms of achieving financial goals. Mamiza et al. (2010) analyzed the cost efficiency of a sample of thirty-nine MFIs in Africa and Latin America. The results show that non-governmental MFIs are the most efficient. Baumann (2005) established a relationship between MFI efficiency and productivity. Thus, after an elaborate analysis, Lafourcade et al (2005) show that the staff of African MFIs are highly productive. This elevate productivity is an indication of their intensive use of group loans as a means of realizing economies of scale.

On the topic of microfinance performance, a lot of studies show that numerous MFIs have enhanced their efficiency and become self-sufficient (United Nations 2011). One of the solutions that help the MFI to ameliorate its efficiency is changing its size in order to operate under a more optimal size that permits to reduce costs.

First, in the theory of market, failure gives rise to the differences between large and small firms; no loan agreement can take place without costs, and guaranties are demanded while risks are disliked (Arrow 1996). The bigger is the firm's size, the higher are its risk and costs. This theory can be explained as follow: between large and small firms, there are measurable differences in capital intensity. These differences affect scale such as total assets (Rajan et Zingales, 1998), equity, employees (Rosen, 1982), sales and ROA (Roberts 1977). It seems that Large MFIs have the advantage of bargaining interest rates for long-term debts, while small MFIs have not this advantage and are financed at a higher capital cost for shorter term. Smith (1776) pointed out that operating scale is limited by market size.

Secondly, unit cost is reduced when there is increase the size and volume of output. It is the economics of scale theory. (Hodgson 2010) says that a number of benefits result from the efficiency related to scale in competitive markets. According to this theory, customers will go to the best providers who can give them the best products and services at the most attractive costs. Besides, some firms are immune to failure because of their large size and they play a leading role in the national economy and if they happen to fail, they would jeopardize the

whole economy (Sorkin 2010). That's why the central bank rushes to salvage these large firms, for example the US Federal Reserve pumps large amounts in State banks to leverage them. The geological concept of 'seismic waves' is often applied to the economic field as individual economies are interrelated, waves crises move from their epicenter and start propagating farther out (Benston 1965). Large firms can be a promoter of the economic prosperity but if they happen to fail, the effect can be felt in many sectors in many parts of the world. So the impact of failure of large firms can be detrimental to other economies while smaller firms will have a limited effect (Krugman 2010). Trong et al. (2014) judge that larger MFIs are more efficient and more profitable than small and medium sized MFIs. Their conclusion is based on statistical data collected for the period between 1996 and 2009. The small MFIs scored poorly in matter of sustainability. Larger MFIs supplied significantly larger loans than small MFIs. These loans were of 2.5 to 5 times bigger in size. This large MFIs efficiency and profitability isn't without implications: cost per borrower was 1.2 -2 times higher (MIX Market 2013). A 2002 Micro-Banking Bulletin survey yielded important results: large MFIs particularly in Latin America accessed more funds and achieved higher financial leveraging than small ones. Funding by large MFIs counts for a greater proportion of commercial debts, which means that large MFIs are more deeply integrated than smaller ones (WWB 2004). Understanding the differences between large and small MFIs is of primary importance if one has to choose the optimal scale, which scale is the most suitable one for their operations and regulations in order to maintain profitability self-sufficiency and viability. Berger and Humphrey (1997) establish sound measurement criteria for identifying optimal size by understanding the relation existing between inputs and outputs. In this context, to determine whether large MFIs are more financially and socially efficient than small ones, Gonzalez (2007) considers that size is the fundamental driver of the efficiency of MFIs, compared to the different possible ingredients. The study of Ben Soltan (2008) shows that MFIs size negatively impacts their efficiency and at the same time it shows that MFIs of medium size are more efficient. A somewhat hasty conclusion might be that "the key point in these organizations resides in their capacity to establish confidence with the borrowers thanks to their size reverberates positively by a decrease of transaction costs''. Several studies on the efficiency of the MFIs and its determinants have been carried out. Yet scarcity of information on the potential of size on the efficiency of MFIs leaves us unable to have clear picture of the financial sustainability and the extent of poverty reduction.

Cull and Al (2011) must be recognized as having done the few theoretical and empirical studies pertaining to this particular issue. There is abundant literature on the efficiency of banks and MFIs which attests to the fact that size is a decisive factor in banks efficiency, size being the physical expression of firms to compete with contenders in the global market space (Gonzalez, 2007), as well as firm's market awareness. Previous empirical studies lead us to draw the conclusion that it is very important to look deeply at how size influences the social and financial efficiency of MFIs. This was stated by Trong et al. (2014) that downscaling as well as upscaling fuels the growth of MFIs with the preset objectives of achieving their social mission and preventing a macroeconomic setback. To evaluate the efficiency scale of MFIs and specify the different determinants influencing efficiency, authors used the DEA method which is considered as the most relevant for the evaluation of efficiency of MFIs. Mamiza et al. (2009), tried to identify the most efficient type of MFI using DEA model. The results show

that non-governmental MFIs are the most efficient under the production approach, with the maintenance of both objectives that are the financial sustainability and the fight against poverty.

Contrary to previous empirical studies using DEA model which bears a number of disadvantages. (Simar and Wilson 1998, 2000) noted that traditional DEA methodology evaluation may reveal a bias and uncertainty about the validity of the sample, which puts the whole argument in a vicious circle. Our study contributes to the existing literature on microfinance by suggesting the use of a two-stage double bootstrap approach (Simar and Wilson, 2000). From the empirical studies which are treated with reference to this method we cite (Mahindra Wijestiri, Laura Vigano, Michele Meoli, 2015). This study examines technical efficiency and its determinants of a sample consisting of 36 Sri Lankan MFIs. The results of the regression show that age, assets are determinants of financial efficiency age, type of the institution and ROA are the central determinants of social efficiency.

3. Two-stages Data Envelopment Analysis

Opting for DEA approach is mainly due to its capacity to handle the issue of MFIs' performance with their financial and social outcome components simultaneously. DEA technique was pioneered thanks to the work of Charnes and al (1978) who used linear programming to identify the efficiency frontier based on a sample of observation comprising data on the amounts of outputs produced and the mix of inputs engaged in the production process. DEA has several advantages such as its capacity to describe the technology without assuming any parametric form for the production function and to handle simultaneously a multi-input multi-output process. Each unit is assumed as an independent decision maker and it is commonly called in the DEA jargon Decision-Making Unit (DMU).

For this article, we implemented two widely used DEA models: CCR-model (Charnes et al. 1978) and the BCC-model (Banker et al. 1984).

Two orientations are possible: orientation inputs or orientation outputs. A DEA model can be oriented towards inputs or outputs. Concerning the input orientation, the DEA model will minimize inputs for a fixed amount of outputs; it indicates how much an institution can reduce its inputs although maintaining the same output level. For the output orientation, the DEA model will maximize outputs for a clear and determined level of inputs; it shows how much an institution can make higher its outputs with the equivalent quantity of inputs.

The sweeping statement of the DEA model has been developed to support the CCR model (Charnes et al., 1978, Banker et al., 1984). The input-oriented CCR model assumes constant returns to Scale (CRS) is:

$$Min_{(\theta,\lambda)}\theta \qquad (1)$$

Subject to

$$\theta_0 x_{ij0} - \sum_j \lambda_j \; x_{ij} \geq 0, i = 1, \dots, m$$

$$\sum_{j=1}^{n} \lambda_j \; y_{rj} \geq y_{rj0}, r = 1, \dots, s$$

$\lambda_j \geq 0, \forall j$

where $\boldsymbol{y_{rj}}$ stands for the quantity of the r-th output produced by unit j, $\boldsymbol{x_{ij}}$ stands for the quantity of the i-th input used by the j-th unit, $\boldsymbol{\lambda_j}$ are the weights of the j-th unit, and $\boldsymbol{\theta_0}$ is the discrepancy factor for DMU_{j0} under evaluation which is the ratio of actual input index to the potential one if the unit was fully efficient. This linear programing problem must be solved separately for each of the DMUs in the sample, to obtain a value of $\boldsymbol{\theta}$ for each DMU. The efficiency score is bounded between 0 and 1: a technically efficient DMU will have a score of 1.

The BCC model (Banker, Charnes and Cooper, 1984) is an extention of CCR model. The authors have added a convexity constraint ($\sum_{j=1}^{n} \boldsymbol{\lambda_j} = 1$) in order to assess the possibility of Variable Returns to Scale (VRS).

The input-oriented BCC model, assuming variable returns to scale (VRS) is:

$$Min_{(\theta,\lambda)}\theta \tag{2}$$

Subject to

$$\theta_0 x_{ij0} - \sum_j \lambda_j \ x_{ij} \geq 0, i = 1, \dots, m$$

$$\sum_{j=1}^{n} \lambda_j \ y_{rj} \geq y_{rj0}, r = 1, \dots, s$$

$$\lambda_j \geq 0, \forall j$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

The difference between these two models is the behavior of the returns to scale. The CCR model imposes constant returns to scale leading to the estimation of efficiency scores θ_{CCR} in which to components are embedded: Pure Efficiency and Scale Efficiency. Pure efficiency is the discrepancy between observed and potential input-output mix due to managerial and organizational failure. While Scale Efficiency is a discrepancy due to a non-optimal production scale. DMUs may operate under Increasing Returns to Scale (IRS) when their size is smaller than their optimal operating size or under Decreasing Returns to Scale (IRS) when their size is larger than their optimal operating size. BCC model, by relaxing the assumption of Constant Returns to Scale, produces Efficiency Scores $\boldsymbol{\theta_{BCC}}$ that only measure the pure efficiency. Based on both measures of technical efficiency, Färe et al. (1994) have a measure of Scale Efficiency (SE hereafter) as following:

$$SE = \frac{\boldsymbol{\theta_{CCR}}}{\boldsymbol{\theta_{BCC}}} \tag{3}$$

When $SE < 1$, the DMU is said to be non-scale efficient, ie. it operate under a non-optimal scale. The DMU is scale efficient when $SE = 1$.

In order to identify the type of scale inefficiency (IRS vs DRS) Technical Efficiency scores under Non Increasing Return to Scale (NIRS) have to be estimated:

$$Min_{(\theta,\lambda)}\theta \tag{4}$$

Subject to

$$\theta_0 x_{ij0} - \sum_j \lambda_j \ x_{ij} \geq 0, i = 1, \dots, m$$

$$\sum_{j=1}^{n} \lambda_j \ y_{rj} \geq y_{rj0}, r = 1, \dots, s$$

$$\lambda_j \ \geq 0, \forall j$$

$$\sum_{j=1}^{n} \lambda_j \ \leq 1$$

Type of scale inefficiency can be stated by comparing $\boldsymbol{\theta_{CCR}}$ and $\boldsymbol{\theta_{NIRS}}$. Following Färe et al. (1994), the following ratio:

$$SE_2 = \frac{\boldsymbol{\theta_{CCR}}}{\boldsymbol{\theta_{NIAR}}} \quad (5)$$

can be used. When *SE* < 1, Increasing Returns to Scale are inferred when $SE_2 = 1$, and Decreasing Returns to Scale are inferred when $SE_2 < 1$.

Our study is composed of two steps:

In the first stage bootstrap DEA approach, the three DEA models (1), (2) and (4) are run. The first stage of the analysis allows us to measure pure technical efficiency under variable returns to scale (VRS). The resulting score goes from 0 to 1. MFIs with scores less than 1 are judged to be inefficient and there inputs and outputs values do not allow them to reach the corresponding reference point on the production frontier. Scale Efficiency scores along with their type are retrieved based on (3) and (5).

In the first stage, we use the bootstrap technique (Efron 1979) based on the idea that we can approach the data generating Process (DGP). Based on the algorithm proposed by Simar and Wilson (2000), we adopt the bootstrap algorithm as a first step in the analysis.

For the second stage of the analysis, Simar and Wilson (1998) have preconized the use of censored regression. They demonstrated as well, using Monte Carlo experiments that Efficiency scores derived from DEA are correlated with the error term since the estimation of each unit's score implies the consideration of all the sample's scores. As a consequence, standard estimation and inference technique fail to produce consistent and unbiased estimates when it comes to estimate a model in which efficiency scores are the dependent variable. They overcome this issue by proposing a procedure based on bootstrapping that allows the retrieving of the correct inference of the estimates along with the correction of the bias in the efficiency scores. Therefore, like Simar and Wilson (2007) we apply the double bootstrap method. The method used in this article allows us to attain more considerable conclusions since this approach takes into account bias and serial correlation of the estimates, therefore, provides a valid inference. This method is a solution to the limitations of the conventional DEA.

3. Methodology

We considered for the needs of our article a sample of 1179 institutions all-around the world. The database is issued from MIX MARKET, which is considered as most famous database

dealing with the collection, the analysis and dissemination of the MFIs' financial statements. We use most recent database the Microfinance Information Exchange (MIX) available at hand which is a non-balanced panel from 2006 to 2012. It is widely admitted that MIX is the microfinance platform that provides the most reliable and standardized information about a large number of MFIs operating in different geographic regions (Servin et al., 2012). MIX proposes both financial and social information about almost all the MFIs in the world. MIX Database was extensively used by several authors (e.g. Gutierrez‐Niéto et al., 2009; Nawaz, 2010;Ahlin et al., 2011; Hermes et al., 2011; Servin et al., 2012; Louis et al., 2013; Shahriar et al., 2015;Wijesiri, 2016).

MENA region a very developed microfinance sector, experimented, and dynamic characterized by a variety of the MFIs which persuaded us to carry out this study.

The choice of including as many MFIs as we do although our main concern is to assess the performance of those institution in MENA region is justified by the fact that we wanted to consider the most realistic benchmark to be able to appreciate the real MENA region MFIs' performance compared to what is observed all-around the world since DEA produces a sample based benchmark.

In the frame of this DEA method, a debate has raised among searchers who see the financial institution as unit of intermediation (Athanassopoulos, 1997). According to production approach, the financial institution is treated as companies that use physical inputs, and employees and pay money to obtain deposits, provide loans and perceive costs in the same manner that a factory uses capital, working hand and raw material product to be sold. In the frame of intermediation, the financial institution seeks to realize profits through acting as intermediates in series of financial operations. Collecting deposits and awarding loans (Sealy et al. 1977).

The selection of inputs and outputs is the key in the calculation of efficiency scores by the DEA Gutiérrez (2009). After a thorough review of the literature on DEA and microfinance institutions, we opted for three inputs and four outputs. The three inputs are standard in the literature: assets, operating costs and number of employees. For the outputs there are two of them financial which are the portfolio of gross financial loans and income, and for the two remaining are two social products, the number of women borrowers and an indicator that measures the weight in which the activities of the MFI institution can benefit the poorest. Variables are discussed below.

Assets: Berger and Huphrey has included the value of assets in financial efficiency models in 1997. According to MixMarket, assets is defined as "The total of all net assets."

Operating costs: were introduced by Berger and Humphrey (1197) and Athanassopoulos (1997) and Pastor (1997).The MixMarket defines the operating costs as "expenses related to operations such as all personnel, rent and utilities, transformation, office supplies and depreciation."

Number of employees: Athanassopoulos (1997), Serman and Gold(1985) and Berger Hamphrey(1997) proposed the number of employees as 'the individuals who are actively employed by the MFI'.

Number of Women borrowers: Poverty goes beyond the concept of an economic issue. It is rather social aspect. This brings to the surface the issue of women empowerment. Microcredit

enabled women to raise their status at home in their society (Amin et Al 1994). Microcredit contributes to the empowerment of women by emphasizing their roles and strengthening their roles within their families (Hashemi et al, 1996). So, that they can take part effectively in the development (Goetz and Gupa, 1996).The MixMarket measures the number of active women who are female.

Indicator of benefit to the poorest: We have followed Gutiérrez-Nieto et al. (2009) by adopting their measure of outreach:

$$POV_i = \frac{K_i - \min(K)}{range(K)}$$

where K_i is the Average loan balance per borrower for the i-th MFI divided by the Gross National Income per capita of the country in which this MFI operates. *Min(K)* stands for the minimum value over all MFIs in the sample, while the *Range(K)* is the range of *K* over all the sample for each year. The indicator will take a value between 0 (weak outreach of poor people) and 1 (strong outreach of poor people). As an output, this indicator is multiplied by the number of active borrowers in order to depict the number of the poorest borrowers that an MFI serves.

Financial revenue: Pastor (1999) used the financial revenue which was defined by the MixMarket as 'revenue generated from the gross loan portfolio and from investments'.

Descriptive statistics are in table .1. We have tried to bring a first insight on the situation of the MFIs in the MENA region compared to the rest of the world. As can be seen from the mean values of the outputs and inputs, MFIs in the MENA region are smaller than the average in the world. This statement can guide us when it comes to the analysis of scale efficiency. For the social output, the mean percentage of women borrowers is slightly higher in the MENA region compared to the world average even if this difference is not significant. However, when it comes to the outreach, MENA region's records a significant lower value of the outreach compared to the whole sample. We might link a priori this gap to the difference in operational size, which can lead to some important results.

Stage 1

The three input-oriented DEA models in (1), (2) and (4) are run using the R package Benchmarking (Bogetoft et al. 2015). We have produced B = 2000 replicates for each model, which is a satisfactory number of replicates when the aim is to retrieve a good inference for confidence intervals and hypothesis testing (Efron et al. 1994). The models are run for each year separately in order to avoid the problem of misleadingly considering annual technological change (the shift of the frontier from year to year) as technical efficiency.

Based on these estimates, Bias-corrected efficiency score are derived. Moreover, the Overall Technical efficiency scores (Scores derived under CRS) can be split into Pure Efficiency (scores under VRS) and Scale Effect by making use of (3). The nature of Scale inefficiency is identified by making use of (5).

Although the sample contain 105 countries from all around the world, our focus when it comes to the analysis of the results will be granted to MENA region since the aim of this article is to address the issue of assessing the true performance of this region compared to

what is performed all around the world. Nine MENA countries are present in the sample which are[3], Egypt, Iraq, Jordan, Lebanon, Morocco, Palestine, Syria, Tunisia and Yemen.

The results show that during the sample period, MENA region was the third best performer in terms of Technical efficiency after Eastern Europe and Central Asia and Latin America and The Caribbean. However, when it comes to scale efficiency, MENA seems to have weak performance compared to the rest of the regions. This means that MFIs in the MENA fail to reach an optimal operating scale. Columns 5-7 of Table .1 exhibit the distribution of type of scale efficiency by region. Although MENA has the second highest percentage of scale efficient observations, it has also the lowest percentage of small scale MFIs (less than 1%).

In Figure .1, times series for the estimates of the scale efficiency of every region from 2006 to 2012 are plotted. We remark that Eastern Europe and Central Asia has the highest rate with an average of 0.9402 and South Asia the lowest rate with an average of 0.8049. MENA region was the third best performer in term of scale efficiency until 2011. In 2012 the average scale efficiency has dramatically dropped down to be the worst performer in the world. This is due to the Arab spring in 2011 that caused a great deal of social and political unrest in Egypt, Syria, Tunisia and Yemen.

The focus on MENA region permits to show the differences between the countries in this region. Figure .3 summarizes the sample means for the Overall efficiency (CRS), pure efficiency (VRS) and Scale Efficiency (SE) for each country. Syria, Jordan and Iraq were the best performers in terms of Overall Efficiency during the sample period with efficiency scores range between 0.75 and 0.78. Egypt and Yemen had the lowest efficiency scores in the region with averages of 0.58 and 0.61 respectively. The same leading countries are observed when it comes to the analysis of scale efficiency. MFIs in Syria, Jordan and Iraq seem to operate at a scale close to the optimal scale. In fact, several factors influence scale efficiency. Social, political and economic conditions can affect performances either positively or negatively.

Figure 4 shows the annual levels of scale efficiency rates of the different countries in the MENA region from 2006 to 2012. A dramatic fall can be depicted among almost all the countries between 2010 and 2011.

Until 2011, Tunisia, Egypt, Yemen and Syria have had political and economic systems that were stable with stable economic indicators that permit to the MFI to operate in relatively normal conditions. The political and social unrest caused by the revolution in these countries have had a negative impact on the MFIs in these countries precluding them to operate efficiently.

Second Stage: Bootstrapped Censored and LOGIT estimation

The second stage permits to identify the main factors that may affect the ability of a DMU to reach its optimal operating scale. Two assumptions are to be tested at this level of the analysis.

The first assumption is that, apart from idiosyncratic factors that may affect its performance such as its financial and social performances, its cost structures, etc. MFIs are affected directly by the economic and social environment of the country in which they are based in. For this reason, multilevel model is adopted for the second stage when a set of contextual

[3] Turkey was excluded from the analysis since it has only 3 observation points which is not representative.

variables is introduced at the country level. Therefore, MFIs operating in the same country share the same contextual factors. Three contextual factors are retained for the estimation and represent the four most relevant governance quality dimensions for the MFIs context. The data are gathered from the Worldwide Governance Indicators (WGI), a dataset hold by the World Bank and aiming at providing a perception based scores for the governance quality worldwide.

All the variables are measured as the percentile rank among all countries, ranges from 0 (lowest) to 100 (highest) rank, of the country in which operates the MFI at each year sample.

gov_eff: Reflects the quality perceptions among several national agents (civil society, entrepreneurs, etc.) of public and civil services and the degree of their independence from political pressures. It measures also the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

cont_cor: this variable Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Contrary to the countries where the government plays a major role in maintaining a political and economic stability, weak government allow indirectly the spread of corruption among the different fields. This disfunctioning of the governmental institutions might affect the efficiency of MFIs.

Rule_law: Reflects the agents' confidence in rules of society, and in the quality of contract enforcement, property rights, the police, and the courts. The quality of legislation and the effectiveness in imposing the law is a key feature of a sane social and economic environment in which peoples and institution can operate under the same rules and with equal chances. The rule of law in a country might affect substantially the performance of the MFIs by giving them more transparency and less problems related to moral hazard and adverse selection.

With the contextual factors described above, we selected a set of the most relevant idiosyncratic factors that might affect the ability of an MFI to reach its optimal scale. The physical size of an MFI is proxied by its assets. Note that other proxies were used in the literature such as Gross Loan Portfolio or the Average Loan Size (Zacharias, 2008), or the Number of active borrowers (Huq, 2017). The choice of Assets as a proxy for the MFIs size is driven by the availability of data for more observation points and a high correlation with the other proxies. Assets and the squared value of Assets are introduced as factors in order to assess any possible threshold effect for the size since the quadratic relationship can show the optimal level of assets at which an MFI can attain its optimal scale.

The impact of financial performance of the MFIs is depicted through their Return to Assets (ROA) as a profitability indicator and their Debt to Equity Ratio (DER) as a financial robustness indicator. In order to assess the impact of the portfolio risk on the scale performance, the percentage of the Portfolio at risk at 30 days (Risk30) is introduced as a covariate.

In order to assess the impact of the social performances, Percentage of Women borrowers (W) and the outreach index are introduced as covariates in the second stage. While the outreach index is an indicator for the overall social performance in reaching the most poor people in a country, Percentage of Women borrowers is an important indicator to tackle the gender issue

and see how reaching vulnerable people, which is the ultimate social goal for an MFI, can affect its chances to operate under an optimal size.

With all the continuous variables described above, a set of dummy variables is introduced. The estimated model permits to exhibit the differences in terms of scale efficiency between the regions (Africa is set as a reference). We introduced also two dummy variables to depict how being a Young or a Mature MFI may affect its scale performance[4]. Since the legal status of an MFI might have an impact on the possibility to reach an optimal operating size, four broad legal status are identified: Bank / Credit Union / Cooperatives (BCUC), Non-Banking and Financial Institutions (NBFI), Rural Banks (RB), and Non-Governmental Organizations (NGO kept as reference group).

The second assumption made in this article is that the impact of both the idiosyncratic and contextual factors may differ depending on the nature of the scale inefficiency. Recall that the scale efficiency scores indicate how far a DMU from the scale efficiency is and don't distinguish between being in increasing scale efficiency or decreasing scale efficiency. Based on (5), we were able to characterize the type of scale efficiency for each observation and for each bootstrap. To relax the assumption of the symmetry of the effect, the sample is split into two subsamples: observations under IRS (too small size) and observations under DRS (too large size). Up to our knowledge, no prior research has adopted this approach.

Following Simar et al. (2007), we consider that the dependent variable as double censored since scale efficiency scores are censored at 0 from the left and at 1 from the right). Adopting censored regression leads to more consistent estimates compared to standard linear models.

Based on the protocol described above, two models are estimated: the first model is for observations situated at the IRS zone and the second is for the observations situated on the DRS zone. For the two models, Scale efficient observations are introduced as a benchmark. So, the censored models permit to assess how idiosyncratic and contextual factors may affect MFIs in moving from scale inefficiency to scale efficiency.

In order to bring more robustness to the analysis, and to avoid the use of punctual estimation of the scale efficiency scores, we transform them into a dummy variable equal to 1 when the observation a scale efficient and 0 otherwise. Here again observations under IRS and DRS are separated and two logit regressions are performed separately. Logit estimation is a way to figure out how retained factors can impact the probability that an MFI can reach the full scale efficiency.

4. Results and Discussion

Bootstrapped censored and logit models are estimated for each scale efficiency group in the sample. The results are presented in Tables. 3. Significance is based on the bootstrap confidence intervals.

The coefficients linked to the regions dummies seem to confirm our finding when the regional averages are analyzed. Holding all other variable unchanged, Eastern Europe and Central Asia has the highest level of scale efficiency in the sample. MENA region has on the average the second or the third best performance depending on the subsample.

[4] New MFIs which age is less than 5 years are set as a control group.

The results show that Banks, Credit Unions and Cooperatives along with the Non-Banking and Financial Institution are likely to reach the optimal operating size when they are operating above it. Based on the estimates of the two dummy variables indicating the age of the MFIs, it is shown that the age of an MFI doesn't have any impact on its chances to reach full scale efficiency weather it is too small or too large. This result implies that there is no experience effect to be exploited to move toward an optimal size whatever the starting point. Financial robustness, proxied by Debt to Equity Ratio (DER), seems to have no significant effect on scale efficiency. On the other side, it is shown that the percentage of risky loans tends to affect negatively the ability of an MFI to reach scale optimality. This result implies that non performant loans tend to bring more difficulties for an MFI to operate under its optimal scale whether it is too small or too large.

The Size of an MFI is depicted through the value of its assets. As explained above, The model allows the assessment of a possible non-constant marginal effect through the quadratic term $1/2\ln A^2$. the estimation results show that the impact of MFIs size on reaching scale efficiency differs from whether the MFI is Too small or too large. For MFIS operating under IRS, the marginal effect of the size is significantly non-linear and for all the sample points this effect is found to be Positive ranging from 0.003 to 0.084 with an average of 0.083 (Figure. 5). While for MFIs under DRS, the quadratic term is found to be non-significant therefor, only the intercept coefficient counts. For MFIs under DRS the effect of the size in negative which is straightforward implying that id large size MFIs want to adjust to reach an optimal operating scale they will have to reduce their assets, which means that they will have to reduce their scope and the extent of their activity.

The impact of social performance on the ability of MFIs to reach an optimal operating scale is depicted through two measures of social outcome: The benefits to poorest (POV) and the percentage of women borrowers (W). The estimation results show that MFIs operating under IRS have less chance to reach the most vulnerable population (the poorest and women). On the other side, MFIs operating above the optimal scale are likely to reach more efficiently this vulnerable population. This finding has a major importance since it helps to dismantle the puzzle linked to scale efficiency and social performance implying that large MFI (operating above their optimal size) reach more ability to reach the most vulnerable population and are more socially efficient.

As expected, contextual variables describing the political and legislative framework MFIs are operating seems to have an impact on their possibility to adjust their scale. Government efficiency and the rule of law have the most significant impact on MFIs scale performance.

References

Abdul Qayyum A, Ahmad M (2006) Efficiency and sustainability of microfinance institutions in South Asia, Pakistan Institute of Development Economics (PIDE), Australia

Amin R, Ahmed AU, Chowdhury J and Ahmed M (1994). Poor women's participation in income-generating projects and their fertility regulation in rural Bangladesh: Evidence from a recent survey. World Dev 22: 555–565.

Arrow, K. J. (1969). The organisation of economic activity: issues pertinent to the choice of market versus non-market allocation. In Joint Economic Committee (Ed.), The analysis and evaluation of public expenditures: the PBB system (pp. 47–64). Washington D.C

Athanassopoulos AD (1997). Service quality and operating efficiency synergies for management control in the provision of financial services: Evidence from Greek bank branches. Eur J Opl Res 98: 300–313

Banker et al (1984) Some models for estimating technical and scale inefficiencies in DEA. Manage sci 30:1078–1092

Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. Management Science, 30(9), 1078–1092.

Baumann, Ted, 2004, "Pro-poor microcredit in South Africa: cost-efficiency and productivity of South African pro-poor microfinance institutions," Development Southern Africa, Vol. 21, No. 5; pp. 785-79

Baumann, T. (2005). Pro poor microcredit in South Africa: Cost efficiency and productivity of South African pro-poor microfinance institutions. Journal of Microfinance, 7(1), 95–118.

Beck, T., Demirguc-Kunt, A., Laeven, L., & Levine, R. (2008). Finance, firm size and growth. Journal of Money, Credit, and Banking, 40(7), 1379–1405.

Benston, George J., 1965, "Branch Banking and Economies of Scale," The Journal of Finance, Vol. 20, No. 2; pp. 312-331

Ben Abdelkader Ines, Hathroubi Salem , Ben Jemaa Mohamed Mekki (2015) :Microfinance Institutions' Efficiency in the MENA Region: a Bootstrap-DEA approach.

Ben Soltane, B. (2008) Efficiency of Microfinance Institutions in the Mediterranean: An Application of DEA. Transition studies review, Mediterranean and Middle East Papers, 15(2), pp. 343-354

Berger, Allen N. and Humphrey, David B., 1997, "Efficiency of Financial Institutions: International Survey and Directions for Future Research," European Journal of Operational Research, Vol. 98, No. 2; pp. 175-212.

Berger AN, Humphrey DB (1997) Efficiency of financial institutions: international survey and directions for future research. Eur J Oper Res 98:175–212.

Charnes, A., & Cooper, W. W. (1962). Programming with linear fractionals. Naval Research Quarterly, 9, 181–186.

Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. European Journal of Operational Research, 2(6), 429–444

Dario, C., Simar , L.,2005.Introducing environmental variables in nonparametric frontier models: a probabilistic approach. J. Prod. Anal. 24,93-121.

Debreu, G., 1951. The coefficient of resource utilisation. Econometrica 19, 273-292.

Dichter TW (1996). Questioning the future of NGOs in microfinance. J Int Dev 8: 259–269.

Efron, B,1979.Bootstrap methods: another look at the jackknife.Ann.Stat.7, 1-16.

Farrell, M. J., 1957. The measurement of productive efficiency. Journal of Royal Statistical Society, Series A, CXX, 253-281

Goetz AM and Gupta RS (1996). Who takes the credit? Gender, power and control over loan use in rural credit programmes in Bangladesh. World Dev 24: 45–63.

Gutie rrez-Nieto B, Serrano-Cinca C, Mar-Molinero C (2005) Microfinance institutions and efficiency. Int J Manage Sci 35(2):131–142.

Guitierrez-Nieto, B., Serrano-Cinca, C., & Molinero, C. M. (2006). Microfinance institutions and efficiency. OMEGA, International Journal of Management Science, 35(2), 131–142.

Gutierrez-Nieto B, Serrano-Cinca C and Mar Molinero C (2007). Microfinance institutions and efficiency. Omega Int J Mngt Sci 35: 131–142.

Gutierrez-Nieto B, Serrano-Cinca C. (2007). 'Factors explaining the rating of microfinance institutions'. Nonprofit Voluntary Sector Quart 36: 439–464

Guitiérrez-Nieto, B., Serrano-Cinca, C. and Molinero, M. (2009) Social efficiency in microfinance institutions. Journal of the Operational Research Society, Vol. 60, pp. 104-119.

Gur, N. (2012). Financial constraints, quality of institutions and firm size: what do perceptions tell us? Eurasian Economic Review, 2(2), 17–36

Haq, M., Skully, M. and Pathan, S. (2010) Efficiency of Microfinance Institutions: A Data envelopment analysis", Asia-Pacific Financial Markets, Vol. 17, pp. 63-97.

Hashemi SM, Schuler SR and Riley AP (1996). Rural credit programs and women's empowerment in Bangladesh. World Dev 24: 635–653.

Hermes, N., Lensink, R., & Meesters, A. (2011). Outreach and efficiency of microfinance institutions. World Development, Elsevier, 39(6), 938–948

Hodgson, S. (2010). Why scale is important and how to achieve it? Microfinance Insights, 17, 10–11.

Japonica Intersectoral (2003) Impact of microfinance on poverty reduction.

Koopmans, T.C., 1951. An analysis of production as an efficient combination of activities. in T.C. Koopmans, Ed., Activity Analysis of Production and Allocation, Cowles Commission for Research in Economics, Monograph13, Wiley, New York**.**

Krugman, P. (2010). Stop stop too big to fail. The New York Times, The Opinion Pages, 21 April 2010. http://krugman.blogs.nytimes.com/2010/04/21/stop-stop-too-big-to-fail/. Accessed 10 April 2012

Lafourcade, A., Isern, J., Mwangi, P., & Brown, M. (2005). Overview of the outreach and financial performance of microfinance institutions on Africa. www.mixmarket.org. (accessed in Jun. 2006).

Mahindra Wijesiri, Laura Vigano, Michele Meoli, (2015) , Efficiency of microfinance institutions in Sri Lanka : a two – stage double bootstrap DEA approach

MicroRate (2013). Microfinance Institution Tier Definitions. MicroRate. http://www.microrate.com/ media/downloads/2013/04/MicroRate-White-paper-Microfinance-Institution-Tier-Definitions.pdf. Accessed 15 May 2014.

Microbanking Bulletin. (2004). Benchmarking Latin American microfinance. The MIX Market, www. mixmarket.org. (accessed in Jan 2006).

Microbanking Bulletin. (2005). Performance and Transparency. A survey of microfinance in South Asia. The MIX market, www.mixmarket.org (accessed in Jun 2006).

MicroRate (2013). Microfinance Institution Tier Definitions. MicroRate. http://www.microrate.com/ media/downloads/2013/04/MicroRate-White-paper-Microfinance-Institution-Tier-Definitions.pdf. Accessed 15 May 2014.

MIX Market (2013). Dataset from 1995 to 2012. Microfinance information exchange. http://www. mixmarket.org/. Accessed 15 Feb 2013.

MIX Market (2014). Methodology for benchmarks and trendlines—microfinance. Microfinance Information Exchange. Benchmarks. http://www.themix.org/sites/default/files/Methodology% 20for%20Benchmarks%20and%20Trendlines.pdf. Accessed 15 Jan 2014

Murdoch, J. (2000). The microfinance schism. World Development, 28, 617–629.

Morduch J, Haley B (2002) Analysis of the effects of microfinance on poverty reduction. In: The NYU Wagner working paper series, No. 1014, June 2002.

Mouzas S., (2006), « Efficiency versus effectiveness in business networks ». Journal of Business Research, vol. 59, N° 10 - 11, pp. 1124–1132

Nghiem HS (2004) Efficiency and effectiveness of micro-finance in Vietnam: evidence from NGO schemes in the North and Central regions, CEPA, School of Economics, UQ

Nghiem, H., Coelli, T. and Rao, D. S. P. (2006) The efficiency of microfinance in Vietnam: Evidence from NGO schemes in the north and the central regions. International Journal of Environmental, Cultural, Economic and Social Sustainability, 2(5), pp. 71-78

Nzongang Joseph, « La mesure de la performance des établissements de microfinance (EMF) au Cameroun » une application combinée DEA et multicritère au cas du réseau des Mutuelles Communautaires de Croissance (MC2), La Revue des Sciences de Gestion, 2011/3 n°249-250, p. 139-146.

PastorJM(1999).EfficiencyandriskmanagementinSpanishbanking: A method to decompose risk. Appl Finan Econ 9: 371–384.

Rajan, R. G. & Zingales, L. (1998). Financial Dependence and Growth. American Economic Review, 88(3), 559–86.

Roberts, P. (1977). Differences between large and small firms'. Application Oil Leasing Policy. Working paper. http://www.mcleveland.org/. Accessed 10 May 2012.

Rosen, S. (1982). Authority, control, and the distribution of earnings. Bell Journal of Economics, 13(Autumn), 311–323

Servet (1996), Risque, incertitude et financement de proximité en Afrique. Une approche économique, Revue Tiers-Monde, t.XXXVII, n°145, Janvier – Mars, pp.41 – 59

Simar,L., Wilson, P.,1998.Sensitivity analysis of efficiency scores: how to bootstrap in nonparametric frontier models.Manag.Sci. 44,49_61 .

Simar,L., Wilson, P.W., 2000. A general methodology for bootstrapping in non –parametric frontier models. J.Appl. Stat. 27(6), 779-802.

Simar, L., Wilson, P.W.,2007. Estimation and inference in two-stage, semi –parametric models of production processes. J.Econ. 136, 31-64.

Smith, A. (1776). An Inquiry into the Nature and Causes of the Wealth of Nations. New York: Modern Library 1937.

Sorkin, A. R. (2010). Too big to fail: the inside story of how wall street and Washington fought to save the financial system. New York: Penguin Books.

Sudhir, K. J., & Tripathy, K. K. (2011). Microfinance and rural enterprises: an analysis of operational performance and constraints in the SHG-Bank linkage program in India. Eurasian Economic Review, 1, 29–50.

Sufian F (2006) The efficiency of non-bank financial institutions: empirical evidence from Malaysia. Int Res J Finance Econ 6. ISSN 1450–2887.

Suranovic, S. (2010). International Trade: Theory and Policy. New York: The Flat World Knowledge Inc.

Trong Vi Ngo . Adrew W . Mullineux . Anh Hoang Ly (2014) The impact of operation on financial performance in microfinance .

United Nations. (2009a). Rethinking Poverty: Report on the World Social Situation: 2010. New York: Department of Economics and Social Affairs.

United Nations. (2009b). The Global Financial Crisis: Impact and Response of the Regional Commissions.

WWB—Women's World Banking. (2004). Strategies for financial integration: Access to commercial debt. Financial Products and Services, 1(1), 1–28 [Occasional Paper].

Yaron J (1994). What makes rural finance institutions successful? The World Bank Res Observer 9: 49–70.

Figure 1. Annual Scale efficiency by Region

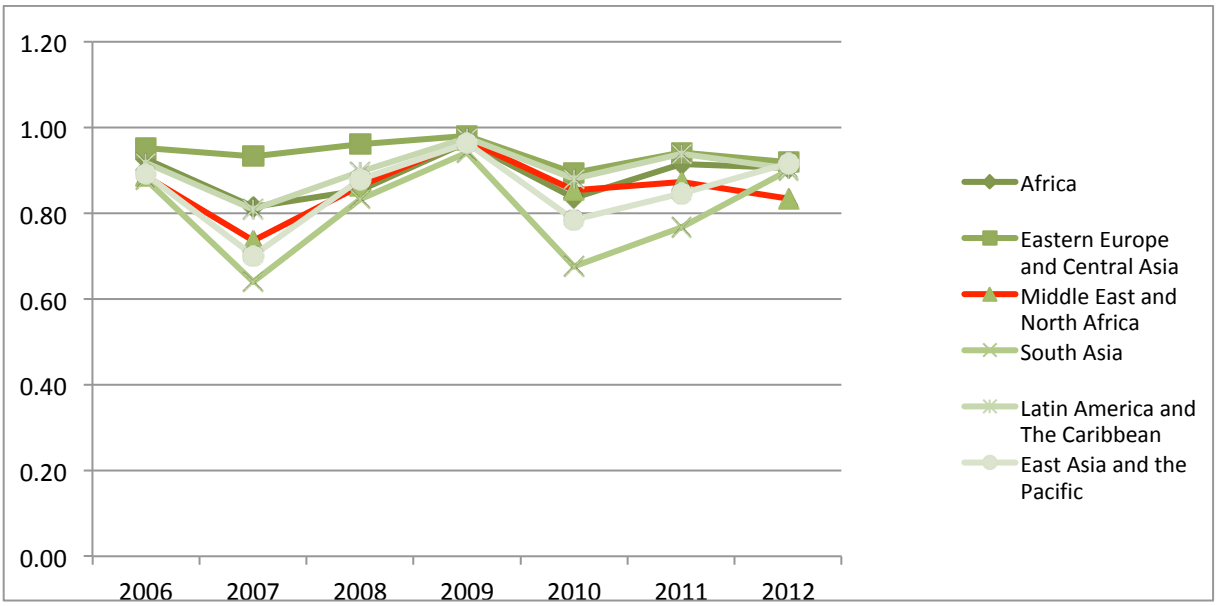

Figure 2. Scale Efficiency

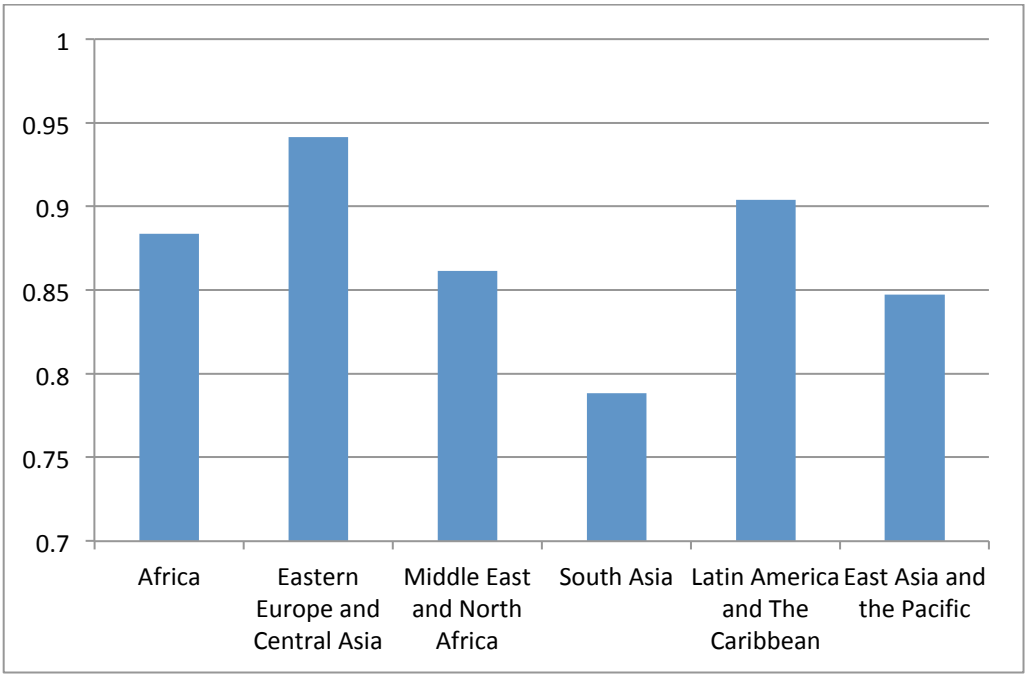

Figure 3. Technical efficiency rate in the MENA region

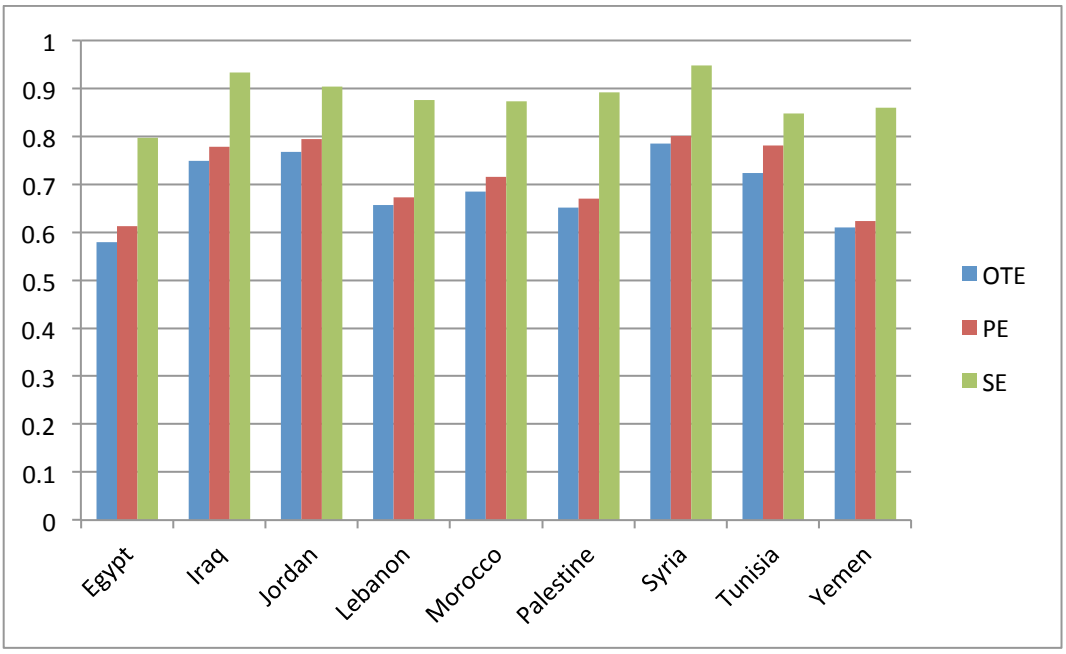

Figure 4. Scale Efficiency for MENA countries

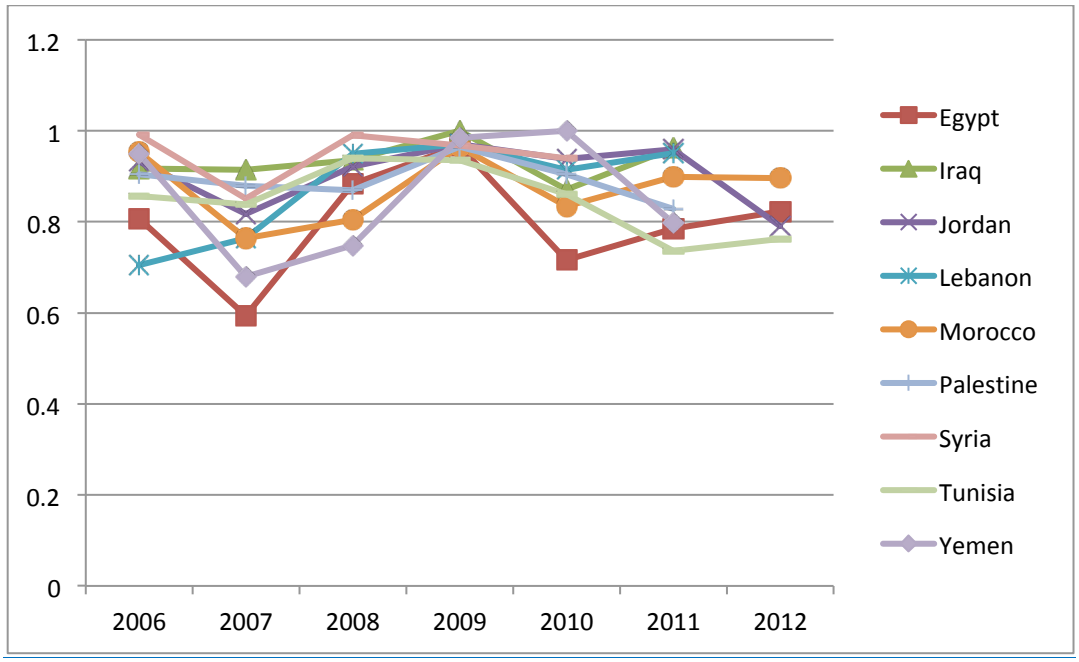

Figure 5. Histogram of the marginal effect of the size on Scale efficiency (MFIs under IRS)

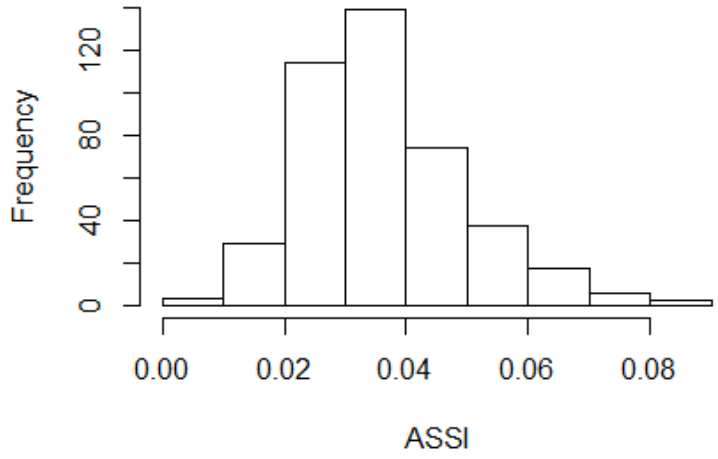

Table 1. Descriptive Statistics

	Total Sample		**MENA region**	
	Mean	sd	Mean	Sd
Assets (in USD)	4.56e+07	1.60e+08	2.90e+07	6.06e+07
Operating Cost (in USD)	5394493	1.77e+07	3223237	5589377
Personnel (in USD)	367.2614	1454.083	287.5333	475.5946
Portfolio at risk 30 (in USD)	23177.12	132101.5	9860.113	28931.54
Percent of women borrowers (%)	63.80437	25.61034	65.436	25.97409
Average loan balance per borrower / GNI per capita	0.65467	2.466831	0.2834338	0.3767121
net Loan portfolio (in USD)	3.97e+07	1.38e+08	2.67e+07	5.78e+07
Financial revenue (in USD)	1.08e+07	4.01e+07	5908543	1.10e+07
Determinants of the scale efficiency				
Legal Status (categorical) :				
Bank / Credit Union / Coopertaive (BCUC)	0,2239	0,3273	0,0048	0,2085
NFBI	0,325	0,3848	0,1714	0,343
NGO	0,4354	0,3776	0,7952	0,1826
Rural Bank (RB)	0,0922	0,2756	0	0
Age				
New	0,1213	0,306	0,1238	0,3082
Young	0,1893	0,3527	0,1762	0,3457
Mature	0,6894	0,2578	0,7	0,2509
ROA	.010682	.1285419	.0223286	.1450802
DER	4.838197	52.85371	3.14119	43.90057
Gov_eff	38.38578	16.71759	39.9112	16.94129
Rule_law	31.27504	16.48267	40.46001	17.56792
Cont_corr	32.66234	17.03802	35.12967	18.01401
Risk_30 (%)	.0657588	.1019495	.0566152	.1115919

Table 2. Average scores by region

Region	CRS	VRS	SE	D[a]	E[b]	I[c]
Africa	0.61	0.62	0.88	89.32	4.42	6.26
Eastern Europe and Central Asia	0.75	0.77	0.94	79.11	14.59	6.3
Middle East and North Africa	0.68	0.71	0.86	89.05	10	0.95
South Asia	0.60	0.63	0.79	91.68	6.9	1.42
Latin America and The Caribbean	0.72	0.74	0.90	94.2	4.15	1.65
East Asia and the Pacific	0.62	0.65	0.85	91.5	6.45	2.05

[a] Percentage of Decreasing operating scale Obs., [b] Percentage of Efficient operating scale Obs.,
[c] Percentage of Increasing operating scale Obs.

Table 3. Second Stage Bootstrapped Estimation Results

	Censored Regression		LOGIT	
	IRS	**DRS**	**IRS**	**DRS**
(Intercept)	1.02493***	1.21454***	42.40496***	25.01921***
t2007	-0,00071	-0,00807	-0,11008	0,12459
t2008	-0,00019	0.02294***	-0,14973	0.41801*
t2009	0,00019	0.03507***	-0,21383	0.43544**
t2010	-0,00106	-0.01649*	-0,69668	-0,08904
t2011	-0.00183***	0,00198	-0,8814	0,31522
t2012	-0,00057	0,00519	-0,36066	0.57694**
EECA	0.00279***	0.01726***	0.57223*	0.86381***
MENA	0.00269***	0,00032	1.88336***	0.34621**
SA	0,0011	-0.01173**	1.14906***	0.35019**
LAC	0.0018***	0.01211***	0.50271*	0.28083**
EAP	0.00149***	-0,00051	0,1058	0,17701
BCUC	0,00081	0.01028***	0,12676	0.48036***
NBFI	-0,00016	0.00563***	-0,1343	0.1439*
RB	-0,0003	0,00545	-0,22766	-0,25733
YOUNG	-0,00024	-0,00105	0,10611	-0,03852
MATURE	-0,00043	0,00106	-0,01076	-0,01963
ROA	0.00354***	0.04244***	1.40003***	2.1717***
DER	0,00001	2,00E-05	0.00514**	0,00116
lnA	-0.00533***	-0.01617*	-6.30712***	-3.14343***
1/2lnA²	0.00038***	0,00048	0.43183***	0.18491***
POV	0.01204***	-0,0129	1.75617***	-0,59022
W	-0.00004***	-0.00059***	-0.03274***	-0.00355**
RISK30	-0.00525***	-0.05079***	-1.4651*	-1.84184***
gov_eff	0.00005***	-0,00013	0.03203***	0.01436***
rule_law	0,00004	0,00014	0.02466**	0.01224**
cont_corr	0,00001	0.00021*	-0.01975*	-0,00026
logSigma	-5.30646***	-2.84095***	-	-

Coefficients are Significant at: *** 1%, ** 5% and * 10%