

# Financial Development and the Efficiency of Microfinance Institutions

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## **Abstract**

This paper investigates whether the country-level financial environment in which microfinance institutions (MFIs) have to work affects their operations. In particular, we argue that the efficiency of MFIs is determined by the extent to which financial markets of countries are developed. On the one hand, well-developed financial markets provide an environment in which MFIs are able to flourish and increase their efficiency. On the other hand, however, well-developed financial markets may also substitute for MFIs, which reduces demands for their services, thus potentially reducing their efficiency. Given the fact that the relationship may go both ways, we empirically investigate the direction of the relationship between measures of financial development and measures of MFI efficiency, using data for 435 MFIs over the period 1997-2007.

## **1. Introduction**

Recently, microfinance has received a lot of attention, both from policy makers as well as from academics. In particular, it has been mentioned as an important instrument to combat poverty. To support this view, the UN declared 2005 to be the international Year of Micocredit. In 2006, the attention for microfinance and its role in reducing poverty was further increased when Mohammad Yunus received the Nobel Peace prize. These developments have led to high expectations among policy makers and aid organizations about the potential poverty reducing effects of microfinance.

An important question, however, is whether microfinance is really able to make a significant and long-term contribution to reducing world-wide poverty. Many microfinance institutions (MFIs) are currently still dependent on subsidies from governments, NGOs, etc. According to some estimates, only 1-2 per cent of all MFIs in the world are financially sustainable, i.e. they do not depend on outside subsidies (Deutsche Bank, 2007). As has been discussed extensively in the literature, financial sustainability may be a prerequisite for microfinance in making a substantial contribution to poverty reduction. Financial sustainability is determined by the extent to which MFIs are efficient in using resources and turning them into services. Knowing the determinants of MFI efficiency would help to increase our understanding of what determines financial sustainability and therefore also of the potential of microfinance in making a significant and long-term contribution to poverty reduction.

Recently, research has focused on the possible determinants of financial sustainability of MFIs. In particular, researchers have looked at micro-institutional, as well as macro-institutional and macroeconomic determinants of sustainability. Micro-institutional factors that have been discussed are, among other things, the type of borrowers, the costs of operation, the type of loans offered, etc. (Cull et al., 2007; Gutiérrez-Nieto et al., 2007;

Hermes et al., 2009). Macro-institutional factors that have been investigated are regulation and economic freedom (Hartarska and Nadolnyak, 2007; Cull et al. 2008; Crabb, 2008); macroeconomic factors that have been studied are general macroeconomic performance and inflation (Ahlin and Lin, 2006).

One potentially important macro-institutional issue that has not been explicitly researched is the country-level financial environment in which MFIs of a country have to work. This issue is the focus of the current paper. In particular, we argue that the efficiency of MFIs is determined by the extent to which financial markets of countries are developed. On the one hand, well-developed financial markets provide an environment in which MFIs are able to flourish and increase their efficiency. On the other hand, however, well-developed financial markets may also substitute for MFIs, which reduces demands for their services, thus potentially reducing their efficiency. This means that the direction of the relationship between financial markets and MFI efficiency is not immediately clear. Improving our knowledge of the relationship between financial development and MFI efficiency is important as it helps understanding how developing financial systems in general may contribute to the scaling up of microfinance, i.e. enlarging access to finance for the poor.

Given the fact that the relationship may go both ways, we empirically investigate the direction of the relationship between measures of financial development and measures of MFI efficiency. In doing this, we bring together two strands of literature, i.e. the literature on MFI performance and efficiency and the literature on financial development. To the best of our knowledge the issue of the relationship between financial development and MFI performance has not been explicitly studied before.<sup>1</sup> With respect to the measurement of MFI efficiency we use stochastic frontier analysis (SFA) to measure efficiency at the individual institutional

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<sup>1</sup> Crabb (2008) links MFI operational sustainability to the extent to which governments interfere with financial markets (based upon data from the Heritage Foundation) as one of the various dimensions of the business environment (or, in his words, the economic freedom) in which MFIs have to work. Caudill et al. (2009) use a measure of financial depth as one of the control variables in their econometric model specifying the efficiency of MFIs, without explicitly discussing the relationship between the two variables.

level. For this we have data for 435 MFIs over the period 1997-2007. These data are obtained from MixMarket™.

The remainder of the paper is organized as follows. Section 2 discusses the two strands of literature on which our analysis is based. In particular, in this section we develop a framework to show how financial development may help improving the efficiency and performance of MFIs. In section 3 we describe the research methodology and explain the SFA in some detail. Section 4 contains the description of the dataset, which is followed by a discussion of the estimation results in section 5. In section 6 we summarize the main findings and provide policy conclusions we derive from the analysis.

## **2. Financial development, microfinance performance and the interrelationship**

Financial development refers to changes in the characteristics of financial systems of a country over time. A financial system consists of financial institutions such as commercial banks, development banks, stock exchanges, pension funds, etc., regulatory and supervisory institutions such as central banks, and financial instruments such as debt and equity. Financial systems and instruments exist because they help allocating resources across space and time. Financial development may be described in terms of the existing variety of financial institutions and instruments, as well as their contribution with respect to improving the efficient allocation of scarce resources. There is long and extensive literature on the importance of financial development for an economy. Generally speaking, the consensus view is that financial development improves macroeconomic performance, since it helps allocating scarce financial sources to the most profitable and efficient investment projects (Levine, 2005). Thus, well-developed financial institutions and instruments provide a growth-stimulating environment.

The question is to what extent the existence of a well-developed financial system affects the operations and performance of MFIs in a country. In order to be able to study this, we first

need to establish which part of the financial system of a country is most relevant for MFI efficiency. Moreover, we need to define what we mean by MFI performance. Since MFIs mostly provide lending and (increasingly also) saving services, financial development in terms of banking institutions is probably most relevant in this context. The performance of MFIs may be characterized in several ways, but in this paper we focus on efficiency in terms of the extent to which institutions are able to produce their services at the lowest cost.

We argue that there are good reasons to believe that MFI performance is related to the level of financial development, and especially the development of the banking sector of a country. This relationship may be either positive or negative, however.

With respect to the positive relationship, several arguments can be given. First, financial development may imply an increasing number of commercial banks and/or an increasing number of services commercial banks offer, among which may also be loans to microfinance businesses. The growth of commercial banks and their activities may lead to increased competition for borrowers among lenders, including the MFIs. In several countries commercial banks have already explicitly entered the market for microfinance business lending (a process referred to as “downscaling”), since these loans have been shown to be increasingly profitable. Isern et al. (2003) list 227 local commercial banks that are active in the market for microfinance. Bell et al. (2002) discuss the development and success of K-REP in Kenya and the Commercial Bank of Zimbabwe in entering microfinance activities. Segrado (2005) describes the involvement of commercial banks in microfinance in Egypt. Isern and Porteous (2005) show that some commercial banks specializing in microfinance (such as K-REP, BancoSol in Bolivia and MiBanco in Peru) have been more profitable than the average of the banking sector in their country. But even without explicit entrance of commercial banks into the market for microfinance, the threat of potential entrance in the near future may affect the practices of MFIs. The increased competition may stimulate MFIs to reduce costs and increase

the efficiency of their operations by improving the quality of their services in order to retain clients. Moreover, competitive pressure from banks may stimulate MFIs to diversify their financial services to keep clients or attract new ones. In particular, it may stimulate MFIs to offer saving accounts, demand deposits and insurance.

Second, the presence of commercial banks may lead to positive spill-over effects. In particular, these banks may use modern and more efficient banking techniques that are new to MFIs. These modern banking techniques may be copied by MFIs, which may help improving their efficiency. The presence and growth of commercial banks may also improve the skills of loan officers and managers working at MFIs, since this enlarges the pool of financially educated people. This again may help improving the efficiency of MFIs.

Third, financial development in terms of more sophisticated regulation and supervision of financial institution may also help improving the efficiency of MFIs. The increasing role of the financial system may trigger the government to enhance existing regulatory and/or supervisory systems and these improved systems may also include MFIs and their practices. Consequently, increased regulation and supervision of the activities of MFIs may contribute to improved efficiency of these institutions. This line of argumentation is supported by Loubière et al. (2004) who argue that, at least in Latin America, the response of regulators to the development of microfinance differs per country depending on the overall development of the financial sector and financial reform carried out by the government.

The main argument supporting the existence of a negative relationship between well-developed financial markets and the efficiency of operations of MFIs again focuses on competition. As discussed above, this argument states that more developed financial markets may imply an increasing number of commercial banks and/or an increasing number of services banks offer, among which also loans to microfinance businesses. Yet, instead of contributing to improving the efficiency of MFIs, the presence of commercial banks leads

borrowers to substitute their loans from MFIs for loans from commercial banks for various reasons, such as lower borrowing costs, more flexibility with respect to borrowing options and larger amounts that can be borrowed. The substitution effect reduces the demand for services of MFIs, which in turn may reduce their efficiency.

Moreover, competition may have an adverse effect on the repayment performance of MFI borrowers, if they take up multiple loans from different financial institutions. Reduced repayment rates leads to decreased financial performance and has adverse consequences for the efficiency of MFIs. In the literature, some papers have shown that indeed there may be adverse effects of increased competition in microfinance (McIntosh et al., 2005a and 2005b).

There may be yet another reason to expect a negative correlation (rather than a causal relationship) between financial development and the efficiency of MFIs. This is the case when it turns out that MFIs are present more in environments in which formal financial markets are lacking. In this case, MFIs complement the low level of financial development in these countries. A high demand for MFI services in environments in which financial services are scarce may help increasing the efficiency of MFI activities.

Since from a theoretical perspective the impact of financial development on the efficiency of MFIs may be either positive or negative, investigating the relationship remains an empirical issue. In the remainder of this paper, we will empirically investigate the nature of the relationship between financial development and MFI efficiency.

### **3. Methodology**

The dependent variable in the analysis is a measure of the efficiency of operations of MFIs. In the literature there are several ways of measuring the efficiency of operations of a business entity. In our analysis we measure cost efficiency in terms of how close the actual costs of the lending activities of an MFI are to what the costs of a best-practice MFI would have been in

case it produces identical output under the same conditions. Cost efficiency measures the reduction in cost that could have been achieved if an MFI were both allocatively and technically efficient. Put differently, an MFI becomes more cost efficient the better it can achieve a cost reduction by improving the allocation or the technical use of inputs, or both (Berger *et al.*, 1993).

As cost functions are not directly observable, inefficiencies are measured relative to an efficient cost frontier. Most studies on cost efficiency use data envelopment analysis (DEA) or stochastic frontier analysis (SFA) to calculate this frontier. We use SFA, since it controls for measurement errors and other random effects.<sup>2</sup> More specifically, we use the SFA suggested by Battese and Coelli (1995), henceforth the BC model. An advantage of the BC model as compared to the standard two-step SFA of Aigner, Lovell and Schmidt (1977), and Meeusen and van den Broeck (1977) is that the BC model simultaneously estimates the cost frontier and the coefficients of the efficiency variables. Thus, the model we apply is a one-step approach using SFA to investigate the determinants of the inefficiency of individual MFIs vis-à-vis a common cost frontier. Wang and Schmidt (2002) show that a two-step approach suffers from the assumption that the efficiency term is independent and identically truncated, normally distributed in the first step, while in the second step the efficiency terms are assumed to be normally distributed and dependent on the explanatory variables. This method inherently renders biased coefficients.

The general BC model specifies a stochastic cost frontier with the following properties:

$$(1) \quad \ln C_{i,t} = C(y_{i,t}, w_{i,t}, q_{i,t}; \beta) + u_{i,t} + v_{i,t}$$

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<sup>2</sup> Non-parametric techniques do not allow for measurement error and luck factors. These techniques attribute any deviation from the best-practice MFI to technical inefficiency. For a more extensive review of the non-parametric and the parametric approach, see Matousek and Taci (2004).

where  $C_{i,t}$  is the total cost MFI  $i$  faces at time  $t$  and  $C(y_{i,t}, w_{i,t}; \beta)$  is the cost frontier. In this cost frontier,  $y_{i,t}$  represents the logarithm of output of MFI  $i$  at time  $t$ ,  $w_{i,t}$  is a vector of the logarithm of input prices of MFI  $i$  at time  $t$ ,  $q$  are MFI specific control variables and  $\beta$  is a vector of all parameters to be estimated. The term  $u_{i,t}$  captures cost inefficiency and is independent and identically distributed with a truncated normal distribution<sup>3</sup>.  $v_{i,t}$  captures measurement errors and random effects, e.g. good and bad luck, and is distributed as a standard normal variable. Both  $u_{i,t}$  and  $v_{i,t}$  are time and MFI specific and can be represented as:

$$(2) \quad u_{i,t} \sim N^+(m_{i,t}, \sigma_u^2)$$

$$(3) \quad v_{i,t} \sim iidN(0, \sigma_v^2)$$

Next, we model the inefficiency of an MFI as:

$$(4) \quad m_{i,t} = \delta_0 + \sum_n \delta_n z_{n,i,t}$$

In equation (4), the  $z$  represents the vector of  $n$  variables that determine the inefficiency ( $m$ ) of MFI  $i$  at time  $t$ . The deltas represent the coefficients. Equations (1) and (4) are solved in one step by using maximum likelihood.

For the specification of the cost function we use the model developed by Sealey and Lindley (1977), who state that a bank acts as an intermediate between funders and borrowers. In particular, we use total expenses per unit of labor and the interest expenses per unit of deposits held as input prices, whereas we use the gross loan portfolio of an MFI as our

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<sup>3</sup> Thus, the total costs a MFI faces are never lower than the costs of the frontier. For a graphical representation of the frontier and its dynamics, see Berger et al. (1993). The authors show how inefficiency is determined by both technical and allocative inefficiency.

measure of output. The cost function has a translog specification, and can be specified as follows:

$$\begin{aligned}
 \ln(TC_{i,t}) = & \beta_0 + \beta_1 \ln(SALARY_{i,t}) + \beta_2 \ln(R_{i,t}) + \beta_3 \ln(GLP_{i,t}) \\
 & + \beta_4 \ln(SALARY_{i,t})^2 + \beta_5 \ln(R_{i,t})^2 + \beta_6 \ln(GLP_{i,t})^2 \\
 (5) \quad & + \beta_7 \ln(SALARY_{i,t})\ln(R_{i,t}) + \beta_8 \ln(SALARY_{i,t})\ln(GLP_{i,t}) \\
 & + \beta_9 \ln(R_{i,t})\ln(GLP_{i,t}) \\
 & + \beta_{j=10...14} MFITYPE_{i,j} + u_{i,t} + v_{i,t}
 \end{aligned}$$

In equation (5)  $TC_{i,t}$  represents total costs MFI  $i$  faces at time  $t$ ,  $SALARY$  represents the price of one unit of labor for one year,  $R$  is the interest expenses of holding money,  $GLP$  is the gross loan portfolio, and  $MFITYPE$  refers to the type of MFI, where subscript  $j$  refers to a particular type.  $TC$  is measured as the total expenses of an MFI;  $SALARY$  is measured as the total operating expenses per employee of an MFI;  $R$  is the MFI's total financial expenses per dollar of deposits; and  $GLP$  is the gross loan portfolio of the MFI.<sup>4</sup> The cost function specification takes into account the individual input and output variables, the square of these variables, as well as combinations of these variables. All variables in equation (5) are taken in logs (except  $MFITYPE$ ).

In order to control for the fact that different types of MFIs may have different cost functions, we add a vector of dummies for the type of MFI ( $MFITYPE$ ). In particular, cost functions may differ between types of MFI due to differences with respect to the levels of external subsidies these institutions receive. The data we use do not provide detailed

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<sup>4</sup> Data for  $TC$ ,  $SALARY$ ,  $R$  and  $GLP$  are not directly available from the dataset we have used for this study (MixMarket<sup>TM</sup>; see section 4 for a description of this source). Instead, information in terms of ratios, such as total costs to total assets, etc. are given only. This is why we have multiplied these ratios with total assets to obtain data for  $TC$ ,  $SALARY$ ,  $R$  and  $GLP$ . Thus,  $TC$  is measured as the total expenses to total assets ratio times total assets in US dollars.  $SALARY$  is the operating expenses to total assets ratio times total assets in US dollars, divided by the total number of employees.  $R$  is the financial expenses to total assets ratio divided by the total deposits to total assets.  $GLP$  is the gross loan portfolio to total assets ratio times total assets in US dollars.

information about subsidies received, which stresses the need for adding controls for MFI type.<sup>5</sup> In the estimation outcomes discussed below we report the results for the specific dummy variables we have created for the type of MFI. In particular, we have dummy variables for banks (*BANK*), cooperatives (*COOP*), non-bank financial institutions (*NONBANK*) non-governmental organizations (*NGO*), rural banks (*RURBANK*) and other organizations (*OTHER*), which are basically those MFIs that cannot be classified as either one of the five types we distinguish. The dummy variable *OTHER* is left out of the empirical analysis for reasons of singularity.

To repeat, the central aim of the paper is to investigate whether the extent to which domestic financial markets are developed has an impact on the efficiency of operations of MFIs. As explained above,  $m_{i,t}$  is our measure of inefficiency of an MFI. To analyze the relationship between MFI efficiency and domestic financial development we specify an empirical model, in which the inefficiency variable is the dependent variable and in which we have a number of measures of financial development. Additionally, we include a number of control variables that may also influence the inefficiency of MFIs.

The general specification of the inefficiency equations we estimate is as follows:

$$(6) \quad m_{i,t} = \delta_0 + \delta_{k=1..3} FINDEV_{k,t} + \delta_4 \ln(ALB_{i,t}) + \delta_5 \ln(ASB_{i,t}) + \delta_6 WOMAN_{i,t} + \delta_7 YEAR_t + \delta_{m=8..11} LOANTYPE_{i,m,t} + \delta_{12} AGE_{i,t} + \delta_{13} \ln(BORROWER_{i,t}) + \delta_{n=14,15} REGION_{n,t}$$

In this equation  $m$  stands for the first moment of the inefficiency distribution for MFI  $i$  at time  $t$ . The higher this moment, the more likely it is that the MFI is inefficient. The first variable in this equation, *FINDEV*, is a vector of  $k$  variables representing domestic financial

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<sup>5</sup> By adding dummies for different types of MFIs we assume that subsidy levels are similar for the same type of MFIs.

development. In particular, in the empirical analysis discussed below we have used the following financial development variables:

- *LIQL* = total liquid liabilities (measured as M3) to GDP ratio;
- *SPREAD* = lending minus borrowing interest rate;
- *DOMCRED1* = total domestic credit provided by banks to GDP ratio; and
- *DOMCRED2* = total domestic credit to the private sector to GDP ratio.

Since the dependent variable of equation (6) measures the extent to which an MFI is inefficient, based on our discussion of the relationship between domestic financial development and efficiency of MFIs, a negative (positive) and significant coefficient for the financial development variables *LIQL*, *DOMCRED1* and *DOMCRED2* would support the view that financial development improves (decreases) efficiency. These three variables are all variables of the depth of a country's financial sector. With respect to the *SPREAD* variable, the expected relationship is the other way round, as a higher spread between lending and borrowing rates of banks is associated with lower financial development. Lower spreads indicate that competition among banks is stronger, indicating a more developed financial system. Thus, a negative (positive) and significant coefficient for the *SPREAD* variable would support the view that financial development decreases (improves) efficiency.

The remaining variables in equation (6) are control variables. First of all, we have three variables measuring outreach of MFI, i.e. the extent to which these institutions are reaching poor borrowers. In the literature there is a debate on the relationship between the efficiency and outreach of MFIs. Recent studies suggest that outreach has an adverse effect on efficiency, since reaching poorer borrowers generally is also more expensive.<sup>6</sup> The measures we have included have also been used in other studies (e.g. Makame and Murinde, 2006; Olivares-Polanco, 2005; Ferro Luzi and Weber, 2006; Paxton, 2007; Hermes et al., 2009).

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<sup>6</sup> See Hermes et al. (2009) for a more extensive analysis of the relationship between outreach and efficiency.

*ALB* is the average loan balance per borrower (in US dollars). Higher values of *ALB* indicate less depth of outreach, since in this case the MFI is expected to provide fewer loans to poor borrowers. *ASB* is the average savings balance per saver of the MFI (in US dollars). Both variables are taken in logs. Higher values for this variable indicate less outreach, because it indicates that the MFI deals with more wealthy clients. *WOMAN* denotes the percentage of female borrowers in the total loan portfolio of the MFI. Higher values for this measure indicate more depth of outreach, since lending to women is associated with lending to poor borrowers. Based on the above short discussion, we expect that for the outreach variable *WOMAN* the coefficient will be significantly positive. For the outreach variables *ALB* and *ALS* the expected coefficient will be significantly negative.

Next, we include *LOANTYPE* in equation (6). *LOANTYPE* is a vector of  $m$  dummy variables indicating which type of loans an individual MFI mainly provides. The inefficiency of an MFI may depend on the type of loans it mainly provides. From the literature we know that some types of loans demand more efforts than other ones and/or that some types show better repayment performance. We have five dummies, indicating that the MFI mainly provides individual loans (*INDIV*), group loans (*GROUP*), village loans (*VILLAGE*), and individual, group and village loans (*ALLTYPE*), or that the MFI does not report their main lending type (*OTHER*). This fifth dummy is left out of the empirical analysis for reasons of singularity.

*YEAR* refers to a year dummy and runs from 1 to 11. This variable is added to control for the possibility that inefficiency effects may change over time. *AGE* is a measure of the age of the MFI, i.e. the number of years since its establishment. We hypothesize that older institutions have had to learn how to cope with microfinance practices by trial and error, whereas more recently established institutions may profit from the knowledge with respect to microfinance practices that has been built-up during the past few decades. In other words,

new MFIs may leapfrog older institutions in terms of the efficiency of their activities. We therefore expect the coefficient for this variable to be positive and significant.

The variable *BORROWER* refers to the number of active borrowers to which the MFI provides loans. This variable measures the size of lending activities of an MFI. Higher values of this measure indicate that there are more opportunities for economies of scale and scope. The variable *BORROWER* is taken in logs. We expect a negative and significant coefficient is expected for this variable, supporting the idea that more economies of scale and scope result in higher efficiency.

Finally, *REGION* is a vector of  $n$  regional dummies. MFI efficiency may be different in different country regions, due to differences in country characteristics such as income levels, human development, cultural characteristics, institutional environment, political environment, etc. We include two dummies, one for African countries (*AFRICA*) and one for East Asia and the Pacific (*ASIA*).

#### **4. Data**

The data on MFIs are taken from MixMarket<sup>TM</sup>, a global web-based microfinance information platform. After adjustments for missing data we have information for 435 MFIs over a period of 11 years (1997-2007). Our full sample consists of 1,318 observations. Appendix table A provides the correlation matrix of the variables used in the analysis. Unfortunately, for most MFIs we have data for only a few years. Moreover, the data availability is not spread equally over the 11 years of data we have. As is shown in table 1, for almost 50 per cent of all MFIs in our dataset we have only one of two observations. For 42 per cent of the MFIs we have data for three, four or five years.

<Insert table 1 here>

Finally, there is not a single MFI for which we have data for entire 1997-2007 period. Most observations are from recent years: 63 per cent refer to the period 2004-2006. This is shown in table 2.

<Insert table 2 here>

At the same time, however, we use one of the most extensive dataset in the literature on MFIs, as we have exploited the MixMarket<sup>TM</sup> data to the highest possible level.

The MixMarket<sup>TM</sup> data provide information for all variables in our model, except for the measures of financial development. Information for these measures come from the financial structure database provided by the World Bank. Unfortunately, we do not have complete data on financial development for all countries and all years for which we have microfinance data. This means that in specifications of our cost efficiency model that include financial development variables the number of observations drops to around 650; when we use the *SPREAD* variable this even drops to 490.

## **5. Estimations and results**

In order to analyze the relationship between MFI efficiency and domestic financial development, we use the version of SFA as proposed by Battese and Coelli (1995), which means that we simultaneously estimate the cost frontier and the inefficiency equation. Tables 3 and 4 provide the estimation results with respect to the relationship between MFI efficiency and domestic financial development. With respect to the cost function, we always estimate using the full specification of equation (5). The estimation results for the cost frontier are presented in table 3.

In table 4 we present the estimation results for the inefficiency equation. We present five different specifications of the inefficiency equation. The first specification does not include a measure of financial development, but does include all control variables discussed in section 4. The remaining four specifications include one of four measures of financial development discussed in section 4, next to the full list of control variables. This allows us to investigate the sensitivity of the results regarding the relationship between efficiency and domestic financial development with respect to different specifications of the inefficiency equation, using different measures of financial development.

<Insert tables 3>

First, we discuss the estimation results of the cost frontier. A positive coefficient implies an outward shift of the cost function, and hence – ceteris paribus – higher costs. The estimation results for the cost function in table 3 appear to be as expected in most cases: the coefficients for *SALARY* and *GLP* are always significant and positive. The coefficient for *R* is negative (although it is not always statistically significant), which is not as expected. Yet, several of the interaction and quadratic terms are significant as well and some of them are positive, which makes it difficult to directly observe the marginal effect of *R* on total costs. We use the so-called delta method to calculate the average marginal effect of *R* on total costs.<sup>7</sup> The calculations show that the marginal effect is significant and positive.<sup>8</sup> This leads us to conclude that our specification of the cost frontier fits theory reasonably well.

Finally, four of the five dummy variables for the type of MFIs are statistically significant in all specifications in table 3 (i.e. *COOP*, *NONBANK*, *NGO* and *RURBANK*), indicating that the type of MFI indeed affects the cost frontier. Our interpretation of this result

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<sup>7</sup> See Oehlert (1992) for a specification of this method.

<sup>8</sup> For completeness, we also calculated the marginal effects of *SALARY* and *GLP* on total costs with the help of the delta method. The results show also for these two variables the marginal effect is significant and positive.

is that different types of MFIs receive different levels of subsidies, influencing their actual cost efficiency.

Table 4 refers to the estimation of the inefficiency equation. The results in column [1], i.e. without a measure of financial development, show that the efficiency of MFIs is associated with: the type of loans provided (*ALLTYPE* and *GROUP*); the outreach of the MFI (*WOMAN* and *ALB*); scale economies related to lending (*BORROWER*); the age of the MFI (*AGE*); the region in which the MFI is located (*AFRICA*); and the year of observation (*YEAR*).

With respect to the type of loans the results show that MFIs that mainly provide group loans and/or a mix of individual, group and village loans are more efficient. The first result supports the view that group lending is an effective way of reducing screening and monitoring costs of the MFI. The second result could perhaps indicate that MFIs using different lending techniques are better able to diversify activities, thereby increasing their efficiency.

With respect to outreach the table shows that MFIs having better outreach are also less efficient. According to the outcomes shown in table 4, lending more to women and/or providing smaller loans (both indicators of outreach) is negatively associated with efficiency. These results support the view that there is a trade-off between efficiency and outreach (Hermes et al., 2009).

The results further suggest that MFIs having more borrowers are also more efficient, which hints at the existence of scale economies related to their lending activities. Moreover, it appears that older MFIs are generally less efficient, supporting the hypothesis that younger institutions profit from the knowledge with respect to microfinance practices that has been built-up during the past few decades. MFIs located in Africa are less efficient as well, which may be due to the fact that the macroeconomic, political and institutional characteristics of these countries are less supportive to building efficient MFIs. Finally, the variable *YEAR* is

positively associated with efficiency, suggesting that MFIs have become more efficient during the period 1997-2007.

Columns [2] to [5] show the results including our four measures of financial development. For *LIQL*, *DOMCRED1* and *DOMCRED2* the coefficients are negative, suggesting that MFIs in countries with a more developed financial system are more efficient. As suggested in section 3 of this paper, this may be explained by pointing out that in countries with better developed financial markets competition in the microfinance market is stronger. This induces MFIs to focus more on reducing costs and hence to become more cost efficient. The same outcome is suggested by the positive significant coefficient on *SPREAD*. A positive coefficient implies that a decrease in the spread, which is an indication of stronger competition in financial markets, induces MFIs to become more efficient. In general, therefore, we find strong supportive evidence that financial development and MFI efficiency are positively associated.

With respect to the control variables, the results in columns [2] to [5] show the following. First, the coefficient for the type of loan variables *GROUP* and *ALLTYPE* remain negative and highly significant in all four specifications, suggesting that providing mainly group loans and/or a mix of different types of loans is positively associated with MFI efficiency. Second, the trade-off between outreach and efficiency remains to be supported as well, although the outcomes are somewhat weaker. Whereas the coefficient of the variable *ALB* is negative and highly significant in all four specifications, for *WOMAN* this is only true for two of the four specifications. Third, the finding that economies of scale related to lending contribute to improving efficiency MFIs is corroborated in all specifications, as the coefficient for *BORROWER* is always negative and significant. Finally, also the coefficient for the *AGE* variable is always significant and positive. As was mentioned above, this finding indicates that older MFI are less efficient. The results for the regional dummy *AFRICA* and the year

dummy are only significant in some of the specifications including financial development variables. Thus, the results for these variables are not robust for different specifications of the inefficiency equation.

Summarizing the results in tables 3 and 4, we find strong supportive evidence for the hypothesis that there is a positive relationship between MFI efficiency and domestic financial development. Thus, more developed financial systems create more efficient MFIs. The development of the financial system in our study is mainly related to the banking sector. In an environment with more developed banks MFIs feel the pressure of competition in the market for microfinance, which leads them to improving the efficiency of their activities. Our findings remain to be significant even after controlling for a large set of control variables.

## **6. Conclusions**

In this paper we have investigated whether the efficiency of the activities of MFIs is related to the level of financial development of the country in which they are located. As we have argued in the introduction of this paper, this is an important issue. Improving our knowledge of the relationship between financial development and MFI efficiency helps understanding how developing financial systems in general may contribute to the scaling up of microfinance, i.e. enlarging access to finance for the poor.

There are two opposing views on how this relationship can be characterized. On the one hand, well-developed financial markets, and in particular the banking market, provide an environment in which MFIs are confronted with increased competition from commercial banks. The increased competition stimulates MFIs to reduce costs and increase the efficiency of their operations by improving the quality of their services in order to retain clients. Moreover, it pressures them to diversify their financial services. Additionally, the development of the financial system may produce new banking techniques and financial

innovations that may spill-over to the market for microfinance. Finally, financial development may encompass improving financial regulation and supervision, including regulation and supervision of microfinance. Improved regulation and supervision of microfinance may positively contribute to improving the efficiency of MFI operations.

On the other hand, however, well-developed financial markets may also substitute for MFIs, reducing the demand for their services. Moreover, due to the increased supply of financial services, MFI borrowers may obtain multiple loans, reducing their repayment performance. Both these effects may potentially reduce their efficiency. Thus, the direction of the relationship between financial market development and MFI efficiency is theoretically undetermined.

Given the fact that the relationship may go both ways, we empirically investigate the direction of the relationship between financial development and MFI efficiency. To the best of our knowledge the issue of the relationship between financial development and MFI performance has not been studied before.

We find strong supportive evidence for the hypothesis that there is a positive relationship between MFI efficiency and domestic financial development. Thus, more developed financial systems create more efficient MFIs. In an environment with more developed banks increased competition provides incentives for MFIs to improving the efficiency of their activities. These findings remain significant after controlling for a large set of control variables. Referring to these control variables, we show that MFI efficiency is also determined by the type of loans they provide, whether they focus on outreach, their age, and whether they are able to generate economies of scale related to lending.

Further research should focus on enlarging the database and improving its panel structure. For almost half of the MFIs in our dataset we only have one or two observations. Moreover, focus should be on analyzing exactly how financial development and MFI

operations are related. In the analysis for this paper, we are able to establish a positive association between financial development and MFI efficiency. As was argued, there may be at least three possible channels for this positive relationship, i.e. competitive pressure, spillover of new banking techniques and financial innovations, and improved financial regulation and supervision. Follow-up research could aim at determining which of these three channels is most important in understanding how financial development and MFI efficiency are related.

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**Table 1: Description of the panel (Number of year observations per MFIs)**

<i>Number of year observations available</i>	<i>Number of MFIs</i>
1	104
2	106
3	85
4	49
5	48
6	19
7	8
8	7
9	5
10	4
11	0
Total	435

**Table 2: Description of the panel (MFIs per year)**

<i>Year</i>	<i>Number of MFIs for which we have data in a particular year</i>
1997	6
1998	19
1999	30
2000	42
2001	60
2002	123
2003	190
2004	243
2005	294
2006	298
2007	13
Total	1,318

**Table 3: Efficiency and Financial Development:  
Cost Frontier Estimations**

	1	2	3	4	5
Ln( <i>SALARY</i> )	1.876*** [0.243]	1.234*** [0.312]	1.214*** [0.310]	1.220*** [0.326]	1.257*** [0.311]
Ln( <i>R</i> )	-0.189** [0.093]	-0.320** [0.137]	-0.314** [0.138]	-0.569*** [0.145]	-0.292** [0.140]
Ln( <i>GLP</i> )	0.968*** [0.144]	1.004*** [0.160]	0.992*** [0.172]	1.138*** [0.205]	1.030*** [0.157]
Ln( <i>SALARY</i> ) * Ln( <i>R</i> )	0.020* [0.011]	0.038** [0.015]	0.035** [0.015]	0.032* [0.017]	0.035** [0.016]
Ln( <i>R</i> ) * Ln( <i>GLP</i> )	0.004 [0.005]	0.004 [0.007]	0.005 [0.007]	0.024*** [0.008]	0.004 [0.007]
Ln( <i>SALARY</i> ) * Ln( <i>GLP</i> )	-0.018** [0.009]	-0.007 [0.011]	-0.005 [0.011]	-0.019 [0.012]	-0.01 [0.011]
Ln( <i>SALARY</i> ) <sup>2</sup>	-0.068*** [0.015]	-0.041** [0.020]	-0.042** [0.020]	-0.029 [0.021]	-0.040** [0.020]
Ln( <i>GLP</i> ) <sup>2</sup>	0.006 [0.003]	0.001 [0.004]	0.001 [0.004]	0.002 [0.005]	0.000 [0.004]
Ln( <i>R</i> ) <sup>2</sup>	0.003 [0.002]	0.010*** [0.003]	0.010*** [0.003]	0.015*** [0.004]	0.010*** [0.003]
<i>BANK</i>	-0.185 [0.186]	-0.793*** [0.254]	-0.777*** [0.252]	-0.854*** [0.235]	-0.780*** [0.253]
<i>COOP</i>	-0.740*** [0.180]	-1.438*** [0.252]	-1.416*** [0.250]	-1.458*** [0.233]	-1.414*** [0.250]
<i>NONBANK</i>	-0.418** [0.186]	-1.050*** [0.254]	-1.035*** [0.252]	-1.127*** [0.235]	-1.026*** [0.252]
<i>NGO</i>	-0.510*** [0.187]	-1.266*** [0.260]	-1.239*** [0.259]	-1.396*** [0.244]	-1.248*** [0.258]
<i>RURBANK</i>	-0.763*** [0.190]	-1.437*** [0.255]	-1.428*** [0.253]	-1.547*** [0.234]	-1.399*** [0.253]
<i>Constant</i>	-11.332*** [1.822]	-7.928*** [2.040]	-7.770*** [2.214]	-9.664*** [2.721]	-8.136*** [2.070]

**Table 4: Efficiency and Financial Development:  
Inefficiency Equation Estimations**

Efficiency	1	2	3	4	5
<i>WOMAN</i>	0.168** [0.072]	0.14 [0.095]	0.147 [0.094]	0.342*** [0.099]	0.162* [0.093]
<i>ALB</i>	-0.306*** [0.059]	-0.289*** [0.059]	-0.289*** [0.065]	-0.366*** [0.091]	-0.280*** [0.060]
<i>ASB</i>	0.008 [0.013]	0.001 [0.018]	0.004 [0.018]	0.011 [0.018]	0.004 [0.018]
<i>INDIV</i>	0.001 [0.058]	-0.013 [0.074]	-0.015 [0.074]	0.035 [0.072]	-0.013 [0.074]
<i>ALLTYPE</i>	-0.182*** [0.055]	-0.206*** [0.071]	-0.230*** [0.072]	-0.243*** [0.071]	-0.226*** [0.073]
<i>GROUP</i>	-0.328*** [0.078]	-0.289*** [0.100]	-0.311*** [0.099]	-0.368*** [0.094]	-0.295*** [0.101]
<i>VILLAGE</i>	0.024 [0.137]	0.07 [0.156]	0.056 [0.155]	0.652*** [0.200]	0.093 [0.155]
<i>YEAR</i>	-0.020** [0.009]	-0.02 [0.013]	-0.022 [0.013]	-0.013 [0.013]	-0.02 [0.013]
<i>AGE</i>	0.006*** [0.002]	0.010*** [0.002]	0.009*** [0.002]	0.008*** [0.002]	0.009*** [0.002]
<i>BORROWER</i>	-0.124** [0.057]	-0.114** [0.057]	-0.116* [0.065]	-0.162* [0.090]	-0.101* [0.061]
<i>AFRICA</i>	0.102** [0.047]	0.091 [0.062]	0.062 [0.063]	0.135** [0.060]	0.121* [0.062]
<i>ASIA</i>	0.041 [0.061]	0.017 [0.083]	0.029 [0.082]	0.06 [0.080]	0.054 [0.083]
<i>DOMCRED1</i>		-0.002** [0.001]			
<i>DOMCRED2</i>			-0.006*** [0.002]		
<i>SPREAD</i>				0.006*** [0.002]	
<i>LIQL</i>					-0.003** [0.001]
<i>Constant</i>	44.264** [18.555]	42.91 [26.315]	47.209* [26.437]	31.374 [26.285]	42.732 [26.136]
<i>ilgtgamma:Constant</i>	1.618*** [0.494]	1.844*** [0.662]	1.720** [0.671]	1.695** [0.730]	1.766** [0.800]
<i>lnsigma2:Constant</i>	-1.533*** [0.058]	-1.508*** [0.078]	-1.521*** [0.080]	-1.711*** [0.076]	-1.515*** [0.087]
Observations	1006	642	642	490	657

Standard errors in brackets

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

## APPENDIX 1: Correlation table

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
<i>TC</i>	1	1.000																					
<i>R</i>	2	0.120	1.000																				
<i>SALARY</i>	3	0.593	-0.112	1.000																			
<i>GLP</i>	4	0.962	0.121	0.527	1.000																		
<i>BANK</i>	5	0.473	0.058	0.305	0.436	1.000																	
<i>COOP</i>	6	-0.329	-0.334	0.019	-0.285	-0.291	1.000																
<i>NBANK</i>	7	0.131	0.124	0.012	0.119	-0.255	-0.440	1.000															
<i>NPROF</i>	8	-0.118	0.211	-0.252	-0.146	-0.177	-0.305	-0.267	1.000														
<i>RUBANK</i>	9	0.038	-0.002	-0.036	0.024	-0.029	-0.050	-0.044	-0.030	1.000													
<i>OTH</i>	10	-0.108	0.020	-0.100	-0.077	-0.123	-0.212	-0.186	-0.129	-0.021	1.000												
<i>ALB</i>	11	0.198	-0.029	0.313	0.243	0.203	0.114	-0.112	-0.180	0.078	-0.054	1.000											
<i>YEAR</i>	12	0.107	0.084	0.124	0.142	-0.065	0.039	-0.064	0.066	-0.108	0.060	0.131	1.000										
<i>WOMAN</i>	13	-0.144	0.225	-0.260	-0.181	-0.121	-0.195	-0.043	0.460	-0.088	-0.024	-0.232	0.001	1.000									
<i>AFRICA</i>	14	-0.308	-0.389	-0.157	-0.340	-0.158	0.220	0.051	-0.041	-0.030	-0.198	-0.190	-0.139	-0.116	1.000								
<i>EASIA</i>	15	-0.037	0.093	-0.130	-0.045	-0.027	-0.237	-0.078	0.047	0.094	0.483	-0.091	0.011	0.098	-0.336	1.000							
<i>IND</i>	16	0.245	-0.038	0.205	0.242	0.161	-0.102	0.006	-0.130	-0.027	0.138	0.058	-0.094	-0.212	-0.187	0.141	1.000						
<i>INDSOL</i>	17	0.222	0.154	-0.038	0.240	0.202	-0.191	0.078	0.054	-0.031	-0.120	-0.086	-0.114	0.101	0.022	0.076	-0.164	1.000					
<i>SOL</i>	18	-0.120	0.105	-0.226	-0.098	-0.102	-0.175	0.341	-0.036	-0.018	-0.074	-0.122	-0.013	0.056	0.202	-0.063	-0.094	-0.107	1.000				
<i>VIL</i>	19	-0.039	0.129	-0.085	-0.054	-0.047	-0.081	0.106	0.048	-0.008	-0.034	-0.058	-0.049	0.167	-0.042	-0.021	-0.043	-0.050	-0.028	1.000			
<i>LALB</i>	20	0.800	0.212	0.162	0.816	0.297	-0.447	0.217	0.091	-0.018	-0.081	-0.183	0.056	0.089	-0.197	0.006	0.123	0.338	0.057	0.031	1.000		
<i>LASB</i>	21	0.383	-0.224	0.590	0.391	0.291	0.107	-0.009	-0.366	-0.010	-0.055	0.456	0.080	-0.395	-0.262	-0.071	0.211	-0.056	-0.275	-0.143	-0.039	1.000	
<i>LBORR</i>	22	0.387	-0.126	0.644	0.425	0.278	0.216	-0.137	-0.392	0.068	-0.004	0.701	0.154	-0.447	-0.270	-0.087	0.220	-0.121	-0.257	-0.141	-0.176	0.728	1.000