

Microfinance and Financial Sector Development

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JEL Classifications: O16, O50, G21

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CEB Working Paper N° 09/040
September 2009

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Working paper version: this version September 2009

Abstract

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* The authors would like to thank Niels Hermes, Marek Hudon, Robert Lensink, Kim Oosterlinck, Ariane Szafarz and Leo Van Hove for comments on earlier versions. They also thank participants of the First European Research Conference on Microfinance at CERMi, Brussels for useful suggestions. Any remaining errors are the responsibility of the authors.

1. Introduction

Development policy is increasingly concerned with expanding financial services to the poorer sections of the population. In a recent World Bank book, Demirguc-Kunt et al. (2008) investigate what hinders and stimulates financial access and development. A policy for increasing access to financial services for the poor that receives a lot of attention is microfinance. Microfinance is the provision of small financial services to the poorer sections of the population. It is thought of as having a positive impact on the life of the poor by providing them access to something they previously did not have, namely access to financial services (Morduch, 1999). Consequently, through serving more people, the providers of microfinance services increase their societal impact.

The microfinance movement has known an important growth during the last couple of decades. However, growth seems unequally dispersed among countries and institutions. Microfinance institutions (MFIs) have known different levels of success: some have become very significant in size and serve a lot of clients, like the Grameen Bank in Bangladesh, or BRI in Indonesia, while other MFIs remain small or even cease to exist (Ahlin et al., 2008). The literature has mainly focused on MFI-specific characteristics such as governance and management-related issues in explaining these differences in success. For instance, Hartarska (2005) explores the relation between managers' experience and compensation schemes on MFI-performance. Along the same lines, Mersland and Strøm (2009) analyze the relation between board-structures and MFI-performance. Recently, a number of studies have explicitly investigated the relationship between microfinance institutions' performance and changes in the macro-environment of the country in which the institution operates. These studies recognize that the macro-economic environment in which the MFI is active is an important determinant for MFI-performance in addition to institution-specific characteristics. Or as

Ahlin et al. (2008) put it: '*any assessment that does not take into account the macro-economic and macro-institutional environment [...] is incomplete*'.

However, the link between the performance of MFIs and the development of the formal financial sector remains unexplored. The market-failure solution theory of microfinance, which suggests that MFIs serve a different purpose than commercial banks, is commonly accepted, but has not yet been confirmed by empirical proof. Is microfinance indeed developing faster in countries where commercial banks fail to serve an important number of people? Or do MFIs rather benefit from existing banking facilities to develop faster? Are they that way having a bigger impact in countries that have less or more developed banking sectors? Similarly, are MFIs performing better in countries with well-developed banking sectors, or do banks hinder MFIs' growth by means of increased competition?

Our paper sheds light on these issues by including the development of the formal banking sector as an explicit determinant for MFI performance, here measured in terms of outreach and profitability. In times where microfinance is increasingly commercializing, it is interesting to see how the two sectors interact. More specifically, we want to test whether the microfinance sector is in competition with the formal banking sector, whether they complement each other or whether they rather develop independently. In order to investigate these issues empirically we relate MFI performance measures to a number of variables that capture the development of the banking sector using a large unique panel dataset of 1,073 institutions over 10 years.

The results indicate that MFIs reach more clients and are more profitable in countries where the formal banking sector is less developed. This suggests that MFIs do serve a different

‘niche’-market and fulfil a need that the formal banking sector does not address, in line with the market-failure hypothesis.

However, the analysis also reveals a number of channels through which the formal financial system positively impacts MFI-performance. First, MFIs are less profitable when interest rates are higher, which reflects the fact that MFIs may partly depend upon funding provided by the formal banking sector of the host country (Rosenberg et al., 2009). Secondly, MFIs are less profitable when inflation is high, suggesting that MFIs perform better in well-functioning and stable financial environments. This is in line with the research by Boyd et al. (2001) who show that banking activities, in general, will be lower in regions heavily affected by inflation. These channels suggest that, although MFIs serve a different audience and a different purpose, the state and development of the formal banking sector and the stability of the overall financial system have a direct impact on MFI-performance. In other words, MFI-performance in terms of both outreach and profitability are contingent on financial sector development.

The remainder of the paper is structured as follows. In the second section, the literature linking the development of the financial sector with MFIs’ performance is presented. In section 3, the hypotheses are derived. In the fourth section, we discuss the data, variables, model and the estimation methods. In the fifth section, the main empirical results are presented. In the sixth section, we provide a number of empirical checks to explore the robustness of the results. Finally, conclusions and implications are presented in section 7.

2. Literature

2.1 Financial sector development, market failures and the development of microfinance

Financial sector development is important because it fosters economic growth (Levine, 2004). Additionally, Jalilian and Kirkpatrick (2005) show that financial sector development plays an important role in poverty reduction. Consequently, an important part of development policy is concerned with developing financial markets for the poor as a way to enhance economic growth (Demirguc-Kunt et al. 2008). Indeed, formal financial institutions do not serve a significant fraction of the population in developing countries. This is mainly due to market failures stemming from imperfect information and informational asymmetries (Stiglitz and Weiss, 1981; Barham et al., 1996).

The development and promotion of Microfinance Institutions (MFIs) has been viewed as a promising development policy able to address the market failures in the formal banking system. Therefore, in the last decades, microfinance has received increased attention as a tool for poverty-reduction (Barr, 2005). Many MFI-initiatives have been undertaken in order to serve the large number of people in developing countries that do not have substantial access to financial services.

In the start-up period during the early eighties, MFIs were mainly funded with donor money under an NGO status. Since the 1990s, however, the sector is undergoing a process towards formalization and commercialization. This means that MFIs try to become independent from donor money forcing them to aim for financial sustainability. In that process towards self-sustainability, MFIs become more formalized and often take another formal regulatory status (Robinson, 2001). Some have transformed completely into banks, like BancoSol in Bolivia and Compartamos in Mexico (Armendariz and Szafarz, 2009).

Due to this formalization process, modern MFIs are believed to serve a dual objective, this is: both to reach the unbanked poor as well as to become self-sustainable (Armendariz and Morduch, 2005; Hartarska, 2005). Consequently, an increasing number of MFIs need external commercial funding in addition to revenues from possible lending-activities once donors stop funding (de Crombrugghe et al., 2008). Increasingly, commercial banks and international investors have become interested in funding microfinance activities, as MFIs seem to be an interesting way to diversify their portfolios (Krauss and Walter, 2008; Isern and Porteous, 2005). This process has lead to a pressure on MFIs to perform better and to quantify their double objective.

2.2 MFI-performance and the influence of the macro-economic environment

The development of the microfinance sector has also attracted increased attention from academics, trying to understand performance and development of MFIs. Within this research field, one strand of literature searches for the determinants for MFI-performance. Empirical research has mainly focused on institutional determinants and governance matters explaining differences in performanceⁱ. Although these issues are very important, it seems that macro factors might also play a role (Ahlin et al., 2008). While the role of the macro-economic environment has been studied in depth in the formal financial literatureⁱⁱ, the relationship between MFI-performance and the macro environment has only recently received attention by a small but increasing number of authors.

The channels through which macro-economic variables may influence the performance of MFIs are multiple. Vanroose (2006) has done a first attempt to link microfinance and the macro-economic environment for the Latin American region through a literature study on the

region. Honohan (2004) studies a number of macro-economic variables that may explain the variation in the development of microfinance markets on a global level. He finds no more than weak correlations with the variables he investigates but takes only around 50 countries into accountⁱⁱⁱ. Vanroose (2008), in a later study that takes into account all developing countries, identifies macro-economic factors that may explain why the microfinance sector is more developed in some countries while not in others. She studies the sector on an aggregated country-level and finds a positive influence of population density, GNI and aid per capita on MFI-outreach.

Another part of the literature focuses on the performance of the individual MFI. Gonzalez (2007) studies different measures of MFIs' financial performance but concludes that macro-economic developments do not influence them in a significant manner. Krauss and Walter (2008) investigate whether changes in the global capital markets influence an MFI's portfolio and find no proof of that. Nevertheless, they do find a significant exposure of MFI performance to changes in the Gross Domestic Product. A possible explanation for the differences between these studies is that they concentrate on other financial measures. Ahlin et al. (2008), on their turn, investigate empirically the relationship between different sets of macro-economic variables and the performance of MFIs and find that several variables, like GDP growth and institutional design, are positively significant in explaining differences in MFI performance.

In a very recent study, Hermes et al. (2009) focus on the relationship between MFI-efficiency and the development of the financial system and find that MFI- efficiency is positively correlated with overall financial sector development. This study is most closely related to the present paper, the main difference being the performance-measures that are being studied.

Hermes et al. (2009) look at efficiency of the MFIs using stochastic frontier analysis. While efficiency is without doubt an interesting aspect, our study looks at MFI-performance in terms of both outreach and profitability. These two performance-measures have been extensively used in the literature (see for instance Hartarska, 2005; Mersland and Strøm 2008; Mersland and Strøm, 2009), since they reflect the dual purpose outlined earlier that is, to reach the poorer segments of the population and reach financial sustainability^{iv}.

The previous discussion shows that while an increasing number of authors recognize that the macro-economic environment in which the MFI is active might have a substantial impact on MFI-performance, the existing empirical evidence is scarce and largely inconclusive. The present paper wants to resolve this by focusing on one important aspect of the macro-economic environment, namely the development of the formal financial system. The next section discusses how the financial system might influence MFI-performance and derives the main hypotheses that will be tested.

3. Hypotheses

The empirical relation between the development of the formal banking sector and the microfinance sector is *a priori* unclear. Different arguments can be made that either predict a positive or negative relation between the development of the formal banking sector and performance of the microfinance-sector.

With respect to the *negative* relation between development of the formal banking sector and the microfinance sector, two arguments can be made. First, one could argue that microfinance and the formal system are *substitutes*. In fact, MFIs can be thought of as one specific niche of the highly segmented financial sector focusing on the poorer, non-served parts of the

population (Christen et al., 2004; Richter, 2004). In countries with well-developed financial systems, the part of the population that is served by formal financial institutions is quite big. For example, in the rich countries more than 80% of households have an account within financial institutions, while that fraction diminishes to 20 to 40% of the households in developing ones (Demirguc-Kunt et al., 2008). In countries where financial markets are more developed the need for microfinance will be less acute. This would then suggest that the microfinance sector would be less developed where the formal banking system is well established.

This argument is closely related to the market-failure theory of microfinance. Namely, microfinance is seen as a solution to market failures in the formal banking sector and solves it through the use of different lending methodologies. Tirole (2006) argues that it is through group lending that microfinance solves the informational asymmetries that hinder the formal financial sector. Armendariz and Morduch (2000) show that next to group liability, MFIs have developed additional methodologies and innovative contracts to overcome lending constraints. Thanks to these alternative methodologies MFIs are able to serve clients considered too risky by banks. MFIs thus concentrate on a clientele that is not served by banks.

A second and closely related argument predicting a negative relation between microfinance and development of the formal banking sector relates to *competition* between the two sectors (Hermes et al., 2009). Specifically, in well-developed banking systems, commercial banks are more efficient and profit from scale advantages and diversification. In that sense, commercial banks can be very active and flexible in adapting credit contracts and serving different groups of people. They can efficiently adapt their credit contracts towards poorer sections of the

population. This could lead to a crowding out-effect where the MFI clientele substitutes its MFI-loans for commercial bank loans at lower interest rates.

Both arguments predict that microfinance would be less developed where formal banking system development is high, which would entail a negative relation between MFI-performance and the development of the formal banking system.

On the other hand, a number of arguments can be made that would predict a *positive* relation between formal banking sector development and microfinance. These arguments relate to positive spill over effects between the formal banking system and microfinance (Hermes et al., 2009). First, MFIs could benefit from increased credit lines offered by the formal banking system. In that respect, the formal banking sector could reinforce the development of the MFI-sector by providing them the necessary external funding for expanding their activities (Isern and Porteous, 2005; Hermes et al., 2009). Similarly, McIntosh and Wydeck (2005) show that interest rates are usually lower in well-developed banking systems due to competition. As a result, MFIs could have access to cheaper loans which would enable them to reach financial sustainability more easily. A second argument relates to the more developed regulatory framework in countries with well-established formal banking system. This could also increase efficiency and performance of MFIs (Hermes et al., 2009).

The previous discussion shows that there are a number of potential interactions between the formal banking sector and development of the microfinance sector, although the nature of the relation is unclear *a priori*. This will be the main hypothesis that will be tested empirically by relating a number of MFI-performance measures to variables measuring the development of the formal banking system:

H1. MFI-performance is influenced by the development of the formal banking sector in the host-country. The relation can either be positive or negative.

Besides analyzing the relation between development of the formal banking system and MFI-performance in general, we investigate an important interdependency between the two financial sectors more in detail. As argued earlier, MFIs are increasingly using domestic bank credit as a finance channel to expand their activities (Rosenberg et al., 2009). In that respect, MFI-performance in terms of outreach and profitability might be a direct function of the interest rates applicable in the host-country. Higher interest rates in the host-country make domestic funding expensive which could be a constraint to the expansion of the microfinance sector. Lower interest rates make domestic funding cheaper, which could accelerate its expansion. Therefore, in the second hypothesis we investigate whether or not MFIs might perform worse where domestic funding is more expensive. This is summarized into our second hypothesis as follows:

H2. MFI-performance is negatively related to interest rates applicable in the host-country.

4. Data, model and estimation methods

4.1. Data

Our dataset was extracted from the MIX market. The sample contains data from 1997 until 2006. In total, 1073 institutions are being used. The MIX classifies institutions under different legal status. All five of them are being used: cooperatives, non-bank financial institutions, banks, rural banks and non-profit organizations. We have used all categories and include as much observations as possible in order to reduce any sample bias.

The dataset includes MFIs from the five main developing regions in the world. These are: the Latin American and Caribbean region (LAC: 258 MFIs), the South-African region (S-Africa: 232 MFIs), the Middle-Eastern and Northern African region (MENA: 36 MFIs), the South-Asian region (S-Asia: 207 MFIs), the East Asian and Pacific region (EAP: 115 MFIs) and finally the Eastern Europe and Central Asian region (ECA: 191 MFIs). The legal distribution is as follows: 486 NGOs, 176 cooperatives, 247 non-banks financial institutions, 50 rural banks, 69 banks and 28 MFIs that are classified under the ‘other’ category.

Given these descriptive statistics, we are convinced that the data gives a representative image of the sector worldwide. All kinds of institutions are represented in the different regions. Nevertheless, some drawbacks of the data must be kept in mind. These are the disadvantages typically related to all studies that use MIX market data.

Firstly, MIX data is self-reported, which could reduce the quality of the data. Nevertheless, the MIX has since a couple of years installed a quality control system in order to help ensure the validity of the data and this has increased its fineness^v. Another critique that is sometimes raised is that the MIX sample is not representative for the whole sector, as only MFIs that are interested in providing information for potential donors and social or commercial investors are reporting^{vi}. Nevertheless, it is reasonable to believe that its representativeness has increased over the years as MFIs are pushed to be more transparent. Furthermore the most important institutions are reporting and as Honohan (2004) shows, the 30 biggest institutions are serving 75% of the clients. It could be, though, that the data indeed gives a bias towards those MFIs that are more commercially oriented or searching for more external funding. Evidently, the results and conclusions should be viewed in light of these drawbacks.

4.2 Model and variables

In line with previous studies focussing on the determinants of MFI-performance (Hartarska, 2005; Mersland and Strøm, 2008; among others) we relate MFI-performance to our variables of interest in addition to a wide set of control-variables. Specifically, we relate MFI-performance to *a.* variables measuring formal banking sector development *b.* macro-economic controls and *c.* micro-institutional controls. The model can be written as follows:

$$MFI_{i,t} = f(bank)_{i,t} + g(macro)_{i,t} + h(MFI_{specific})_{i,t} + \mu_i + \varphi_r + u_{i,t} \quad (1)$$

where $MFI_{i,t}$ is a set of performance-measures; $bank_{i,t}$ is a set of variables that capture the state of the formal banking sector of the country in which the MFI is active; $MFI_{specific}_{i,t}$ is a set of institution-specific variables taken from previous literature; μ_i is the institution-specific effect that captures all unobserved institution-specific variation and φ_r is a set of regional dummies that captures regional differences in MFI-performance.

With respect to *MFI-performance* we use both outreach and profitability measures. As argued earlier, the performance of an MFI can be evaluated based upon the sector's double objective, namely reaching as much clients as possible and still obtaining operational self-sustainability (Hartarska, 2005). Outreach is measured in terms of the (natural logarithm of) number of active borrowers (*lnNAB*) as well as the (natural logarithm of) total loan portfolio (*lnTLP*). Profitability is measured in terms of operational sustainability (*OSS*) defined as the ability of an institution to cover its operational costs. Besides OSS we also look at return on assets (*ROA*) and return on equity (*ROE*).

With respect to the variables measuring *financial sector development*, we want to measure the development of the formal banking sector both in terms of access and financial depth. While financial depth has long been one of the most important variables to assess financial development, recently more focus is being put on access and actual use of financial services (Claessens, 2005; Honohan, 2008). Financial depth is the amount of credit disbursed as percentage of total GDP and measures the activity and size of financial intermediaries (Beck et al., 1999). Financial access captures how many people potentially have access to banking services. Financial use is the number of accounts people actually have. Financial access and use are closely correlated and access is accepted as a proxy for use, as it is difficult to obtain representative data on the number of accounts in developing countries belonging to one household (Demirguc-Kunt et al., 2008). A clear distinction between financial depth on the one side and access and use on the other side is being made, because recent studies have shown significant differences between the two measures. For example, Demirguc-Kunt et al. (2008) show that while measures of financial depth are the same between Colombia and Lithuania – around 20% of credit to GDP – there exist big differences in actual use of financial services between the two countries. While in Lithuania 70% of households have accounts, only 40% in Colombia make use of them. Beck et al. (2007), argue that financial access is important as a measure besides financial depth because it actually quantifies how easily people can make use of financial services.

In line with this recent discussion in the literature, we look at a measure for both access to the formal financial system as well as financial depth of the formal financial system. For access we use the number of ATM-machines available per million inhabitants (*ATMs*). This variable is fairly new and can be found in the database on financial access by Beck et al. (2007). For

debt of the financial system we use the domestic credit disbursed to the industry (per capita) (*DOMCREDIT*). This variable is taken from the World Development Indicators (WDI).

To assess the relation between performance and the interest-rates applicable in the host-country (hypothesis 2) we look at the average annual deposit rate (*DEPRATE*) and the average annual lending rate (*LENDINGRATE*). Interest rates are also taken from the WDI-database.

For the *MFI-specific controls* we look at *size*, *age*, *type of institution* (NGO, bank, NBFI, cooperative, other) and *geographical focus* (rural vs. urban) which are controls commonly used in other performance-studies.

For the *macro-economic or institutional* variables, we look at *industry-value added* (*INDVA*), *population density* (*POPDENS*), *rural population* (*RURPOP*), *foreign direct investment* (*FDI*), *aid per capita* (*AID*), *lnGNI per capita* (*GNI*) and *inflation* in line with previous studies focusing on the impact of the macro-economic environment on MFI-performance (Ahlin et al., 2008; Vanroose, 2008).

4.3 Estimation methods

The parameters of the panel data regression model presented in (1) are estimated using a random effects model (RE). A RE-model has a number of important benefits that has made it popular in performance-studies. First, the RE-model takes into account all unobserved institution-specific residual variation in MFI-performance in the term μ_i , thereby reducing any bias resulting from potential omitted variables (Stock and Watson, 2007). Secondly, the RE-model is better suited to tackle the time-invariant nature of some of the covariates than for

instance the fixed effects model that eliminates time-invariant variables by first-differencing (Stock and Watson, 2007; Lensink and Mersland, 2009; Hartarska, 2005).

However, there are a number of methodological issues that might bias parameter estimates and that require careful attention. First, the RE-model assumes that regressors are uncorrelated with the unobserved effect μ_i . If, however, some unobserved variable is omitted from the analysis that is correlated with one of the regressors, μ_i , will be correlated with that regressor, making the estimates on that parameter biased or inconsistent. Therefore, besides looking at the RE-model we also re-estimate some of the equations using the Hausman-Taylor approach. This is in essence an instrumental variables approach that fits random-effects models where some of the covariates might be correlated with the unobserved institution-specific effect μ_i .

Secondly, endogeneity-bias resulting from reversed causality might plague the estimation. Indeed, one could make the case that the causal link does not run from bank sector development to MFI-performance, but rather the other way around. This causality-bias makes the regressor correlated with the idiosyncratic component of the error term $u_{i,t}$, again introducing bias in the estimated parameters (Stock and Watson, 2007, pg. 325). To account for this endogeneity-bias we also re-estimate some of the regressions using an instrumental variables approach (IV) where the potentially endogenous variables are instrumented by a set of instruments composed of first, second and third order lag of the endogenous variable.

Finally, many of the covariates in the panel regression equation are time-invariant. Specifically, one of the key variables for development of the banking sector, number of ATMs per million (*ATMs*), is only available in the most recent year of the sample period. In addition, the MFI's legal status, geographical focus (*urban* versus *rural*) and the regional

dummies are also time-invariant. Therefore, we re-estimate some of the regressions using the Fixed Effects Vector Decomposition-estimator (FEVD) developed in Plümper and Troeger (2008), designed to tackle time-invariant covariates in models that take up unobserved institution-specific effects. This estimator uses a three-step estimation approach to produce efficient parameter estimates when covariates are time-invariant and has been used in the context of microfinance in a recent paper by Lensink and Mersland (2009).

5. Empirical results

5.1 Descriptive statistics

In Table 1, we present a number of summary statistics for the sample under study. The table includes the MFI-specific variables (4611 MFI-year observations), macro-economic variables and the variables measuring development of the formal banking sector. The MFI-specific variables indicate that the mean $\ln NAB$ is 8.63, which corresponds to 50,000 borrowers served on average. Mean OSS is 1.13 indicating that on average MFIs are self-sustainable i.e. costs are covered by income.

< Insert Table 1 around here >

In Table 2 we report correlations between the variables. Panel A investigates the correlation between the performance-variables in terms of outreach and profitability. As can be seen there is a high correlation (0.75) between the two outreach-measures $\ln NAB$ and $\ln TLP$. Similarly there are high correlations between the profitability measures ROA , ROE and OSS . Interestingly, there is a somewhat weaker, but still positive correlation between the outreach-measures and profitability-measures. This suggests that MFIs that reach more borrowers are also slightly more profitable in our sample. This finding gives further justification to look

both at outreach and profitability and suggests that these are alternative, complementary performance-measures.

Panel B investigates the relation between the variables measuring development of the banking sector in the host-country. As can be seen, there is a positive correlation between the number of ATMs (measuring access to the formal financial system) and domestic credit (measuring depth of the formal financial system). The relation between development of the banking system and the interest rates is close to zero or even negative, which reflects the fact that interest rates are usually lower in well-established competitive banking systems (McIntosh and Wydeck, 2005).

Panel C investigates the relation between the MFI-performance measures and the banking development variables. As can be seen, in general there is a negative relation between MFI-performance and development of the formal financial sector both in terms of domestic credit and number of ATMs. This is a first indication that MFIs reach more clients and are more profitable where access to the formal banking system is lower. Similarly, there is a negative correlation between the interest rates variables and the MFI-performance measures both in terms of outreach and profitability. This finding is in support of our second hypothesis that MFIs perform better where interest rates are lower.

< Insert Table 2 around here >

In Table 3 we analyze the relation between MFI-performance measures and banking-variables univariately by reporting mean values for the performance-measures in different discrete classes divided according to quartiles in the banking variables. As can be seen, generally

performance-measures both in terms of outreach and profitability decline when bank sector variables indicate a higher level of bank sector development. Again, this is an indication of the market-failure argument, namely that MFIs and the formal sector serve two different markets. One exception is the class with the lowest level of bank sector development. Performance measures are in fact lowest where the number of ATMs is lowest, and where domestic credit provided by the banking sector is lowest. This suggests that, while in general there is a negative relation between MFI-performance and formal financial sector development, a certain level of banking development must be present before microfinance can reach positive returns on equity and assets^{vii}.

Turning towards the interest rates in terms of the deposit and lending rate, we see that performance measures usually decline monotonically when interest rates are higher. Again, although this is only univariately, this is a first indication in favour of the second hypothesis: MFIs depend upon domestic funding provided by the formal banking sector to develop their activities. When interest rates are higher, domestic funding is generally more expensive which has a negative influence on MFI-performance in terms of outreach and profitability.

< Insert Table 3 around here >

5.2. Multivariate analysis

Table 4 summarizes the regression outputs from the MFI-performance model estimated using random effects. Panel A investigates the impact of development of the formal system in terms of the number of ATMs (measuring access to the formal system) and domestic credit (measuring depth of the formal financial system). Panel B analyzes the impact of the interest rates on MFI-performance in terms of the deposit rate and the lending rate. The different

columns correspond to the different performance measures (*lnNAB* and *lnTLP* for outreach; *ROA* and *OSS* for profitability). First we discuss the variables measuring development of the formal system. Next we discuss the institutional-specific and macro-economic controls.

As can be seen from Panel A, more access to the formal financial system in terms of number of ATMs is negatively associated with MFI-outreach and MFI-profitability. In other words, MFIs perform better where access to the formal financial system is lower, the effects being significant at the 1% significance level. This confirms our first hypothesis: MFI-performance is influenced by formal banking sector development and the results show that the relation is negative. Similarly, columns (5) – (8) reveal a negative association between depth of the formal financial system, and MFI-performance. This effect is particularly strong and highly significant for MFI-performance in terms of profitability. The effects on outreach are not statistically significant. This demonstrates that the two bank variables measure financial sector development in a different manner and that there exist significant differences between them, as mentioned by Demirguc-Kunt et al. (2008).

Overall, the results from Panel A seem to confirm the univariate analysis that was carried out in tables 2 and 3 namely, MFIs are reaching more clients and are more profitable where the formal banking sector is less developed. This is in line with the market failure argument put forward by theory: MFIs flourish where the formal banking sector is less developed.

As can be seen from Panel B, the variables measuring the interest rates applicable in the host-country are negatively related to MFI-performance, both in terms of outreach and profitability, which is in support of hypothesis 2. These effects are highly significant at conventional significance levels and are also in line with the univariate analysis carried out in

previous tables. High interest rates are associated with costly domestic funding which negatively affects MFI-activities.

Turning towards the other covariates in the regression we see the mainly the institution-specific controls explain a lot of variation in performance. The signs of the coefficients are fully in line with expectations and have been documented in previous literature (Ahlin et al. 2008). Older MFIs perform better both in terms of outreach and profitability although the effect is decreasing with age (significant negative second order effect). Larger MFIs in terms of assets also perform better both in terms of outreach and profitability.

Looking at legal status we see that the effect on outreach and profitability diverge. Specifically, NGOs (which is the reference category) have the highest outreach. These results confirm the findings by Hartarska and Nadolnyak (2007) that changing into a more formal regulated institution does not automatically result into serving more clients. NGOs thus still reach most clients in the microfinance industry and their legal status does not limit their outreach. However, NGOs do not have the highest profitability measures as can be seen from columns (3) and (4). In fact cooperatives and non-bank financial institutions have better profitability. This differential effect on outreach and profitability reflects the fact that in general NGOs are less commercially oriented and care more about reaching out to the poorer sections.

Looking at the geographical focus we see again a differential impact on outreach and profitability. Rural MFIs have significantly lower outreach measures but have higher profitability measures (although for profitability the differences are not always statistically significant). Lower outreach can be explained by a lower degree of potential clients in the

rural environment as has been mentioned by Yaron and MacDonald (1997). Better repayment rates or clients being more closely monitored by the rural institutions could explain why rural MFIs have slightly better profitability-measures.

Turning towards the other macro-variables, we see that they are playing almost no role in explaining performance. However, there seems to be one important exception, namely inflation. There is a consistent negative relation between inflation and MFI-performance both in terms of outreach and profitability, with the effects usually highly significant at the 1% level. These findings suggest that MFIs perform better in countries not heavily affected by high inflation rates. This allows us to make a direct parallel with the formal banking sector. To be precise, also in heavily affected inflation regions, banking activity will be lower, as shown by Boyd et al. (2001). Our results indicate that this argument applies also to the microfinance-market. It seems that, although MFIs reach more clients in the less-developed banking regions, once active in those countries, inflation has a negative influence on the number of total borrowers as well as on profitability.

Finally, we turn towards the regional dummies (not reported) and find that there is a differential impact on outreach and profitability. Specifically, we find that outreach is highest in the MENA, EAP and S-ASIA region. It is significantly lower in ECA, LAC and S-AFRICA. This finding reflects the success of microfinance in the Asian region as well as the dynamics of the MENA region, where microfinance took off only more recently and is highly dynamic (MIX, 2006a). On the other hand, it shows that the Latin American region has a significant lower outreach, although the region is very well known for its commercial oriented microfinance market (MIX, 2006b). This suggests that there is a lot of potential to increase outreach in Latin America. As for the South-African region, the results confirm the findings

in Vanroose (2008) that the South-African region has high number of MFIs, but that they do not reach significant outreach levels. The overall low level of economic development in the South-African region could be a possible explanation for that.

Profitability is highest in the EAP, ECA, LAC and MENA region. It is significantly lower in S-AFRICA and S-ASIA. We obtain the similar results if we look at OSS. This could be explained by the fact that MFIs in South Asia are mainly NGO-oriented and that the commercialization movement is not taking place there at the same intensity as in the other regions (Armendariz and Vanroose, 2009). Latin American MFIs are traditionally more commercially oriented than the other regions. Also the MIX (2006b) comments on the fact that there exist huge differences between the levels of commercialization of the sector in the different developing regions.

< Insert Table 4 around here >

6. Robustness checks

In Section 3 we have argued that although the RE-model seems to be most suited for estimation of the performance model, a number of methodological issues might plague the parameter estimates. In Table 5 we have re-estimated some of the regression outputs using different estimation techniques to account for these methodological issues. In columns (1) to (3) we re-estimate the impact of access to the formal system on the outreach measure *InNAB*. In columns (4) to (6) we re-estimate the impact of access to the formal system on the profitability measure OSS.

The different columns correspond to the different estimation techniques that were discussed in detail in Section 3. In columns (1) and (4), an instrumental variables approach was used to account for potential endogeneity of the banking variables. In columns (2) and (5) we report the Hausman-Taylor regression that accounts for correlation between the covariates and the unobserved institution-specific effect. In columns (3) and (6), the FEVD-estimator has been used that accounts for the time-invariant nature of some of the covariates.

As can be seen from Table 5, usually, similar signs and magnitudes are being found, not only for the number of ATMs but also for the different controls. One exception is the FEVD-estimator that usually returns very small standard errors and consequently highly significant variables. Apart from this issue, the results seem quite robust to the different estimation methods.

< Insert Table 5 around here >

7. Conclusion and discussion

A recent stream of literature advocates that MFI-performance is not only determined by the way MFIs are organized internally but also by the macro-economic and macro-institutional environment in which the MFI is active (Ahlin et al., 2008; Krauss and Walter, 2008; Hermes et al., 2009; among others). In line with these recent insights, this paper analyzes whether the development of the formal banking system of the MFI's host-country is a significant determinant for MFI-performance in terms of outreach and profitability.

Theoretically several arguments can be made with regard to the nature of the relation between development of the formal banking sector and microfinance. On the one hand, the well-known

market failure hypothesis predicts that MFIs serve a different purpose than the formal banking sector and fill a void that the formal banking sector fails to fulfil. Consequently, we would expect MFIs to flourish where bank sector development is low. On the other hand, one could argue there might be positive spill over effects from the formal banking sector to microfinance, resulting from increased credit availability and better regulation.

Our paper sheds light on these issues by regressing MFI-performance measures, both in terms of outreach and profitability, on bank development variables while controlling for other MFI-specific variables as well as macro-economic variables. A large panel data set based on the MIX database is used to test the hypotheses.

The results confirm that there is a negative link between formal financial sector development and MFI-performance. We find that MFIs reach more clients and are more profitable where access to the formal bank sector is low. This finding confirms the general belief that MFIs serve a different niche-market and flourish where the formal banking sector fails. Consequently, microfinance can be seen as an alternative for formal financial sector development. Through the use of different lending methodologies and innovative contracts, it seems to have found ways to increase access to financial services for people, this way having a positive impact on their life.

However, we also find empirical evidence for a number of interdependencies between the formal banking sector and MFI-performance. First, we find that MFIs are less profitable where interest rates are higher. This finding suggests that MFIs depend upon domestic funding and seem to struggle where this domestic funding is expensive. This is in line with

recent findings that MFIs are increasingly using domestic bank credit as a financing channel to expand their activities (Rosenberg et al., 2009).

Secondly, we find that MFIs are less profitable when inflation rates are high. This suggests that MFIs do benefit from a well-functioning financial system and struggle where the financial system is under severe pressure. This is in line with Boyd et al. (2001) who showed that banking activities are lower in heavily affected inflation regions. Our findings indicate that this argument applies also for the microfinance market.

The paper also underpins the importance of recent interest in measuring actual access to financial services. While the depth of the financial system is not significant in explaining differences in MFI-outreach, access is. This confirms that access to and depth of the financial system, are two different measures of financial development as argued by Demirguc-Kunt et al. (2008) and that financial access is an alternative and probably more accurate variable in order to measure actual bank-sector outreach in a country.

Concluding, we believe that these results bring forward a number of implications that might be useful to academics and policy makers as well as practitioners in the field. First, the macroeconomic environment in general, and the formal financial system of the host-country, in particular, should be taken into account when evaluating MFI-performance. Secondly, the results indicate that the microfinance-sector and the formal financial system are interrelated. This relation is likely to become more important in light of the current evolution that MFIs are increasingly commercializing, while formal banks and investors seem more and more interested in the microfinance-markets. Thirdly, the research shows that, although

microfinance serves a specific purpose, certain insights from the formal financial literature could apply to the microfinance field.

Evidently this research comes with a number of limitations that should be kept in mind and that offer interesting routes for further research. First, as argued before, MIX data are self-reported and are known to have a bias towards larger and more commercially oriented MFIs. It would be interesting to see whether the results hold when using different databases. Secondly, the variables at our disposal for measuring formal banking sector development were scarce. It would be interesting to analyze the impact of using additional and perhaps more detailed measures for bank sector development. Finally, although our results point towards an overall negative relation between MFI-performance and the banking sector, the univariate statistics indicate that MFIs perform worse at the very lowest levels of bank sector development. This might point towards the need for a certain minimal threshold level for bank sector development before microfinance can work, which could be studied more in detail.

LIST OF TABLES

Table 1. Summary statistics

This table presents a number of summary statistics for the key-variables used throughout the study. *LnTA* is the natural logarithm of total assets. *Age* is the number of years the MFI is active in microfinance. *lnNAB* is the natural logarithm of the number of active borrowers. *lnTLP* is the natural logarithm of the MFI's total loan portfolio. *OSS* is operational self-sufficiency measured as net income divided by operating expenses. *ROA* is return on assets. *ROE* is return on equity. *DumNGO* is 1 if the MFI is an NGO and 0 otherwise. *DumBANK* is 1 if the MFI is a bank and 0 otherwise. *DumNBFI* is 1 if the MFI is a non-bank financial institution and 0 otherwise. *DumCOOP* is 1 if the MFI is a cooperative and 0 otherwise. *DumRURAL* is 1 if the MFI operates solely in rural areas and 0 otherwise. *INDVA* is the added value of industry of the country in which the MFI is active. *POPDENS* is the population density of the host-country. *FDI* is the share of foreign direct investment being invested in the host-country. *GNI* is the per capita gross national income of the host-country. *INFLATION* is the yearly inflation rate of the host-country. *ATMs* is the number of ATMS available in the host-country per 1,000,000 inhabitants. *DOMCREDIT* is domestic credit for the industry provided by the formal banking sector measured as percentage of GNI. *DEPRATE* is the yearly average deposit-rate of the host-country measured in percentages. *LENDINGRATE* is the yearly average lending rate applicable in the host-country measured in percentages.

| | <i>N</i> | <i>mean</i> | <i>st.dev</i> | <i>min</i> | <i>max</i> |
|-----------------------------------|----------|-------------|---------------|------------|------------|
| MFI-specific variables | | | | | |
| lnTA | 4,580 | 14.81 | 1.98 | 5.43 | 22.42 |
| Age | 4,560 | 10.01 | 9.53 | 0 | 111 |
| lnNAB | 4,611 | 8.63 | 1.93 | 0.00 | 15.74 |
| lnTLP | 4,582 | 14.44 | 1.99 | 6.14 | 19.36 |
| OSS | 4,315 | 1.13 | 0.44 | 0.002 | 2.70 |
| ROA | 3,442 | 0.005 | 0.12 | -0.69 | 0.24 |
| ROE | 3,364 | 0.03 | 0.46 | -2.58 | 1.28 |
| DumNGO | 4,773 | 0.45 | 0.49 | 0 | 1 |
| DumBANK | 4,773 | 0.07 | 0.27 | 0 | 1 |
| DumNBFI | 4,773 | 0.24 | 0.43 | 0 | 1 |
| DumCOOP | 4,773 | 0.14 | 0.35 | 0 | 1 |
| DumRURAL | 4,773 | 0.04 | 0.21 | 0 | 1 |
| Macro-economic environment | | | | | |
| INDVA | 4,591 | 28.72 | 8.35 | 11.34 | 72.59 |
| POPDENS | 4,659 | 164.22 | 256.45 | 1.50 | 1198.36 |
| FDI | 4,657 | 3.24 | 4.22 | -13.31 | 46.48 |
| AID | 4,587 | 35.07 | 42.81 | 0 | 228.91 |
| GNI | 4,645 | 3435.00 | 2786.74 | 200 | 17230.00 |
| INFLATION | 4,482 | 7.23 | 7.29 | 0.00 | 52.24 |
| Formal banking sector | | | | | |
| ATMs | 3,360 | 99.57 | 140.35 | 0 | 1317 |
| DOMCREDIT | 4,624 | 39.75 | 28.13 | -8.89 | 197.38 |
| DEPRATE | 4,003 | 7.52 | 5.80 | 0.85 | 103.21 |
| LENDINGRATE | 3,619 | 18.46 | 12.15 | 4.93 | 270 |

Table 2. Correlations

This table summarizes the correlations between the main MFI-performance variables (Panel A); the variables measuring the state of the formal banking system (Panel B) as well as the correlation between both categories (Panel C). The definition of the variables can be found in Table 1.

Panel A. Correlations between MFI-performance variables

| | lnNAB | lnTLP | OSS | ROA | ROE |
|-------|-------|-------|------|------|-----|
| lnNAB | 1 | | | | |
| lnTLP | 0.75 | 1 | | | |
| OSS | 0.07 | 0.19 | 1 | | |
| ROA | 0.13 | 0.25 | 0.77 | 1 | |
| ROE | 0.14 | 0.23 | 0.61 | 0.72 | 1 |

Panel B. Correlations between bank-sector development variables

| | ATMs | DOMCREDIT | DEPRATE | LENDINGRATE |
|-------------|------|-----------|---------|-------------|
| ATMs | 1 | | | |
| DOMCREDIT | 0.45 | 1 | | |
| DEPRATE | 0.08 | 0.00 | 1 | |
| LENDINGRATE | 0.11 | -0.15 | 0.76 | 1 |

Panel C. Correlations between bank-sector development and MFI-performance

| | lnNAB | lnTLP | OSS | ROA | ATMs | DOMCREDIT | DEPRATE | LENDINGRATE |
|-------------|-------|-------|-------|-------|------|-----------|---------|-------------|
| lnNAB | 1 | | | | | | | |
| lnTLP | 0.76 | 1 | | | | | | |
| OSS | 0.10 | 0.15 | 1 | | | | | |
| ROA | 0.12 | 0.25 | 0.77 | 1 | | | | |
| ATMs | -0.04 | 0.09 | -0.10 | -0.11 | 1 | | | |
| DOMCREDIT | 0.14 | 0.12 | -0.09 | -0.07 | 0.46 | 1 | | |
| DEPRATE | -0.08 | -0.09 | -0.09 | -0.09 | 0.04 | 0.01 | 1 | |
| LENDINGRATE | -0.08 | -0.06 | -0.01 | -0.01 | 0.02 | -0.01 | 0.72 | 1 |

Table 3. Performance variables in different banking-classes

This table summarizes mean values for the MFI-performance variables in different categories for the variables representing the state of the formal banking sector. In panel B the observations have been classified according to the number of ATMs in the host-country ranging from very low to very high. In Panel B the observations have been classified according to the domestic credit provided by the formal banking sector in the host-country. In Panel C, the observations have been classified according to the average annual deposit rate in the host-country. In Panel D the observations have been classified according to the annual average lending-rate in the host-country. Cut-off values correspond to the 1st, 2nd and 3rd quartile in the distribution of the respective banking-variables denoted by P_{25} , P_{50} and P_{75} .

| Panel A. | <i>very low</i> | <i>low</i> | <i>high</i> | <i>very high</i> |
|-----------------|-----------------|-----------------------|-----------------------|------------------|
| lnATMs | $x < P_{25}$ | $P_{25} < x < P_{50}$ | $P_{50} < x < P_{75}$ | $x > P_{75}$ |
| | $x < 18$ | $18 < x < 63$ | $63 < x < 134$ | $x > 134$ |
| lnNAB | 8.27 | 9.03 | 8.97 | 8.51 |
| lnTLP | 13.72 | 15.02 | 14.75 | 14.74 |
| OSS | 1.08 | 1.13 | 1.19 | 1.13 |
| ROA | -0.01 | 0.01 | 0.02 | 0.01 |
| ROE | -0.05 | 0.08 | 0.13 | 0.02 |

| Panel B. | <i>very low</i> | <i>low</i> | <i>high</i> | <i>very high</i> |
|-----------------|-----------------|-----------------------|-----------------------|------------------|
| DOMCREDIT | $x < P_{25}$ | $P_{25} < x < P_{50}$ | $P_{50} < x < P_{75}$ | $x > P_{75}$ |
| | $x < 17$ | $17 < x < 37$ | $37 < x < 51$ | $x > 51.82$ |
| lnNAB | 8.22 | 8.22 | 8.94 | 9.09 |
| lnTLP | 14.07 | 14.58 | 14.47 | 14.59 |
| OSS | 1.13 | 1.13 | 1.14 | 1.10 |
| ROA | 0.01 | 0.01 | 0.01 | 0.00 |
| ROE | 0.00 | 0.02 | 0.07 | 0.05 |

| Panel C. | <i>very low</i> | <i>low</i> | <i>high</i> | <i>very high</i> |
|-----------------|-----------------|-----------------------|-----------------------|------------------|
| DEPRATE | $x < P_{25}$ | $P_{25} < x < P_{50}$ | $P_{50} < x < P_{75}$ | $x > P_{75}$ |
| | $x < 3$ | $3 < x < 6$ | $6 < x < 9$ | $x > 9$ |
| lnNAB | 8.76 | 8.54 | 9.13 | 8.33 |
| lnTLP | 14.72 | 14.64 | 14.52 | 14.10 |
| OSS | 1.13 | 1.17 | 1.17 | 1.06 |
| ROA | 0.01 | 0.02 | 0.02 | -0.01 |
| ROE | 0.04 | 0.07 | 0.08 | -0.02 |

| Panel D. | <i>very low</i> | <i>low</i> | <i>high</i> | <i>very high</i> |
|-----------------|-----------------|-----------------------|-----------------------|------------------|
| LENDINGRATE | $x < P_{25}$ | $P_{25} < x < P_{50}$ | $P_{50} < x < P_{75}$ | $x > P_{75}$ |
| | $x < 11$ | $11 < x < 15$ | $15 < x < 21$ | $x > 21$ |
| lnNAB | 8.85 | 8.97 | 8.82 | 8.42 |
| lnTLP | 14.73 | 14.83 | 14.49 | 14.42 |
| OSS | 1.13 | 1.15 | 1.12 | 1.10 |
| ROA | 0.01 | 0.01 | 0.01 | 0.00 |
| ROE | 0.06 | 0.06 | 0.06 | 0.01 |

Table 4. Analyzing the impact of the banking-variables on MFI-performance

In this table we report the regression output from regressing MFI-performance variables on the variables measuring the state of the formal banking sector as well as a number of controls. In Panel A we investigate the impact of development of the formal banking in terms of the number of ATM-machines and domestic credit provided by the formal sector. In Panel B we investigate the impact of the interest rates in terms of the deposit rate and the lending rate. Robust standard errors are provided in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% significance level, respectively. Note that for reasons of space, we do not report the results of the regression analysis where the different financial sector development measures were tested together, but the results of that analysis are similar to the ones presented here.

Panel A. Impact of number of ATMs and Domestic credit on MFI-performance

| Dep. Var. | lnNAB (1) | lnTLP (2) | OSS (3) | ROA (4) | lnNAB (5) | lnTLP (6) | OSS (7) | ROA (8) |
|------------------------------|-----------------------|-----------------------|----------------------|-----------------------|-----------------------|-----------------------|----------------------|----------------------|
| lnATMs | -0.09 (0.051)*** | -0.07 (0.023)*** | -0.11 (0.023)*** | -0.04 (0.007)*** | | | | |
| DOMCREDIT | | | | | -0.001 (0.001) | -0.001 (0.000) | -0.002 (0.001)*** | -0.001 (0.001)*** |
| MFI-specific controls | | | | | | | | |
| lnTA | 0.75 (0.014)*** | 0.99 (0.007)*** | 0.06 (0.002)*** | 0.02 (0.002)*** | 0.72 (0.012)*** | 0.99 (0.006)*** | 0.02 (0.002)*** | 0.02 (0.002)*** |
| age | 0.03 (0.006)*** | 0.02 (0.003)*** | 0.01 (0.003)*** | 0.00 (0.001)** | 0.03 (0.005)*** | 0.02 (0.002)*** | 0.00 (0.001)*** | 0.00 (0.001)*** |
| age ² | -0.0002 (0.000)*** | -0.0005 (0.000)*** | -0.001 (0.000)*** | -0.0001 (0.000)*** | -0.0003 (0.000)*** | -0.0005 (0.000)*** | -0.001 (0.000)*** | -0.001 (0.000)*** |
| dumBANK | -0.41 (0.140)*** | -0.19 (0.061)*** | -0.08 (0.057) | -0.02 (0.018) | -0.47 (0.128)*** | -0.26 (0.054)*** | -0.03 (0.016)* | -0.03 (0.016)* |
| dumNBFI | -0.22 (0.065)*** | 0.04 (0.031) | 0.03 (0.032) | 0.01 (0.009) | -0.15 (0.057)*** | 0.04 (0.028) | 0.02 (0.008)*** | 0.02 (0.008)*** |
| dumCOOP | -0.65 (0.105)*** | 0.00 (0.045) | 0.19 (0.045)*** | 0.04 (0.014)*** | -0.58 (0.140)** | 0.01 (0.034) | 0.05 (0.010)*** | 0.05 (0.011)*** |
| dumRURAL | -1.31 (0.162)*** | -0.06 (0.069) | 0.16 (0.064)** | 0.03 (0.019)* | -1.19 (0.141)*** | -0.04 (0.061) | 0.02 (0.018) | 0.02 (0.018) |

| <i>Macro-economic controls</i> | | | | | | | | |
|---------------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|----------------------|---------------------|--------------------|
| INFLATION | -0.01 (0.002)*** | -0.01 (0.001)*** | -0.01 (0.001)*** | -0.001 (0.004)** | -0.01 (0.000)* | -0.002 (0.000)*** | -0.004 (0.001)** | 0.00 (0.000) |
| INDVA | 0.00 (0.003) | 0.01 (0.002)*** | 0.00 (0.002) | 0.00 (0.001) | 0.00 (0.003) | 0.00 (0.002) | 0.00 (0.001) | 0.00 (0.004) |
| POPDENS | 0.00 (0.001) | 0.00 (0.004) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) |
| FDI | 0.01 (0.003)* | 0.00 (0.001) | 0.00 (0.000) | 0.00 (0.000) | 0.01 (0.002)** | 0.00 (0.001) | 0.00 (0.000) | 0.00 (0.000) |
| lnAID | -0.03 (0.021) | 0.01 (0.010) | 0.00 (0.000) | 0.00 (0.003) | -0.03 (0.017)* | 0.03 (0.009) | 0.00 (0.000) | 0.00 (0.000) |
| lnGNI | -0.04 (0.089) | 0.13 (0.041)*** | -0.06 (0.042)* | 0.01 (0.012) | -0.20 (0.053)*** | 0.04 (0.024)* | -0.03 (0.007)** | -0.03 (0.007)** |
| #MFIs per country | 0.00 (0.001) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) |
| <i>Regional dummies</i> | | | | | | | | |
| | <i>included</i> | <i>included</i> | <i>included</i> | <i>included</i> | <i>included</i> | <i>included</i> | <i>included</i> | <i>included</i> |
| <i>Model statistics</i> | | | | | | | | |
| N | 2,653 | 2,740 | 2,563 | 2,045 | 3,762 | 3,400 | 2,893 | 2,542 |
| Wald χ^2 | 7,222*** | 4,748*** | 404*** | 327*** | 9,955*** | 4,630*** | 363*** | 576*** |
| R ² -within | 0.72 | 0.94 | 0.13 | 0.10 | 0.70 | 0.93 | 0.08 | 0.09 |

Panel B. Impact of interest rates in terms of deposit rate and lending rate on MFI-performance

| Dep. var. | lnNAB (1) | lnTLP (2) | OSS (3) | ROA (4) | lnNAB (5) | lnTLP (6) | OSS (7) | ROA (8) |
|--------------------------------|-----------------------|-----------------------|----------------------|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| DEPRATE | -0.02 (0.003)*** | -0.01 (0.001)*** | -0.002 (0.001)*** | -0.001 (0.001)*** | | | | |
| LENDINGRATE | | | | | -0.007 (0.001)*** | -0.005 (0.001)* | -0.002 (0.001)* | -0.003 (0.002)* |
| MFI-specific controls | | | | | | | | |
| lnTA | 0.71 (0.013)*** | 0.99 (0.006)*** | 0.02 (0.002)*** | 0.02 (0.002)*** | 0.71 (0.014)*** | 1.00 (0.007)*** | 0.05 (0.007)*** | 0.02 (0.002)*** |
| age | 0.03 (0.006)*** | 0.02 (0.003)*** | 0.00 (0.001)*** | 0.00 (0.001)*** | 0.03 (0.006)*** | 0.02 (0.003)*** | 0.01 (0.003)*** | 0.00 (0.001)*** |
| age ² | -0.0002 (0.000)*** | -0.0005 (0.000)*** | -0.001 (0.000)*** | -0.001 (0.000)*** | -0.0003 (0.001)*** | -0.0004 (0.000)*** | -0.0002 (0.000)*** | -0.0004 (0.000)*** |
| dumBANK | -0.35 (0.132)*** | -0.26 (0.057)*** | -0.03 (0.017) | -0.03 (0.016)* | -0.38 (0.133)*** | -0.23 (0.059)*** | -0.07 (0.057) | -0.02 (0.018) |
| dumNBFI | -0.18 (0.061)*** | 0.04 (0.030) | 0.02 (0.009)*** | 0.02 (0.008)*** | -0.17 (0.061)*** | 0.05 (0.032)* | 0.08 (0.033)*** | 0.04 (0.009)*** |
| dumCOOP | -0.86 (0.084)*** | 0.01 (0.037) | 0.05 (0.011)*** | 0.05 (0.011)*** | -0.86 (0.092)*** | 0.00 (0.042) | 0.18 (0.042)*** | 0.05 (0.012)*** |
| dumRURAL | -1.17 (0.143)*** | -0.04 (0.061) | 0.02 (0.018)* | 0.02 (0.018) | -1.21 (0.143)*** | -0.01 (0.066) | 0.12 (0.064)* | 0.03 (0.018) |
| Macro-economic controls | | | | | | | | |
| INFLATION | -0.001 (0.001) | -0.003 (0.000)*** | -0.004 (0.001)*** | -0.001 (0.001)** | -0.001 (0.001) | -0.003 (0.001)*** | -0.001 (0.001)*** | -0.001 (0.001) |
| INDVA | 0.00 (0.003) | 0.00 (0.001) | 0.00 (0.001) | 0.00 (0.004) | 0.00 (0.002) | 0.00 (0.001) | 0.00 (0.002) | 0.00 (0.000) |
| POPDENS | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) |
| FDI | 0.01 (0.002)*** | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.001) | 0.00 (0.000) | 0.00 (0.000) |
| lnAID | -0.01 (0.018) | 0.01 (0.009) | 0.00 (0.000) | 0.00 (0.000) | -0.02 (0.018) | 0.03 (0.010) | -0.01 (0.011) | 0.00 (0.003) |
| lnGNI | -0.20 (0.050)*** | 0.04 (0.024)* | -0.03 (0.007)** | -0.03 (0.007)** | -0.23 (0.054)*** | 0.06 (0.026)** | -0.11 (0.026)*** | -0.04 (0.008)*** |
| #MFIs per country | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) |

| Regional dummies | <i>included</i> |
|-------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Model statistics | | | | | | | | |
| N | 3,257 | 3,875 | 2,893 | 2,893 | 2,937 | 3,040 | 2,865 | 2,299 |
| Wald χ^2 | 7,875*** | 6,687*** | 363*** | 487*** | 7,106*** | 4,585*** | 303*** | 256*** |
| R ² -within | 0.67 | 0.93 | 0.08 | 0.07 | 0.68 | 0.93 | 0.08 | 0.06 |

Table 5. Robustness of the results

In this table we re-estimate the model using different estimation techniques to account for a number of methodological issues that might influence the estimation results presented in Table 4. Specifically, we account for the fact that the banking-variables might be correlated with the idiosyncratic error term or with the unobserved institution-specific random effect. In both cases, endogeneity might play a role. Therefore we use an instrumental variables approach (IV) where the banking variable is instrumented by its first, second and third order lag to account for the fact that the banking variable might be correlated with the idiosyncratic error. We also use the Hausman-Taylor approach (HT) that accounts for the fact that the banking-variable might be correlated with the unobserved effect. Additionally, we account for the fact that one of the main banking variables (number of ATMs) is time-invariant. Therefore, we report the Fixed Effects Vector Decomposition-estimator (FEVD) that accounts for the time-invariant nature of some of the covariates. For a more detailed discussion on the different sources of potential endogeneity bias, see main text.

| Dep. var. Method | InNAB | | | OSS | | |
|------------------------------|-----------------------|-----------------------|----------------------|---------------------|---------------------|----------------------|
| | IV (1) | HT (2) | FEVD (3) | IV (4) | HT (5) | FEVD (6) |
| lnATMs | -0.05 (0.056)*** | -0.11 (0.124)*** | -0.03 (0.015)*** | -0.08 (0.022)*** | -0.11 (0.055)** | -0.21 (0.011)*** |
| MFI-specific controls | | | | | | |
| lnTA | 0.76 (0.017)*** | 0.72 (0.016)*** | 0.61 (0.006)*** | 0.03 (0.008)*** | 0.09 (0.009)*** | 0.11 (0.004)*** |
| age | 0.01 (0.007) | 0.05 (0.009)*** | 0.07 (0.002)*** | 0.00 (0.003)*** | 0.00 (0.004) | 0.01 (0.001)*** |
| age ² | -0.0007 (0.000)*** | -0.0005 (0.000)*** | -0.001 (0.000)*** | 0.00 (0.000) | -0.0001 (0.001)* | -0.001 (0.000)*** |
| dumBANK | -0.35 (0.148)*** | -0.19 (0.253)*** | -0.09 (0.032)*** | -0.03 (0.054) | -0.14 (0.095) | -0.03 (0.022)*** |
| dumNBFI | -0.23 (0.059)*** | -0.13 (0.072)*** | -0.13 (0.022)*** | 0.05 (0.030)* | 0.04 (0.041) | -0.13 (0.016)*** |
| dumCOOP | -0.73 (0.108)*** | -0.59 (0.164)*** | -1.05 (0.028)*** | 0.18 (0.043)*** | 0.22 (0.071)*** | 0.23 (0.019)*** |
| dumRURAL | -1.35 (0.164)*** | -1.36 (0.303)*** | -2.34 (0.037)*** | 0.23 (0.058)*** | 0.23 (0.110)* | 0.76 (0.027)*** |

| <i>Macro-economic controls</i> | | | | | | |
|---------------------------------------|--------------------|----------------------|---------------------|-----------------|----------------------|---------------------|
| INFLATION | 0.00 (0.001) | -0.008 (0.002)*** | -0.01 (0.002)*** | 0.00 (0.000) | -0.003 (0.001)*** | -0.001 (0.001)** |
| INDVA | 0.00 (0.003) | 0.00 (0.004) | 0.00 (0.001)*** | 0.00 (0.001) | 0.00 (0.002) | 0.00 (0.001) |
| POPDENS | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) |
| FDI | 0.01 (0.002)*** | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.001) |
| lnAID | -0.03 (0.025) | 0.01 (0.009) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.013) | 0.00 (0.010) |
| lnGNI | -0.19 (0.098)* | -0.06 (0.124) | -0.19 (0.023)*** | 0.01 (0.043) | 0.18 (0.067)*** | 0.42 (0.019)*** |
| #MFIs per country | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) | 0.00 (0.000) |
| <i>Regional dummies</i> | <i>included</i> | <i>included</i> | <i>included</i> | <i>included</i> | <i>included</i> | <i>included</i> |
| <i>Model statistics</i> | | | | | | |
| N | 1,482 | 2,653 | 2,183 | 1,466 | 2,563 | 2,129 |
| Wald χ^2 /F-stat | 4,701*** | 6,890*** | 2,646*** | 202*** | 410*** | 214*** |
| R ² -within | 0.75 | | 0.96 | 0.04 | | 0.62 |

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ⁱ See for example Labie (2001), Hartarska (2005), Cull et al. (2007), Hartarska and Nadolnyak (2007) and Mersland and Strøm (2008, 2009).

ⁱⁱ See for example Levine (2004) and Huang (2005) for overviews.

ⁱⁱⁱ In a more recent paper, he explains why access to financial services may differ dramatically between regions (Honohan, 2008).

^{iv} As argued by Hartarska (2005) a focus on both outreach and profitability is justified by the fact that the debate whether outreach and profitability are substitutes or rather complements is ongoing (Morduch, 2000; Navajas et al., 2000)

^v See <http://www.mixmarket.org/> (consulted in December 2008).

^{vi} See for example Barr (2005).

^{vii} This finding might in fact pinpoint to a certain minimal threshold level for formal banking sector development before MFIs can gain substantial performance. While this is an interesting route for further research, analysis of a potential threshold is beyond the scope of the current paper.