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Threshold Effects of Poverty Targeting on Financial Sustainability and Social Outreach of Microfinance Institutions

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Abstract

From the original concept of poverty alleviation to the current financial inclusion, microfinance is now serving a wide range of clientele with different poverty levels (including the non-poor). This paper pays special attention to the poorest of the poor and answers questions of whether an MFI's poverty targeting measured by the percentage of the poorest clients affects financial sustainability and how the relationship between financial sustainability and outreach changes after controlling the poverty level. The study is conducted based on a cross sectional dataset of 68 MFIs using a non-linear threshold regression model. Poverty targeting puts threshold effects on an MFI's financial sustainability and based on it, both the positive and the negative links between financial sustainability and average loan size/GNI per capita are observed. To achieve financial viability, high poverty targeting MFIs provide relatively smaller loans to a larger number of borrowers while low poverty targeting MFIs serve a smaller scale of clients by larger loans. Besides, different poverty targeting strategies also reflect the different operating mechanisms in terms of interest rate, cost, risk, and capital structure.

Keywords: microfinance institutions, financial sustainability, social outreach, poverty targeting, the poorest of the poor, threshold

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1 Introduction

Microfinance Institutions (MFIs) challenge traditional banking institutions by demonstrating that they can provide financial services in addition to other non-financial services such as training, capacity building, and other social and environmental welfares to people that are excluded from the traditional financial system. However, in the meantime, MFIs are also challenged by themselves –how to best achieve financial viability while outreaching to the vast poor, especially the poorest of the poor[1].

With a strong social mission of outreaching to the poor and the poorest, MFIs have been receiving tremendous support from donor agencies, private investors and government authorities. On the one hand, the proven ability to be profitable of non-profit MFIs has brought for-profit institutions to the microfinance market, leading to increased competition in the sector (McIntosh and Wydick, 2005). On the other hand, donors and policy makers questioned the role of continuous subsidies and encourage the independence of MFIs from subsidies and become self-sustainability. From the first transformed NGO MFI (PRODEM, later BancoSol) in Bolivia to the IPO of Banco Compatamos in Mexico and SKS in India, growth and sustainability seem to be the main rhythm. The commercialization process and over-emphasis on sustainability apparently improve MFIs'financial performance and the scale in terms of total number of borrowers, yet concerns about mission drift also come along with this trend (Christen 2001;Drake and Rhyne, 2002; Copestake, 2007; Armendaritz and Szafarz, 2009; Mersland, 2010).That is, some MFIs in pursuit of better financial performance might have shifted away to serve the marginal poor or non-poor clients with larger loans instead of the original poor and the poorest who require smaller loans.

Whether focusing on financial sustainability is necessarily at the sacrifice of serving less poor clients? Does client poverty targeting (especially the poorest of the poor) affect an MFI's financial sustainability? There are two aspects concerning the questions. First is the relationship between financial sustainability and average loan size proxied for depth of outreach. Whether focusing on financial sustainability is necessarily at the sacrifice of serving less poor clients? Many existing studies have tried to explain the sustainability-outreach relationship by investigating different conditions under which it may be affected, such as regulation (Cull et al., 2009b; Cull et al., 2009b; Mersland and Strøm, 2009), regional distribution (Awaworyi and Marr, 2014), competition (Kai, 2009; McIntosh and Wydick, 2005; Cull et al., 2009), financing (Borgan, 2009; Kyereboah-Coleman, 2007), and so forth. Conclusions are inconsistent-some suggest a trade-off relationship, some show a complementary linkage, while others indicate a mixed or no significant

[1]The broadly defined "poor people" by the World Bank are the population living under $1 or $2 per day per capita. The "poorest of the poor" in the microfinance industry, according to the latest Microcredit Summit Campaign Report (2013), refers to any of the 1.4 billion living on less than $1.25 per day adjusted for purchasing power parity, or families whose income is in the bottom 50 percent of all those living below their country's poverty line.

association between the two. There are several reasons for the controversial results: 1) the vast diversity among MFIs operating under the definition of “microfinance”. “Microfinance institutions” is an umbrella term that contains many different types (Philippe, 2013); 2) sample selection biases. Except for case studies on individual/selected MFIs, the most popular public database for constructing a sample is the one developed by the MIX Market but it is questioned to have some biases in the data (Bauchet and Morduch, 2010); and 3) the potential non-linear relationship between financial sustainability and average loan size. The inconsistent results implicate that linear regressions may be insufficient to explain the sustainability-outreach linkage. A better choice over sample data may enable us to further explore the changes in the size of trade-off/synthase or the changes from trade-off to synthase or vice versa.

The second aspect is how much average loan size can tell us about client poverty level that an MFI is serving. The changing client targeting (especially the exclusion of the poorest) shows that client poverty level affects an MFI’s financial performance. Compared to serving the less or marginally poor clients, outreaching to the poorest is obviously much more difficult as this unique segment is considered to be less elastic to the credit market, more costly and riskier compared to the corresponding profits in return, and less attractive to microfinance investors who also seek good financial returns. In certain ways, the poorest are excluded by MFIs through deliberate and unintentional mechanisms (Simanowitz and Walter, 2002). There is the rare public information on the different poverty levels of clients since most MFIs serve a mixed clientele. Average loan size is so far the most recognized indicator by researchers and investors. But it is also a critical one since the information it delivers is limited. The actual loan amount that a client can finally get is not only decided by a client’s need, but also determined by the availability of credit that an MFI can supply. Therefore, average loan size is a very rough indicator which measures the overall depth an MFI has reached but it is unable to tell whether the poorest are actually being served.

Given the previous inconclusive findings on the linear sustainability-outreach regressions due to measurement, sample selection problems and other definitional or methodological issues, and addressing the particular effects of serving the poorest on an MFI’s financial sustainability, this paper reexamines the linkage between financial sustainability and social outreach by adopting a non-linear threshold regression method developed by Caner and Hansen (2004) which allows to endogenously divide the total sample based on characteristics of the sample data instead of MFI related features such as regional distribution, legal status, regulations, lending methodologies, and so forth. Using a cross-sectional dataset of 68 MFIs, this paper shows empirical evidence that poverty targeting poses threshold effects on an MFI’s financial sustainability. Financial sustainability can be achieved by providing small loans to substantial (more than 70%) or exclusively poorest clients. Divided by the

percentage of the poorest clients, both positive and negative linkage between financial sustainability and average loan size are found. Besides, interest rate, operating cost, repayment risk and capital structure also show different effects on MFIs with different poverty targets.

The rest of the paper is structured as follows: Section two presents an overview of existing literature on the relationship between financial sustainability, social outreach, and serving the poorest. Section three describes the data, variables and methodology used in the study. Section four presents the main empirical results and robustness checks. Conclusions are made in the final section.

2Literature Review

Due to the opposite nature of an MFI's financial and social goals, it is difficult to find the best balance point at which trade-offs can be greatly minimized and financial performance can be maximized by providing small loans to poor and the poorest clients.

One fundamental question around serving the poor while achieving sound financial performance is whether services can be delivered at a cost that is affordable to clients (Rhyne, 1998). Due to this reason, many early studies support the trade-off theory. For example, Conning (1999), who studies the linkage between outreach, sustainability and financial leverage for a dataset of 72 MFIs, points out that sustainable MFIs targeting poorer borrowers should charge higher interest rates, undertake higher costs per loan and be less leveraged. Navajas et al. (2000) analyzes five Bolivian MFIs with high financial sustainability among peers and find that they are not targeting the poorest but rather those near the poverty line as the poorest are less likely to be creditworthy and to demand loans. Olivares-Polanco (2005) investigates the determinants of outreach in terms of loan size using data for 28 MFIs in Latin America for the years 1999-2001. Using Ordinary Least Square, he also confirms the trade-off between sustainability and outreach though he doesn't specify the client poverty level.

However, if affordability is a major issue concerning serving the poor and the poorest and being financially viable, then these two goals are compatible if MFIs can meet clients' specific needs through innovative methods to develop suitable products and services. Gibbons and Meehan (1999) demonstrates three MFIs from Asia, Latin America and Africa respectively and argues that financial sustainability actually can be achieved by serving substantial number of the poorest clients. "Progressive" lending to this clientele, along with efficiency and other initiatives at the program level, enables the compatibility of these two goals. The paper also summaries some best practices on how to achieve it. Other supporters of the complementary view are Christen et al. (1995), Woller et al. (1999), Churchill (2000), Woller and Schreiner (2002), and so forth.

Fernando (2004) summarizes three camps of hypothesizes on the issue of providing financial services to the poorest and its effects on financial sustainability. The first camp holds the opinion that the poorest can't be reached on a sustainable basis due to the ineffective demand for financial services among the poorest, the high service delivery costs for MFIs, and the unaffordable prices charged by MFIs to the poorest. The second camp argues that the poorest can be reached on a sustainable and large-scale basis. If funding agencies provide more funds to these MFIs, outreach to the poorest can be rapidly increased. The third camp considers the potential for reaching the poorest on a sustainable but limited scale basis. Innovation in service delivery mechanisms is a must and subsidies play an important role in reaching the poorest in a sustainable way.

Gonzales and Rosenberg (2006) study the relationship between outreach, profitability and poverty using data reported to Microcredit Summit Campaign (MSC) and the MIX Market platform respectively. In the MIX Market data, the correlation between average loan size and profitability (measured by return on assets) is very weak and the slop of the curve is low. Using the percentage of the poorest clients and operational self-sufficiency from the MSC dataset, they find that the correlation between these variables and the slope for the relationship are still very weak and low. They conclude that there may be relatively little conflict between improving sustainability and reaching poorer clients and it can find individual MFIs who are strongly profitable while serving the very poor clients.

It is hard to draw a consistent conclusion on this issue as the microfinance sector is still evolving. Besides, more diversified institutions with mixed clientele join the sector, making it harder to conclude. Recent empirical studies start to divide the total sample dataset into subsamples based on certain features that may affect the sustainability-outreach relationship.

Cull et al. (2007) are among the first to conduct a comprehensive empirical study using a global dataset of 124 MFIs in 49 countries. He divides the total sample based on different lending types and find mixed results. Individual-based lenders perform better in terms of profitability but it is achieved through focusing less on very poor and women borrowers, indicating the existence of a trade-off. Meanwhile, the study also finds examples of institutions that have realized both profitability and outreach to the poor. As stated in their study, institutions making smaller loans are not necessarily less profitable when other relevant factors are included. However, the study doesn't specifically focus on the poorest clients.

Quayes (2012), based on MFIs' disclosure level, divided the sample of 702 MFIs from 83 countries into two groups. The full sample shows that financial sustainability has no impact on the depth of outreach proxied by average loan size/GNI per capita. Though trade-off exists in low-disclosure MFIs, financial sustainability has a positive impact on the depth of outreach for the high disclosure MFIs. The results hold after considering the simultaneity issue by

applying a three-stage least squares model. Not-for-profit MFIs have better outreach but poorer financial performance in comparison to for-profit MFIs. Again, this study doesn't provide further information on client poverty level.

In sum, findings on the relationship between financial sustainability and depth of outreach are mixed from both anecdotal experience and empirical investigations. Though studies especially focus on the poorest of the poor are rare, conclusions vary. So this paper tries to use a non-linear methodology to examine the linkage among sustainability, loan size and the poorest.

3Data, Variables and Methodology

3.1 Sample Data Collection

There are two major global microfinance databases-the Microcredit Summit Campaign (MSC) database and the MIX Market database-each of which shows different data characteristics.

MSC has been constantly collecting data on the social outreach of MFIs since 1997. It also records the movement of clients and their families out of extreme poverty[2]. The original data on client poverty level is collected by MFIs using one or more poverty assessment tools and is then submitted to MSC who finally verifies the data through third-party corroboration to improve data quality and accuracy. As of December 2011, 637 MFIs report data to MSC, most of which show strong social commitment and are located mainly in South Asia (especially in Bangladesh and India).

Different from the MSC database, the MIX Market database provides a much wider range of indicators regarding MFIs' institutional and financial performance but limited social information since most of the data is collected from MFIs' audited financial reports. MFIs are reported at all levels with a strong concentration in the Latin American and the Caribbean region. Besides, *the Microbanking Bulletin (MBB)*, a publication released by the MIX, is another data source where it provides some additional information on a small number of MFIs out of the big MIX database.

Data reporting to the above mentioned platforms is voluntarily. MFIs may choose to submit data to neither, either or both platforms. Bauchet and Morduch (2010) compare the two databases for the years 2004-2006 and find that MFIs' reporting patterns correlate with region of operation, mission and size. Due to this data reporting bias, the relationship between financial and social performance also changes based on which dataset is used.

To capture the special effects of the poorest clients on financial sustainability, this paper collects MFIs that transparently report their financial and social indicators to both platforms. Though both datasets have a large number of MFIs, the combination of the two dramatically reduces the total sample size

[2]The Microcredit Summit Campaign is committed to achieving two goals by 2015: 1) reaching 175 million poorest families with microfinance and 2) helping lift 100 million families out of extreme poverty.
Source: www.microcreditsummit.org.

due to the difference in MFIs that report to each database and the difference in MFIs' reporting periods. To improve the data quality and make the study comparable, this paper only includes MFIs reporting the same total number of clients at the same reporting date. Number of poorest clients is from the MSC database and the rest of other variables used in the paper are from the MIX dataset. After eliminating missing values, the final sample is formed by 68 MFIs from 62 countries as of December 2011.

The first part of Table 6.3 provides information on the distribution of MFIs in terms of legal status and regions. NGO MFIs take the largest proportion (58%), followed by NBFIs (27%) and Banks (12%). An over-weighted percentage of NGO MFIs is reasonable as they are usually perceived as having a stronger poverty alleviation goal. Concerning the regional distribution, most MFIs in this sample are located in Latin America-Caribbean (LAC) region (48%). 27% of MFIs are from Asia and 14% from Sub-Saharan Africa. Though it would be expected a larger proportion of data in the Asia region where the largest extreme poor population is located, the over-representation in LAC will not strongly bias the results.

3.2 Variables Description

This paper tries to investigate the threshold effects on the relationship between financial sustainability and social outreach. *Operational self-sufficiency (OSS)* is used as dependent variable to measure an MFI's ability to cover costs through operating revenues without adjustment from donations and subsidies. *Average loan size adjusted by GNI per capita*, a proxy for depth of outreach, is included in order to make the results comparable to the existing literature. As mentioned earlier, it is a rough indicator of client poverty level. So the inclusion of the percentage of the poorest as a sample splitting point is expected to add more explanatory power to the sustainability-outreach relationship. *Total active borrowers*, a measurement for breadth of outreach, is included to observe its relationship with sustainability and depth of outreach. Besides, some other independent variables that are closed related to an MFI's operation and are controllable at the institutional level are adopted, including an MFI's cost, profit, risk, capital structure, size and age.

Operating expense ratio, a cost indicator, refers to all the expenses related to lending loans to borrowers, including all personnel and administrative expenses. Cost efficiency improves an MFI's financial sustainability. Regarding social outreach, Gutiérrez-Nieto et al. (2009) view that financially efficient MFIs are also socially efficient in reaching the poor. This is not supported by Herms et al. (2011) who argue that improving efficiency may only be achieved if MFIs focus less on the poor. Serving the individual poorest may be more costly, but it is also possible for MFIs to benefit from the joint efficiency by serving the majority or exclusively the same segment.

Portfolio yield (nominal) is the interest and fees that an MFI charges from their borrowers. Interest rate is the major income source for credit only MFIs to

gain profit and become financial sustainability. Due to the high costs of serving the poor, MFIs usually tend to charge higher interest rates than traditional banking institutions. However, too much high interest rates may reduce loan demands from poorer clients and increase potential repayment related problems such as MFIs' high default rates and clients' over-indebtedness. Cull *et al.* (2007) argues that there may exist certain threshold beyond which portfolio yield has negative effects on financial sustainability. In this study, we test whether poverty targeting influences the relationship between portfolio yield and financial sustainability.

Loan loss reserve measures MFIs' loan portfolio quality. Low portfolio risk is supposed to be linked with high financial performance. As quoted by Quayes (2012), findings of Sharma and Zeller (1997) in Bangladesh and Zeller (1998) in Madagascar indicate that client poverty level is positively related with repayment performance. The poorest people are more vulnerable to external economic changes and invest in activities with lower rates of return. Under the influence of client poverty level, we assume that the effects of portfolio risk on financial sustainability will also show different regimes.

Debt to equity ratio, also named as leverage, is used to reflect the capital structure of an MFI. Social oriented MFIs with strong focus on the poor and the poorest tend to have more equity and less debt since they usually receive more donations from donor agencies while commercial oriented MFIs rely more on debt from commercial and private investors to finance their lending activities. It generally has a negative impact on the financial performance of an MFI.

Finally, I control for an MFI's loan size and age. *Loans to assets* is the size of total loan portfolio out of total assets in an MFI. Loan portfolio is supposed to be positively linked to an MFI's financial sustainability. MFIs providing smaller loans can also have a large loan portfolio by reaching more clients. *Age* is the number of years that MFIs have been operating for since inception. As MFIs grow and become more mature, they are expected to have better knowledge on serving clients at all poverty levels.

3.3 Methodology

Threshold regression models or sample splitting models have wide application in economics and applied econometric practice (Hansen 1999; Hansen 2000).It allows to endogenously determine the threshold level(s) at which the sample is split. It treats the threshold value(s) as unknown instead of arbitrarily deciding the splitting point.

Before considering the non-linear threshold effects of poverty targeting on financial sustainability, we first look at the linear sustainability-outreach regression model:

$$FSS_i = \alpha + \beta_1 Outreach_i + \beta_2 x_i + \varepsilon_i \quad (1)$$

where the dependent variable FSS_i is the financial sustainability of an MFI i proxied by operational self-sufficiency (OSS). $Outreach_i$refers to an MFI's

breadth and depth of outreach. $x_i$is a set of other independent variables that are discussed in the previous section. $\varepsilon_i$is the error term.

One important issue that most models have to concern is the endogeneity problem which occurs when an explanatory variable correlates with the error term due to omitted variables, measurement errors, or simultaneity (Wooldridge, 2006). Existing literature regarding sustainability and outreach address this issue differently. For example, Cull et al. (2009) don't point out the endogeneity in the model. Quayes (2012) uses a three stage least square to cope with the simultaneity issue but doesn't further address the endogeneity problem. In this sustainability regression model, I consider the potential existence of endogeneity between financial sustainability and outreach (both breadth and depth).Ordinary Least Square (OLS) may lose its efficiency in estimating the coefficients. A common practice is to introduce instrumental variables (IVs) and to estimate the equation by the Generalized Method of Moments (GMM).

In consideration of the endogeneity problem and account for the non-linearity in a cross sectional dataset, this study applies the threshold regression model with instrumental variables developed by Caner and Hansen (2004) which allows for the right-hand side variables to be endogenous. Equation (1) is thus extended into the following form:

$$FSS_i = \alpha + \beta_1' \, Outreach_i \, I(q_i \le \gamma) + \beta_2' \, Outreach_i \, I(q_i > \gamma) + \beta_3' \, x_i \, I(q_i \le \gamma) + \beta_4' \, x_i \, I(q_i > \gamma) + \varepsilon_i \quad (2)$$

Where I(·) is the indicator function that takes the value of 1 if the argument in parenthesis is valid and 0 otherwise; q_i is the threshold variable; γ is the threshold parameter which is assumed unknown and needs to be estimated. The slope parametersβ_1,β_2 ,$\beta_3$and$\beta_4$vary depending on the value of $q_i$and the difference between these parameters is the magnitude of the threshold effect. The error term ε_i follows a martingale difference sequence since simple orthogonality assumptions are insufficient to identify nonlinear models (Caner and Hansen, 2004).

Outreach is endogenous and is correlated with the error term. The reduced form equation for outreach is the conditional expectation of $Outreach_i$given the vector of covariatesz_i:

$$Outreach_i = \mathrm{g}(z_i, \pi) + \mu_i \quad (3)$$

where z_i includes the selected instrumental variables, π is an unknown parameter, g is a linear function which is presumed known and μ_i is a random error. Equation (3) can be substituted into Equation (2), yielding

$$FSS_i = \alpha + \beta_1' \, \mathrm{g}(z_i, \pi) I(q_i \le \gamma) + \beta_2' \, \mathrm{g}(z_i, \pi) I(q_i > \gamma) + \beta_3' \, x_i \, I(q_i \le \gamma) + \beta_4' \, x_i \, I(q_i > \gamma) + v_i \quad (4)$$

where

$$v_i = \beta_1' \, \mu_i I(q_i \le \gamma) + \beta_2' \, \mu_i I(q_i > \gamma) + e_i \quad (5)$$

The parameters are estimated as follows: 1) the reduced form parameter π in equation (3) is estimated by Least Squares (LS); 2) the threshold γ is obtained from the minimizer of the sum of squared residuals from regressions

of financial sustainability on predicted values of the endogenous variable from the first stage; 3)the slope parametersare estimated by the Generalized Method of Moments (GMM) on the split samples implied by the estimation ofγ.

Besides the estimation of all the parameters, another thing that we haveto check is the existence of the threshold. The null hypothesis is written as$H_0: \theta_1 = \theta_2$. Caner and Hansen (2004) test H_0 by extending the supremum (Sup) test of Davies (1977) to the GMM framework. For each fixed γ inΓ, estimate the model (2) by GMM. By repeating the calculation for all $\gamma \in \Gamma$, the supremum Wald (SupW) statistic can be obtained as the largest value of these statistics:

$$\text{SupW} = \sup_{\gamma \in \Gamma} W_n(\gamma)$$

The asymptotic distribution of this test statistic is non-standard as the parameter γ is not identified under the null hypothesis. Hansen (1996) and Caner and Hansen (2004) suggest a bootstrapping procedure to obtain the asymptotic P-value. Collect the estimated residual under the unrestricted model for each γ and then use this pseudo-dependent variable to replace $FSS_i$to repeat the calculation above. The resulting SupW* statistic has the same asymptotic distribution as SupW.By repeating the simulation draws, the asymptotic p-value of the test statistic SupW can be calculated with arbitrary accuracy.

4Empirical Results

By applying the sample splitting technique of Caner and Hansen (2004)[3], we get a threshold value of 0.7 at which the full sample is divided into two regimes-the first regime is a subsample of low poverty targeting MFIs and the second regime is a subsample of high poverty targeting MFIs. The corresponding p-value (0.000) of the SupW test reported in Table 6.4 suggests the existence of the threshold.

Table 6.2 provides the summary statistics of the full sample (Part A) as a benchmark and the two subsamples (Part B) divided based on the threshold value. The full sample covers both sustainable and non-sustainable MFIs with OSS (log) ranging from -0.247 to 0.694. The mean value of the percentage of the poorest is 46.1% with a minimum value of0.2% and a maximum value of 100%, indicating the great disparity in poverty targeting among MFIs. In the two-regime subsamples, while the financial sustainability level in the two regimes is very close, with the mean value of OSS (log) 2.2% slightly higher in low poverty targeting MFIs than in high poverty targeting MFIs (17.7% versus 15.5%), the mean value of the total active borrowers (log) in high poverty targeting MFIs is bigger than it is in low poverty targeting MFIs (11.334 versus

[3]The R program used to compute the statistics in this paper is available at http://www.ssc.wisc.edu/-bhansen/

10.665) yet the average loan size/GNI per capita is much smaller (0.198 versus 0.480), suggesting that high poverty targeting MFIs achieve financial sustainability by serve a larger number of borrowers (especially the poorest) with smaller loans in general. Summary statistics on the rest variables will be provided as supplementary information for the following empirical analysis with financial sustainability.

Table 6.4 presents the detailed non-linear threshold regression results for the two regimes. For the benchmarking purpose, the linear OLS and GMM estimations for the full sample without thresholds are also presented in the table.

4.1 Financial Sustainability and Outreach Variables

The linear regression for the full sample shows that MFIs' financial sustainability is positively related with total active borrowers and average loan size/GNI per capita in the case of both before and after dealing with the potential endogeneity problem. These results are compatible to most of the existing literature supporting the trade-off theory. When threshold effects are considered, the coefficient for total active borrowers in high poverty targeting MFIs is twice as bigger as it is in low poverty targeting MFIs (6.6% versus 3.2%). That is, a 1% increase in the total number of active borrowers in high poverty targeting MFIs can generate twice positive effects on financial sustainability compared to the effects generated in low poverty targeting MFIs. In terms of average loan size/GNI per capita, it is negatively correlated with financial sustainability in high poverty targeting MFIs, indicating a complementary relationship between them. However, in low poverty targeting MFIs, average loan size/GNI per capita shows a statistically significant positive link with financial sustainability which, in most cases, is interpreted as a trade-off. On one hand, the reduction of the percentage of the poorest may be the result of clients' moving out of extreme poverty but they are still in the poverty camp. Trade-off occurs when MFIs serve a mixed clientele with a relatively high percentage of the poor and the poorest. On the other hand, when the percentage of the poorest is relatively low and MFIs are actually serving a large number of marginally poor or non-poor clients, this positive correlation can be considered as a complementary relationship since wealthier clients demand bigger loans. In this case, there exists the possibility of mission drift. However, we lack enough information on other poverty levels of clients except for the percentage of the poorest. So this paper doesn't have enough evidence to support/oppose the mission drift theory.

4.2 Financial Sustainability and Other Variables

Operating expense has a statistically significant negative relationship with financial sustainability both in the linear regression and in the non-linear threshold regression. However, the estimated coefficient in high poverty

targeting MFIs is smaller than it is in low poverty targeting MFIs. A 1% increase/reduction in cost in high poverty targeting MFIs reduces/improves 183% in financial sustainability while it reduces/improves 283.6% in low poverty targeting MFIs. With a close mean value of total operating expense in the two regimes presented in table 6.2 (0.187 versus 0.196), cost is more sensitive to low poverty targeting MFIs. A better control over operating cost in low poverty targeting MFIs can greatly improve their efficiency and further financial sustainability levels. However, cost per borrower, calculated as the ratio of total operating expense divided by total number of active borrowers, is much smaller in high poverty targeting MFIs than in low poverty targeting MFIs in this sample due to the larger total number of borrowers. This finding is consistent with Littlefield et al (2003) who point out that programs serving very poor clients perform better than others in terms of cost per borrower.

Portfolio yield shows a positive relationship with financial sustainability linearly and non-linearly. Yet, the estimated coefficient in high poverty targeting MFIs is much smaller than it is in low poverty targeting MFIs (0.885 versus 1.757). That is, high poverty targeting MFIs have to charge higher interest rates in order to achieve the same level of financial sustainability as low poverty targeting MFIs. Statistics on the subsamples show that the mean value of portfolio yield in low poverty targeting MFIs is slightly higher (36.6%) than it is in high poverty targeting MFIs (35.3%).It is in accordance with Conning (1999) who recommends MFIs to charge higher interest rates to poor borrowers in order to achieve financial sustainability.

Loan loss reserve is negatively correlated with financial sustainability. The negative coefficient in high poverty targeting MFIs is smaller (-2.713) and significant at 5% level while low poverty targeting MFIs significantly correlated with sustainability at 1% level. This suggests that a better control over default risk in low poverty targeting MFIs can largely improve their sustainability. In fact, Table 6.2 shows that high poverty targeting MFIs have higher mean value of the reserve level than low targeting MFIs.

Debt to equity ratio (leverage) is negatively related with financial sustainability. Table 6.2 shows that high poverty targeting MFIs have much lower mean value of leverage compared to low poverty targeting MFIs (0.287 versus 1.038 in log). Debt financing is more popular in low poverty targeting MFIs while equity plays a more important role in high poverty targeting MFIs.

Gross loan portfolio has positive effects on financial sustainability in the full sample linear regression and the threshold regression with a higher coefficient in high poverty targeting MFIs. Given that high poverty targeting MFIs are providing much smaller loans in average, the total size is smaller than low poverty targeting MFIs.

Age doesn't have statistically significant effects on sustainability though it has negative coefficients in both linear and non-linear cases. As stated by Gonzales and Rosenberg (2006), older MFIs don't tend to be more profitable

than younger ones and there is not a strong learning effect beyond the initial years.

4.3 Robustness Checks

This paper applies the threshold model of Caner and Hansen (2004) which allows endogenous variables in the right-hand side. Since the sample size is very limited and the threshold value-the percentage of the poorest borrowers-is not fully distributed at every point from 0% to 100%, it is difficult to check whether the threshold value presented in this study is robust to a larger dataset or an extended time framework. However, some tests have been conducted to check how robust the threshold value and the corresponding results are in this sample dataset.

First, return on assets (ROA) and profit margin (PM) are used as alternative dependent variables to measure an MFI's sustainability and profitability level. Table 6.5 shows the results for the threshold regressions. The threshold value keeps the same level of 0.7 in both ROA and PM cases. The threshold regression results is very robust using PM as dependent variable except that portfolio yield is not significantly correlated with financial sustainability. In the ROA case, some variables lose their significance statistically in the second regime but the main result for sustainability and average loan size is still robust.

Second, the results are tested in a reduced sample size of MFIs that report as not-for-profit and MFIs that have achieved operational self-sufficiency .The threshold value in Table 6.6 still shows 0.7 though it is significant at 10% level in the OSS case. When we only choose non-profit MFIs, average loan size/GNI per capita has a negative but statistically insignificant coefficient. This may be explained by the fact that not-for profit MFIs generally issue smaller loans. It is consistent with Quayes (2012) who finds that not-for-profit MFIs have positive effect on financial sustainability and have better depth of outreach though poorer financial performance than for-profit MFIs.

Lastly, we add more explanatory variables such as percentage of deposits (deposits to assets), staff efficiency (measured by number of borrowers charged by each staff), and macroeconomic indicators (GDP and inflation). While certain coefficients change at different significance levels, the main results on the relationship between financial sustainability and outreach still the same.

5Conclusions

This paper pays particular attention to the poorest of the poor and questions whether and how improvement of the percentage of poorest clients served by an MFI will affect its financial sustainability and the relationship with average loan size proxied for depth of outreach.

Using a cross-sectional data sample of 68 MFIs in XX countries as of December 2011 by applying the threshold regression model developed by Caner and Hansen (2004). The results show that poverty targeting, proxied by the percentage of the poorest, has significant threshold effects on sustainability. The trade-off and complementary relationship between financial sustainability and depth of outreach in terms of average loan size are observed simultaneously in this dataset. With a similar level of financial sustainability, high poverty targeting MFIs achieve sound financial performance by serving a substantial number of poorest clients with small loan size while low poverty targeting MFIs tend to serve less clients but with larger loans. Due to the different poverty targeting strategies, MFIs also show different operating mechanisms and results. Compared to low poverty targeting MFIs, high poverty targeting MFIs have to charge higher interest rates, face higher repayment risk and keep a low level of leverage but they are more efficient in terms of cost per loan/per borrower. Though leverage has negative effects on financial sustainability in both regimes, high poverty targeting MFIs have much lower leverage than low poverty targeting MFIs.

Though it is worth noting that many MFIs probably don't even include reaching the poorest of the poor in their institutional mission, it delivers some encouraging news for MFIs that are targeting or have the intent to increase the proportion of this unique segment. For MFIs with a mixed clientele, it is better to have a separate operating mechanism in order to minimize leakage to the non-poor (Gibbons and Meehan,1999). Government agencies and social impact investors may also help MFIs in the wider inclusion of the poorest population by supporting them with a better policy environment and a better design over capital structure. From the sector level, user-friend tools measuring client poverty level are especially helpful for MFIs and other players to participate in this poverty alleviation campaign. Transparency in more social outreach information is also needed.

Yet this study has some limitations. Sample size is a big concern given the large number of MFIs publicly reported or non-reported. Time series are not considered since this study uses only one-year cross-section data. In additions, one may question that the percentage of the poorest is endogenous to financial sustainability. This requires other threshold models to allow the threshold variable to be endogenous such as the one developed by Kourtellos et al. (2011).

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6 Appendix

Table 6.1 Correlations of Key Variables

	OSS (Log)	ROA	Profit margin	Percent poorest borrowers	Total active borrowers (Log)	Average loan balance	Portfolio yield	Operating expense ratio	Loan loss reserve	Debt to equity Ratio(Log)	Loans to assets	Age (Log)
OSS (Log)	1											
ROA	0.873***	1										
Profit margin	0.979***	0.907***	1									
Percent poorest borrowers	-0.076	-0.112	-0.117	1								
Total active borrowers (Log)	0.413***	0.458***	0.441***	0.067	1							
Average loan balance	0.155	-0.072	0.154	-0.210*	0.106	1						
Portfolio yield	-0.103	0.032	-0.094	0.038	-0.003	-0.347***	1					
Operating expense ratio	-0.298**	-0.065	-0.262**	0.03	-0.028	-0.337***	0.838***	1				
Loan loss reserve	-0.240**	-0.345***	-0.354***	0.201	-0.261**	-0.149	0.135	0.014	1			
Debt to equity ratio (Log)	-0.085	-0.049	-0.022	-0.329***	0.222*	0.275**	-0.113	-0.12	-0.325***	1		
Loans to assets	0.182	0.246**	0.151	-0.176	0.202*	-0.141	-0.211*	0.002	0.109	0.129	1	
Age (Log)	-0.011	-0.1	-0.015	-0.224*	0.147	0.172	-0.217*	-0.184	-0.021	0.068	-0.008	1

Table 6.2Summary Statistic of Key Variables

	Part A				Part B							
	Full Sample Number of Observations: 68				Regime 1 q<=0.7 Number of Observations: 49				Regime 2 q>0.7 Number of Observations: 19			
	Mean	Std.Dev.	Min	Max	Mean	Std.Dev.	Min	Max	Mean	Std.Dev.	Min	Max
OSS (Log)	0.171	0.211	-0.247	0.694	0.177	0.195	-0.247	0.577	0.155	0.253	-0.191	0.694
ROA	0.035	0.053	-0.102	0.162	0.037	0.047	-0.067	0.162	0.030	0.065	-0.102	0.133
Profit Margin	0.135	0.180	-0.280	0.500	0.147	0.165	-0.280	0.439	0.106	0.218	-0.247	0.500
Percent poorest borrowers	0.461	0.311	0.002	1.000	0.302	0.201	0.002	0.700	0.870	0.089	0.700	1.000
Total active borrowers (Log)	10.852	1.766	6.495	15.417	10.665	1.774	6.495	15.417	11.334	1.696	7.580	15.288
Average loan balance	0.401	0.658	0.023	4.399	0.480	0.755	0.023	4.399	0.198	0.166	0.040	0.634
Portfolio yield	0.357	0.157	0.042	1.020	0.353	0.157	0.137	1.020	0.366	0.160	0.042	0.624
Operating expense ratio	0.190	0.104	0.056	0.589	0.187	0.105	0.056	0.589	0.196	0.104	0.088	0.440
Loan loss reserve	0.020	0.026	-0.017	0.177	0.016	0.016	-0.017	0.053	0.031	0.041	-0.012	0.177
Debt to equity ratio (Log)	0.828	1.081	-2.996	2.691	1.038	0.901	-2.996	2.691	0.287	1.327	-2.207	2.063
Loans to assets	0.810	0.156	0.304	1.090	0.818	0.135	0.304	1.012	0.789	0.204	0.345	1.090
Age (Log)	2.727	0.487	1.099	3.664	2.796	0.405	1.609	3.664	2.549	0.631	1.099	3.497

Table 6.3 Sample Distribution in Terms of Region and Legal Status

	SSA	EAP	ECA	LAC	MENA	SA	Total
Full sample							
Bank	3%	1%	0%	6%	0%	1%	12%
Credit Union	2%	0%	0%	2%	0%	0%	3%
NBFI	3%	7%	3%	9%	1%	3%	27%
NGO	6%	7%	3%	32%	3%	7%	58%
Total	**14%**	**16%**	**6%**	**48%**	**4%**	**11%**	**100%**
First Regime q<=0.7							
Bank	2%	2%	0%	9%	0%	0%	13%
Credit Union	0%	0%	0%	2%	0%	0%	2%
NBFI	2%	11%	4%	13%	2%	2%	34%
NGO	2%	4%	4%	36%	0%	4%	51%
Total	**6%**	**17%**	**9%**	**60%**	**2%**	**6%**	**100%**
Second Regime q>0.7							
Bank	5%	0%	0%	0%	0%	5%	10%
Credit Union	6%	0%	0%	0%	0%	0%	6%
NBFI	5%	0%	0%	0%	0%	6%	11%
NGO	15%	15%	0%	20%	10%	12%	73%
Total	**31%**	**15%**	**0%**	**20%**	**10%**	**23%**	**100%**

Table 6.4Main Threshold Regression Results

	Dependent variable: OSS (Log)			
	Full sample		Threshold valueγ=0.7 (supW= 143.006, P= 0.000)	
	OLS	GMM	q<=0.7	q>0.7
Total active borrowers (Log)	0.029**	0.029***	0.032**	0.066***
	(0.011)	(0.011)	(0.014)	(0.022)
Average loan balance	0.075**	0.064**	0.063***	-0.416***
	(0.030)	(0.029)	(0.024)	(0.122)
Portfolio yield	1.400***	1.436***	1.757***	0.885*
	(0.247)	(0.427)	(0.330)	(0.457)
Operating expense ratio	-2.313***	-2.369***	-2.836***	-1.830***
	(0.347)	(0.563)	(0.443)	(0.478)
Loan loss reserve	-3.740***	-3.755***	-4.342***	-2.713**
	(0.791)	(0.776)	(1.071)	(1.214)
Debt to equity ratio (Log)	-0.085***	-0.083***	-0.090***	-0.088***
	(0.018)	(0.019)	(0.021)	(0.022)
Loans to assets	0.667***	0.664***	0.457**	0.788***
	(0.138)	(0.114)	(0.178)	(0.196)
Age (Log)	-0.021	-0.018	-0.036	-0.014
	(0.037)	(0.036)	(0.043)	(0.049)
Constant	-0.575***	-0.575***	-0.396**	-0.953***
	(0.179)	(0.153)	(0.167)	(0.269)
Number of observations	68	68	49	19
R^2	0.606	0.605	0.68	0.728
Hansen's *J P-value*		0.796	0.937	0.803

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

The P-value of the test statistic Sup W is obtained through 5,000 bootstrap replications

Instrumental Variables (IVs) used here are one-year lagged endogenous variables-lagged log of total active borrowers and lagged average loan balance GNI per capita, and lagged GDP. Besides, to test the exogeneity of the threshold variable, the percentage of the poorest is also used as an IV.

Hansen's J test (1982) is applied to avoid the problem of over-identifying restrictions.

Table 6.5 Threshold Regressions with Alternative Dependent Variables

	ROA		Profit Margin	
	Threshold q=0.7 (supW= 143.006, P= 0.000)		Threshold q=0.7 (supW= 69.524, P= 0.028)	
Variables	q<=0.7	q>0.7	q<=0.7	q>0.7
Total active borrowers (Log)	0.007**	0.007	0.027**	0.051**
	(0.003)	(0.006)	(0.012)	(0.020)
Average loan balance	0.006	-0.281***	0.045**	-0.411***
	(0.005)	(0.028)	(0.020)	(0.135)
Portfolio yield	0.484***	0.041	1.586***	0.584
	(0.073)	(0.070)	(0.278)	(0.405)
Operating expense ratio	-0.667***	-0.017	-2.536***	-1.135***
	(0.090)	(0.072)	(0.368)	(0.395)
Loan loss reserve	-1.103***	-1.288***	-3.814***	-3.245***
	(0.234)	(0.298)	(0.933)	(0.989)
Debt to equity ratio (Log)	-0.018***	-0.028***	-0.064***	-0.068***
	(0.004)	(0.006)	(0.019)	(0.021)
Loans to assets	0.170***	0.121***	0.384***	0.586***
	(0.032)	(0.045)	(0.139)	(0.130)
Age (Log)	-0.018	-0.013	-0.031	-0.013
	(0.012)	(0.011)	(0.036)	(0.035)
Constant	-0.143***	-0.017	-0.349**	-0.691**
	(0.047)	(0.058)	(0.137)	(0.284)
Number of observations	49	17	49	19
R^2	0.661	0.781	0.688	0.697
Hansen's *J P-value*	0.989	0.456	0.946	0.942

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

The P-value of the test statistic Sup W is obtained through 5,000 bootstrap replications

Hansen's J test (1982) is applied to avoid the problem of over-identifying restrictions.

Table 6.6 Threshold Regressions with Selected Samples

Dependent Variable: OSS (Log)

	Non-Profit MFIs		OSS MFIs	
	Threshold q=0.7 (supW=130.458, P=0.010)		Threshold q=0.7 (supW= 55.685, P= 0.071)	
Variables	q<=0.7	q>0.7	q<=0.7	q>0.7
Total active borrowers (Log)	0.002	0.038*	0.018	0.092***
	(0.009)	(0.022)	(0.014)	(0.008)
Average loan balance	-0.042	-0.885***	0.092***	-1.778***
	(0.032)	(0.299)	(0.024)	(0.220)
Portfolio yield	2.207***	1.305***	1.484***	-1.808***
	(0.374)	(0.384)	(0.479)	(0.296)
Operating expense ratio	-3.337***	-2.483***	-2.454***	0.791***
	(0.442)	(0.309)	(0.690)	(0.234)
Loan loss reserve	-6.064***	-5.192***	-3.542***	-9.267***
	(1.111)	(1.148)	(0.867)	(1.124)
Debt to equity ratio (Log)	-0.088***	-0.188***	-0.097***	-0.025**
	(0.022)	(0.056)	(0.015)	(0.012)
Loans to assets	0.792***	1.598***	0.513***	-0.945***
	(0.105)	(0.313)	(0.181)	(0.187)
Age (Log)	-0.103**	-0.049	-0.055	-0.236***
	(0.049)	(0.045)	(0.040)	(0.036)
Constant	-0.158	-1.101**	-0.22	1.673***
	(0.177)	(0.442)	(0.225)	(0.314)
Number of observations	29	15	41	12
R^2	0.828	0.795	0.612	0.846
Hansen's *J P-value*	0.422	0.654	0.538	0.104

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

The P-value of the test statistic Sup W is obtained through 5,000 bootstrap replications