

# Contribution of microfinance to economic growth: Transmission channel and the ways to test it

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Since its birth in 1970s microfinance has been growing rapidly with the aim to lift people out of poverty and promote economic growth. Its role and importance has been amplified amidst the global financial crisis when trust into formal banking is shaken. Despite global recognition and popularity of microfinance there is mixed evidence of its net benefits and very limited work on its contribution to financial intermediation and economic growth. This paper first, identifies and discusses possible transmission channels for microfinance and second, establishes the choice of appropriate methodology for robust empirical test. Adapted for panel data the Arellano-Bond (1991) technique allows for the Granger-Causality type test to reveal the direction of causality and overcome endogeneity issue. The main purpose of the estimation is to check whether microfinance matters - matters for financial sector development and economic growth.

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## Introduction and motivation

Around 1.4 billion people globally live on less than one dollar per day facing poverty, social, financial exclusion while recent food crisis has thrown millions into extreme poverty (World Bank 2009a, 2009b). As history of development economics revealed not all of the poverty eradication programs have been efficient in reaching the poorest of the poor. Microfinance has emerged as a promising tool to address this problem, as it requires less investment yet still serves a large portion of the poor that traditional banking finds unprofitable. In a broad definition *microfinance* is a non-standard provision of a large variety of financial services such as collateral free loans, saving deposits, insurance, remittances, leasing and money transfers to low-income households that are used to support their family business or productive activities (Armendariz de Aghion & Morduch, 2005).

The microfinance services are delivered by specialized microfinance institutions (MFIs) that can be both bank and non-bank type. Historical evolution of MFIs has been different from cooperatives, self-help and informal credit groups such as ROSCAs<sup>1</sup>. NGOs appeared as new players in the late 1970s which laid further foundation for specialized microfinance institutions (Vanroose, 2007). The industry is rapidly increasing and around 133 million clients are served by 3300 MFIs worldwide that grew by 26% during 2005-2007 worldwide (MIX, 2009). The success of microfinance is characterized by high (almost 95%) repayment rates and commitment, low probability of default and most

<sup>1</sup> ROSCA stands for Rotating Savings and Credit Associations, informal way of group financing.

important - social impact. Poor people running a tiny business from microfinance loans also improve their knowledge and skills, health, housing and have alternative employment opportunities. Also, by having access to microfinance, women's participation in society has rapidly increased which is especially important for the least developed countries where family and child-rearing responsibilities inherently fall to women.

Since its first establishment in 1970 by Dr. Muhammad Yunus in Bangladesh the microfinance movement spread around the world, attracting the attention of a large community by its successful lending practices, poverty alleviation impact and women empowerment. As a global recognition the United Nations proclaimed 2005 as the Year of Microcredit, Dr. Yunus was awarded the Nobel Peace Prize in 2006 and Presidential Medal of Freedom in August 2009 by US President Barack Obama.

The importance and value of microfinance has been reinforced amidst the global financial crisis of late 2008 as trust and reliability in formal banking sector has been seriously shattered. Few anecdotal surveys claim that microfinance has deep shock-resistant roots. As such during the currency crises in East Asia and the banking crises in Latin America in the 1990s the institutions serving low-income households generally performed better financially than commercial banks (Walter & Krauss 2006; Galema et al 2008; Visconti, 2008). However by current economic recession microfinance has been more integrated with domestic and international financial markets, and as a result today's financial crisis is more likely to infect microfinance institutions (Littlefield & Kneiding, 2009). It is expected that many MFIs may suffer and fail, but the important message is that the sector has built sound foundations and shock-resilience.

Growing popularity and importance of microfinance has lured academic research. There is a wide range of literature on microfinance, its diverse services, socio-economic impact and overall promised success to combat poverty by reaching low-income households. However, adequate empirical test of theory and impact evaluation remains a challenging task because of the limited good quality, comparable data and the difficulty to design an appropriate methodology. Self-selection of borrowers, non-random placement of MFIs, difficulty to identify treatment and control groups, endogeneity and other measurement issues create inconsistency in results and misleading conclusions about the ultimate benefit of microfinance programs. As a result the evidence is mixed, biased or limited to anecdotal surveys and subject to various critiques (Karnani 2007; Dichter & Harper 2007; Morduch 2001).

Most of the empirical microfinance research has been concentrated around the optimal design of the microfinance products, its impact on various development indicators, effect of moral hazard and adverse selection, i.e. overall micro level. In contrast the role of microfinance on meso and macro level, particularly the channel through which the sector contributes to the financial intermediation and growth is relatively underdeveloped. In addition to data constraints the problem of endogeneity and reverse causality between the key variables plague existing research on microfinance and growth nexus. Not controlling of these econometric problems can seriously hide the results and doubt the robustness of implications.

Addressing these issues given paper thus contributes to the microfinance literature by laying the foundation of the channels through which microfinance affects the financial sector development-economic growth and the ways of controlling endogeneity. The aim is to test whether microfinance actually matters by identifying the direction of causality between microfinance, financial sector development and economic growth. Recent trends of commercialization of MFI funds and proposals for a hybrid<sup>1</sup> structure by combining profit and social objectives imply that microfinance has the potential to become an alternative inflow to the capital markets. Microfinance is considered as a unique and non-standard way to mobilize the enormous savings of millions of the poor that traditional banking does not serve. Therefore microfinance is perceived to deepen access to finance

<sup>1</sup> "Microfinance must embrace the free market", The Economic Times, August 20, 2008.

at the household level and hence contribute to financial development. In this regard it is important to investigate the impact of microfinance on commercial banking and financial sector development together, a question not addressed explicitly before. Of particular interest is to determine not only the direction of causality, but more importantly, the transmission channel which can be tested employing a Vector Autoregressive (VAR) model adapted for panel data and estimated by Arellano-Bond (1991) methodology.

The paper is organized further as follows: section 2 summaries and reviews both theoretical and empirical literature on research agenda and microfinance transmission channels. Section 3 presents Arellano-Bond (1991) methodology and other panel data causality tests. Section 4 overviews the panel data from the Microfinance Information eXchange (MIX). Section 5 discusses the implications and the way how to interpret the results. The last section concludes.

## Literature review

There is abundant theoretical and empirical literature that affirms a positive effect of the financial sector (i.e. debt and equity markets, banking) on economic growth at the firm, industry and country levels [King & Levine (1993), Levine & Zervos (1998), La Porta et al (1998), Rajan & Zingales (1998), Beck et al (2004)]. On the other hand development oriented scholars claim that what actually matters is the access to finance measured by its depth and outreach<sup>1</sup> [Ravallion (2001), Beck & Levine (2002), Beck et al (2007a) and others]. To ensure sustainable economic growth improved access to finance has to reduce income inequality so that low-income households, that still constitute a majority, have chances to escape from poverty. Access to formal payment services is important for developed countries that have achieved strong market-based economies. However poor households in developing countries need access to different financial services than formal bank credits as banks often exclude them as unattractive clients due to high risk and insufficient assets for collateral (Beck et al 2008, p.111). The provision of microfinance services in the form of small collateral-free loans, savings and insurance facilities has thus evolved as a vital alternative for poor households to smooth consumption, start their own business, cushion income shocks, and improve living conditions.

Microfinance is a rapidly growing industry that enjoys its own niche in the financial sector different from formal banking. Many MFIs have achieved financial sustainability and independence from donor subsidies, and serve a broader and more diverse clientele. Indeed, microfinance has revealed the remarkable ability of the poor to save and to mobilize significant though still underused household assets (see de Soto, *Mystery of Capital*). Growing commercialization of MFIs and successful IPO of pioneering Mexican MFI Compartamos in 2007 demonstrates that besides its poverty eradication mission, microfinance can be very profitable and therefore should be also researched under financial development framework.

### ***Theoretical background: Identification of transmission channels***

The evolution and taxonomy of microfinance was quite different from formal banking, even though both have the same aim of delivering financial services. Therefore it is important to review first the motives behind microfinance and why formal banking excluded low-income people from its clientele.

In standard neoclassical theory, the concavity of production function implies diminishing marginal returns to capital. In our context it means that low-income borrowers have higher returns to capital and therefore have a higher ability to repay. If this is correct, then

<sup>1</sup> Outreach means access to and use of financial services. Beck, Demirgüç-Kunt and Peria (2007b) found that “available” is not the same as “use”.

investors should have invested heavily in the poor, and capital should flow from rich to low-income countries, a pattern first revealed by Lucas (1990). But these theoretical predictions do not hold in reality because of frictions and transaction cost differentials between rich and poor borrowers that excluded the latter from banking services. Specifically, poor borrowers belong to a high-risk category due to unstable income flow, lack of collateral assets, inability of banks to generate complete information (i.e. moral hazard and adverse selection), difficulty to enforce contracts in the weak judicial system of less developed countries and high transaction costs when working in poor communities (Armendariz de Aghion & Morduch, 2005). All of these factors hampered access to finance for low-income households and created a need for alternative solutions that came in the form of microfinance.

Another motive behind the evolution of microfinance was the unsuccessful experience of subsidized bank credit in the past. David (1984) and McKinnon (1973) document that low-income countries (i.e. Philippines, India, Mexico) in an attempt to recover their devastated agriculture sector and recoup the whole economy after World War II, decided to subsidize rural finance. Heavy subsidies were allocated to state banks to promote agricultural productivity and alleviate extreme poverty in rural areas. Subsidies were granted to banks also as a compensation for bearing extra risk and provision of loans to poor borrowers at a lowered interest rate. These policies, however, did not bring the desired outcome and even worsened already poorly managed economies since the cost of the government subsidies far exceeded the economic benefits. “Rather than delivering improved access, the policies have been blamed for creating financial repression” (McKinnon 1973, p.32). In this credit failure environment, the microfinance movement gained ground as a viable alternative for private and rural sector development.

Given the importance of microfinance, the next step is to analyze *how the presence of microfinance affects traditional banking*. During 1950-70 the financial system in most developing countries was mainly represented by a banking sector dominated by state-owned and commercial banks with foreign investment [“World Development Report 1989”; Adams et al, 1984]. While private, domestic commercial banking did exist until 1980, it was underdeveloped because of tight regulations on interest rate ceilings, directed credit issues, and high reserve requirements. These factors impeded domestic commercial banks from serving low-income entrepreneurs because of the higher transaction costs and extra risk. A shift in structural adjustments and financial sector liberalization begun in the 1980s improved the environment for small commercial banks, but even in this case banks did not serve microentrepreneurs who haven’t sufficient asset for collateral. Today, increasing banking competition has pushed commercial banks to look for new markets and wider clientele. Engaging in microfinancing, which has shown to be profitable, is seen as a promising opportunity for banks to serve a large demand for credit in developing countries that MFIs are unable to meet fully on their own. Delfiner and Peron (2007) analyze such “downscaling” of commercial banks through their ventures into microfinance in Argentina, Brazil and Mexico. In spite of its promise not all commercial banks engage in microfinancing due to the trade-off between benefits and costs. Delfiner and Peron (2007) review the (dis)incentives for banks to engage in microfinancing, which stem from the (dis)advantages of competing in the market. A summary of their main findings is given in Table 1 of Appendix.

Large commercial banks such as Citigroup, Deutsche Bank and HSBC<sup>1</sup> and investors especially from developed countries have created separate microfinance divisions. Hermes et al (2008) argue that MFI financing allows multinational banks to meet two objectives: to show corporate social responsibility and get a high risk-return from these investments. From a banker’s point of view, microlenders are seen as “specialists” in delivering microloans. Following this logic there is evidence of why and how microfinance development affects commercial banking.

<sup>1</sup> The Hongkong and Shanghai Banking Corporation (HSBC). As of 2009 HSBC is the world's largest banking group and the world's 6th largest company according to a composite measure by Forbes magazine.

We should also examine the feedback in the other direction. In particular the next channel to examine is

*How microfinance development is helped or harmed by commercial banking?* From the MFIs perspective, the urge for profitability and independence from the donor subsidies involves “upgrading” - serving higher-income clientele under transformed regulation. But this contradicts their social mission, and therefore MFI upgrading has been criticized. Beck et al (2008) claim that MFIs lack enough resources to meet the credit demand of large microenterprises while the latter may not be able to pay a higher interest rate to the MFI as their business expands (Beck et al., 2008, p.38). The solution to these problems is to link the microfinance sector with the banking sector, which indeed has become a very popular trend in Bolivia, Uganda, Brazil, and Argentina. At the same time Rhyne and Lopez (2003) claim that the microfinance-bank relationship is not always a friendly partnership but can also be quite competitive. On the one hand the large and experienced commercial banks offer MFIs a number of advantages not commonly available to NGOs and which make them potentially strong competitors. On the other hand there are number of disadvantages for MFIs if they cooperate with banks. Advantages and disadvantages for MFIs from interacting with banks are summarized in Table 2.

Rhyne and Lopez (2003) claim that only retail-oriented banks with large branch networks serving low-income clientele are most likely to succeed. The authors also argue that if commercial banks become serious players “they can offer very strong competition to traditional microfinance institutions” (p. 24). But from the perspective of the microfinance community, banks’ entry into microfinance is expected to be short or shallow. First, it may take too much time for banks to raise new microfinance business to a profitable level and hence the banks might decide against entering at all. The post-entry exit of banks from microfinance could also be very costly or banks may move up market by increasing the loan amount. Among microfinance practitioners there is even the proclamation that “downscaling is dead!” and therefore many MFIs have abandoned work with commercial banks (Rhyne and Lopez, 2003, p. 14). The nature of the co-existence of commercial banks and microfinance, either as strategic partners or as competitors, is therefore unclear. Examining this relationship empirically may tell us something about the direction of causality. Since we do not know ex ante the causal directionality, the most proper way is to examine it in a system of equations managed in vector autoregressive framework (VAR) which is presented in Section 3.

To complete the analysis, the role of microfinance and financial sector development is analyzed next. The channel to investigate is *how microfinance can contribute to financial sector development*. The motivation comes from the fact that microfinance envisages the integration of the financial needs of households into a country’s financial system and hence is expected to positively affect the growth. One can argue that the immediate channel of microfinance impact is through reducing income inequality and poverty. However, such an impact is long-term and thus difficult to measure. In this paper therefore we focus on financial sector development instead. Barr (2005) provides four reasons to view financial development through the lens of microfinance. First, financially sustainable MFIs can promote market deepening that in turn advances financial development. Second, microfinance is seen as a powerful tool in countries with poor governance that hinders development programs. Third, microfinance could facilitate financial market maturity in both developed and developing countries. Finally, microfinance could help to support domestic financial reforms by breaking down constraints.

The most striking contribution of microfinance is through enlarging the access to finance of households. Recent findings of Beck et al (2007a) and Honohan (2004) demonstrate that financial assets are highly concentrated and therefore asset holdings of the lower-income population are mostly ignored in deriving national resources and aggregate wealth. However, these authors found that the development of the financial sector per se is not enough to reduce poverty and income inequality; what actually matters is the depth of the

financial system. The depth of the financial system shapes the structure of the economy in indirect ways and leads to economic growth. The authors suggest that the degree of poor households' access to various financial services that microfinance promotes could help alleviate poverty and reduce inequality. Therefore policy reforms in developing countries should focus on improving household finance by creating better access of the poor to basic services such as deposits, money transfers, insurance, credit and savings - in large what microfinance does.

Given the positive impact of microfinance on development, it is also worth analyzing the relationship from the other direction, i.e. *how microfinance can benefit from financial sector development*. It is often thought that promoting microfinance-type institutions is the right way to address poverty. Yet according to Honohan (2004), strong financial development also facilitates poverty reduction, therefore "roles played by microfinance and mainstream finance in tackling poverty should be regarded as complementary and overlapping rather than as competing alternatives" (p. 19). Further evidence comes from the new World Bank research indicating that a high level of financial development, as measured by the high percentage of private credit as a share of GDP (also called "depth of finance"), is a powerful tool to reduce poverty (Beck et al, 2008). This implies that as financial sector deepens it also increase its reach, providing financial services directly to the poor. In their earlier paper Beck et al (2004) also argue that even when financial development does not touch poor people directly; it nevertheless promotes aggregate economic growth, thus benefiting the poorest in a disproportionately better way. To quote the authors: "the more abundant private credit creates a rising tide that lifts all boats, but a bigger lift to the poorest ones" (Beck et al. 2004, page 32). Therefore it is expected that in countries with a better developed financial sector microfinance will also be more efficient and more active. Particularly this hypothesis has been tested by Hermes et al (2009). The authors found strong and positive relationship between domestic financial development the efficiency of MFIs.

From this section it follows that microfinance is an important "ingredient" in shaping the financial inclusion of the households. The nature of the co-existence of microfinance and formal banking services encompasses cross-country differences in depth of outreach and hence differences in access to finance and ultimately - financial development.

### **Empirical research agenda: Endogeneity issue**

Microfinance cross-country and panel data studies are limited by availability of appropriate data and/or sensitive to model specification. Most of the empirical literature so far has employed the data from the Microfinance Information exchange (MIX) which remains the only aggregate cross-country data source collected through unified methodology. Since econometric identification is a common thread in the literature it is worth reviewing in a greater context.

Hatarska (2005) empirically tested the impact of the governance of MFIs in Central and Eastern Europe on their outreach and financial sustainability indicators. The author combined three survey data to obtain cross-country observations for 140 MFIs and estimated a cross-MFI random effect model. The justification of a random effect with MFI performance variable on the left-hand-side is because the impact of time invariant explanatory variables (MFI type, regulatory status, lending technology) is independent of the dependent variable. This assumption, however, is quite vague as no formal test was conducted to draw conclusions about the random vs. fixed effect. Hartarska & Nadolnyak (2008) use data from MIX Market on a sample of 394 MFIs to determine whether special microfinance rating agencies were able to "discipline" institutions. As part of their identification strategy the authors assume that MIX data provides both data on treatment (those who got a rating) and control (those who did not get a rating) groups and therefore conducted differences in means. To control for endogeneity the authors used regressors' lagged variables and put separate dummies for each rating agency. In addition to cross-

country regression the authors also estimated logit, where the dependent variable takes a binary form if MFI was rated. Conclusions from differences in means and logit indicate that if some rating agencies facilitated MFIs to raise funds, the others did not, while additional donor subsidies did not improve fundraising.

The growing interest of commercial banks and private investors in MFIs in recent decades implies that these institutions reveal profit margins reaching financial sustainability similar to a competitive company. This increasing commercialization of microfinance institutions has been criticized by original mission drivers as healthy profit margins reached at the expense of social outreach, i.e. reaching the poorest of the poor. To shed more light on whether there are significant trade-offs between social outreach and financial sustainability Cull et al (2007) examined financial profitability and outreach measures of 124 MFIs in 49 countries worldwide; Makame and Murinde (2006) analyzed a balanced panel dataset of 33 MFIs from five African countries for 2000-2005 and found significant evidence of a trade-off between two “extreme” missions of MFIs. Yet even if larger and balanced panel type data is available, the results are subject to oversimplified OLS estimations that are inconsistent for potential endogeneity and reverse causality in research objectives.

A slightly revised approach is used by Hermes et al (2008). The authors increased the time span of the MFIs sample and used stochastic frontier analysis (SFA) to determine a cost frontier and factors that explain distance from efficient (i.e. minimum) cost function. The methodology for cost function is similar to a bank performance evaluation where banks are perceived as intermediaries between funders and borrowers. In their recent paper Hermes et al. (2009) test the link between the MFI efficiency and financial sector development using the MIX data for 435 MFIs over the period 1997-2007. Stochastic frontier analysis (SFA) has been used to measure the efficiency of MFIs. The main findings suggest on robust one direction of causality, i.e. operational efficiency of MFIs is determined by the development level of the financial sector they operate. Bogan (2008) examined sources of funding for a panel of the largest MFIs worldwide for the years 2003 and 2006. The author used life cycle theory to explain the causal link between capital structure, sustainability and outreach. Following this theory and observing cross-region variations Bogan divided the sample into three life stages (new, young and mature) and used dummies respectively to analyze the effect of cycles on sustainability using probit. Robustness checks, regional, fixed and random effect regressions were performed to control for any cultural, political and environmental unobservable that might affect operational self-sufficiency with random effect having outperformed. Finally GDP growth and inflation lagged variables were used as exogenous instruments (based on initial regressions) to control for possible simultaneity of MFI funds and their operational self-sufficiency. The grand conclusion from all his estimates is that financially healthier, operationally more sustainable MFIs are those less reliant on external donor funds.

Amidst the current financial crisis there are several new papers investigating its impact on asset quality of MFIs and overall crisis-resilience. For instance Gonzalez (2007) find no evidence of a strong and robust relationship between growth (i.e. changes in GNI per capita) and MFI portfolio quality (four indicators of portfolio risk). Empirical findings of Galema et al (2008), Visconti (2008), Walter & Krauss (2006) show very low correlations between the performance of MFIs and financial market performance measures which imply that microfinance portfolios can be considered as a special asset class useful for portfolio diversification.

Finally there are several empirical studies on microfinance at a macro level investigating uneven distribution of microlenders across countries (Hardy et al 2002; Murlando & Otero 2005) and potential economy wide factors that might determine causal effect (Leegwater & Shaw, 2008; Vanroose 2007, 2008; Marconi and Mosley 2005; Honohan, 2004). Acknowledging the fact that these studies are pioneering in measuring the macro level impact of microfinance, at the same time identification issues and very small sample are obvious drawbacks. There are number of country-level studies on the impact of microfinance on poverty alleviation, on spillover effect, income inequality and reaching

UN Millennium Development Goals, yet they have little bearing on the cross-country nature of the paper and therefore are not presented here.

## Methodology: Panel data causality tests

Given these methodological constraints in the microfinance cross-country literature, the most plausible alternative is to utilize the one which is well-established and widely tested in finance literature. In any finance-growth research the primary methodological concern is to handle simultaneity or reverse causality between finance variables and dependent variables. In our context it implies that microfinance, financial sector development and growth are interrelated and driven by common economic factors that are difficult to disentangle.

Addressing reverse causality between growth and finance variables, researchers use initial values of independent variables or instrumental variables (Levine, Loyaza, Beck 2000). But this approach does not eliminate reverse causality since initial values affect contemporaneous values while serial correlation persists (Rousseau and Wachtel, 2000). A better solution is to use the Vector Autoregressive (VAR) version adapted for panel data with large cross-country observations and shorter time series developed by Holtz-Eakin, Newey, Rosen (1988) and Arellano & Bond (1991). To deal with unobserved country-specific effects which remain in the error term researchers use country dummies; but these obtain very unstable and imprecise estimates because of multicollinearity. Arellano-Bond (1991) proposed an improved methodology for country-fixed effects by introducing differencing in levels in VAR specification. Since the major task is to examine the direction of causality and the nature of transition path between microfinance, financial development and growth VAR for panel data is more appropriate than a cross-sectional approach. The model to estimate is a tri-variate VAR with fixed effects for a panel of  $i=1, \dots, N$  countries and  $t = 1, \dots, T$  years as applied in Rousseau & Wachtel (2000):

$$f_{it} = \sum_{j=1}^k \alpha_{1j} f_{it-j} + \sum_{j=1}^k \beta_{1j} b_{it-j} + \sum_{j=1}^k \gamma_{1j} m_{it-j} + \eta_{1i} + \phi_{1t} + \varepsilon_{1it} \quad (1a)$$

$$b_{it} = \sum_{j=1}^k \alpha_{2j} f_{it-j} + \sum_{j=1}^k \beta_{2j} b_{it-j} + \sum_{j=1}^k \gamma_{2j} m_{it-j} + \eta_{2i} + \phi_{2t} + \varepsilon_{2it} \quad (1b)$$

$$m_{it} = \sum_{j=1}^k \alpha_{3j} f_{it-j} + \sum_{j=1}^k \beta_{3j} b_{it-j} + \sum_{j=1}^k \gamma_{3j} m_{it-j} + \eta_{3i} + \phi_{3t} + \varepsilon_{3it} \quad (1c)$$

Where,  $\eta_i$  is country-specific fixed effects;  $\phi_t$  is time effect to account for trending;  $\varepsilon_{it}$  is random disturbance whose distribution is approximately normal;  $k$  is number of lags that can be determined using either information criteria: Akaike (1969), Hannan-Quinn (1979), Schwarz (1978).

Following variables are chosen:  $f_{it}$  is “financial depth” measured by M3 / GDP and revealing level of intermediation in the economy commonly accepted in finance literature. M3 includes currency, demand and all time deposits and liabilities of money market mutual funds and is available from the World Bank *World Development Indicators*. Complementary and as an alternative specification, the growth in nominal GDP from IMF *International Financial Statistics* is taken.  $b_{it}$  measures banking sector development as Private Credit / GDP found in IMF *International Financial Statistics*.  $m_{it}$  is loans outstanding in Microfinance Institutions, a most commonly available indicator in MIX data.

Important assumptions to convey is that equations 1a-1c imply that the error terms  $\varepsilon_{it}$  are orthogonal to the fixed and time effects; also to lagged values of endogenous variables. The error terms are also assumed to have positive variance. After first differencing (1a) becomes as follows:

$$(f_{it} - f_{it-1}) = \sum_{j=1}^k \alpha_{1j} (f_{it-j} - f_{it-j-1}) + \sum_{j=1}^k \beta_{1j} (b_{it-j} - b_{it-j-1}) + \sum_{j=1}^k \gamma_{1j} (m_{it-j} - m_{it-j-1}) + (\phi_{1t} - \phi_{1t-1}) + (\varepsilon_{1it} - \varepsilon_{1it-1}) \tag{2}$$

From this differencing correlation between the lags of endogenous variables and the error terms becomes evident. Arellano-Bond (1991) proposed predetermined lags of the system variables as instruments to have larger set of overidentifying restrictions and obtain consistent estimates. Another important feature of Arellano-Bond (1991) is that it enables use of unbalanced panel as MIX data is available for 1997-2008 years for selected countries. Therefore it is expected that for some countries the microfinance data could be highly underrepresented. After doing first differencing of all (1a), (1b) and (1c) tri-variate VARs will be estimated as follows:

$$\bar{f}_{it} = \sum_{j=1}^k \alpha_{1j} \bar{f}_{it-j} + \sum_{j=1}^k \beta_{1j} \bar{b}_{it-j} + \sum_{j=1}^k \gamma_{1j} \bar{m}_{it-j} + \bar{\phi}_{1t} + \bar{\varepsilon}_{1it} \tag{3a}$$

$$\bar{b}_{it} = \sum_{j=1}^k \alpha_{2j} \bar{f}_{it-j} + \sum_{j=1}^k \beta_{2j} \bar{b}_{it-j} + \sum_{j=1}^k \gamma_{2j} \bar{m}_{it-j} + \bar{\phi}_{2t} + \bar{\varepsilon}_{2it} \tag{3b}$$

$$\bar{m}_{it} = \sum_{j=1}^k \alpha_{3j} \bar{f}_{it-j} + \sum_{j=1}^k \beta_{3j} \bar{b}_{it-j} + \sum_{j=1}^k \gamma_{3j} \bar{m}_{it-j} + \bar{\phi}_{3t} + \bar{\varepsilon}_{3it} \tag{3c}$$

The key parameters of the interest are the presence of Granger-Causality that may arise among the variables of the system. To test the Granger-Causality we construct F-tests for block exclusions based on the difference in criterion functions (i.e. microfinance, financial sector development and growth) of Restricted and Unrestricted models of following form:

$$F = \frac{[e_R' Z_A N Z' e_R] - (e_U' Z_A N Z' e_U)] / k}{e_U' Z_A N Z' e_U / (obs - q + k)} \approx F(r, obs - q + k)$$

Where,  $e_R$  - residuals of restricted model

$e_U$  - residuals of unrestricted model

$r$  - number of restrictions

$Obs$  - number of observations in the model

Under the null hypothesis F-test states that lagged values have no significant effect or there is no Granger causality. If we reject the null hypothesis than the presence of lagged values is justified and we observe Granger causality.

As a robustness check we can apply causality test in panel setting and estimating single equation thus not requiring instruments:

$$f_{it} = \mu_i + \sum_{j=1}^k \alpha_i^j f_{it-j} + \sum_{j=1}^k \beta_i^j m_{it-j} + \varepsilon_{it}$$

where  $i=1,2,\dots,N$  countries and  $t=1,2,\dots,T$  time span.

This is so-called *Homogenous Non Causality (HNC) test* that was developed fairly recently by Hurlin (2004) and applied by Hurlin and Venet (2004) on finance-and-growth panel data framework and Zemcik and Mikhed (2007) on testing for bubbles in housing markets. The motivation for using HNC test in microfinance context is that for majority of the developing countries financial sector is dominated by banking sector therefore there is less distinction between banking and financial sector development. Therefore we could simplify procedures and instead of estimating bi-variate VAR could perform HNC using single equation, while profiting from the same data dimension: use short time series and large cross-country observations. The objective remains the same - test whether microfinance matters for financial sector development, particularly for developing countries. Similar to classical Granger-Causality under null hypothesis microfinance do not have causal impact on FSD:

$$H_0: \quad \beta_i = 0, \quad \text{for all } i=1,2,\dots,N$$

$$H_A: \quad \alpha_i = 0, \quad \text{for } i=1,2,\dots,N_1$$

$$\alpha_i \neq 0, \quad \text{for } i=N_1+1,2,\dots,N$$

As can be seen alternative hypothesis is more broadly defined then in Arellano-Bond (1991) GMM F-test and allows that microfinance could matters for one country and not for another. The final conclusion we should made by averaging Wald statistics  $W_{it}$

associated with individual test of  $H_0$  for each  $i=1,2,\dots,N$ :  $W_{NT} = \frac{1}{N} \sum_{i=1}^N W_{it}$

## Data overview

The primary data source for microfinance variables defined in previous section comes from the Microfinance Information eXchange (MIX) which provides unique and complete panel data per MFIs that are willing to report to this agency. The time span of the panel is 1995-2009 which is rather unbalanced for most of the countries. Having an unbalanced panel though does not hinder application of the panel data causality test. The growth dynamics of MFIs covered in MIX is visualized in Figure 1. The database is rather comprehensive and contains 28 indicators per MFIs. A summary statistics of these indicators is presented in Table 3, while regional distribution is decomposed in Table 4. As can be seen most MFIs in this sample are concentrated in Sub-Saharan Africa and South Asia, while most of the borrowers are concentrated in South Asia, and East Asia/Pacific region. There are certain limitations of the data as not all microfinance institutions and clients are covered in the sample. For instance, one important bias of the sample to note is the omission of many MFIs focusing on savings mobilization.

Along with MIX database there are several other complementary sources on microfinance such as (a) Microcredit Summit Campaign (MCS) data collected on number of MFIs and

borrowers (b) Inter-American Development Bank (IADB) data for 2005 covering Latin America and the Caribbean region.

It should be mentioned that for cross-country analysis not all of 28 indicators will be used. In particular Loans Outstanding and Total Number of Clients are the best candidates as these variables are present for all MFIs which allows of not “wasting” of observations. Since the database contains indicators per MFIs for our cross-country analysis we construct a panel taking time averages per country. Alternatively we can pool observations across countries within each income group or pool the entire sample to create an unbalanced panel that Arellano-Bond (1991) estimation is able to cope with.

Measures of financial intermediation (Private credit/GDP and M3/GDP) and economic growth (GDP growth in nominal currency) is taken from IMF International Financial Statistics. There are also complementary data from the World Bank World Development Indicators; however priority is given to the data from IMF reference as careful choice of the database should be done. For instance Hanousek, Hajkova, Filer (2008) have shown the importance and sensitivity of choosing the right database for growth regression and in particular implications of using data from IMF, World Bank and Penn World Tables.

## Expected results and interpretation

Arellano and Bond (1991) estimation technique enables to disentangle the reverse causality and more important endogeneity of microfinance in growth and financial sector development equations. After estimating tri-variate VARs by GMM we can expect to have three-by-three table of coefficient estimates with robust standard errors that will reflect the sign and significance of the effects. While expected economic implications will be the evidence or no of the feedback from microfinance to the financial sector development and growth. In other words, the aim of whole estimation procedure is to reveal whether microfinance matters, particularly for developing countries where formal financial intermediation is immature leaving significant space for alternative means such as microfinance. In addition impulse response functions should be plotted to visualize the dynamic effect of VAR system estimations. Finally use of alternative measures of microfinance (number of clients and loans outstanding) helps to shed light on nature of transmission channel through which microfinance affects financial sector and growth: through extent of outreach measured by number of clients or depth of outreach - serving less but more poor people and measured by loans outstanding. Important conceptual note is that if we do not grasp and see the effect of microfinance on aggregate numbers such as aggregate portfolio and total number of clients than we could expect less or even no effect at lower levels. In other words if there is an effect than it should be reflected on aggregates already.

## Conclusion

Increasing growth of microfinance in recent decades in developing countries signals that alternative means of financing could play a significant role by filling the gap of immature formal intermediation. Theory and anecdotic country level studies suggest that microfinance could have significant effect on banking sector and growth and vice versa; while financial sector development and microfinance relationship is build on improved access to finance. In an attempt of addressing the lack of research on microfinance and growth interaction, this paper first, identifies transmission channels and second, defines appropriate empirical methodology to test the direction of causality, which to date remains ambiguous. Acknowledging reverse causality between the system variables vector autoregressive (VAR) model adapted for panel data is an appropriate model to use. The model choice is also justified by the limitations of the microfinance data obtained from MIX as on average 7-8 years data is available for majority of the countries leading to the

unbalanced panel problems that Arellano-Bond (1991) technique cope with. As a result of estimation procedures we expect to obtain a robust answer whether microfinance matters, particularly for developing countries where formal financial intermediation is immature leaving significant space for alternative means such as microfinance.

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## Appendix

TABLE 1. MOTIVES FOR BANKS TO ENGAGE IN MICROFINANCING

- Profit and risk diversification	- Competition
- Excess liquidity	- Regulations
- Cross-selling opportunities	- Government or donor initiative
- Bank leadership and image	- Market pressure on margins
- Public relations and social responsibility	- Desertion of traditional clients
Competitive advantages:	Competitive disadvantages:
+ Extensive network of branches	- Higher operating costs
+ Technology infrastructure (ATMs, MIS)	- Lack of knowledge of the microfinance market
+ People with skills in areas such as information technology, marketing and legal management who can support microfinance operations.	- Implementation of credit methodologies inappropriate for the MF market
+ Market presence and brand recognition.	- Labor-intensive nature of microenterprise credit as the antithesis of the banking sector drive toward automation
+ Lower operating cost structure.	

Source: Adapted from Delfiner and Peron (2007)

TABLE 2. EFFECT OF INTERACTION OF MFIS AND BANKS

Advantages:	Disadvantages:
+ <i>Physical and Human Infrastructure:</i> Large banks have extensive network of branches covering all major cities. This infrastructure could help MFIs cut costs.	- <i>Market Knowledge:</i> traditional banks lack full and deep understanding of microfinance market. They also tend to keep microfinance portfolio relatively small.
+ <i>Market Presence and Brand Recognition:</i> MFIs can benefit from well-established brand and recognition of banks that have also access to middle and low-income population through savings and account payments.	- <i>Credit Methodology:</i> banks tend to apply the standard credit instruments for micro-lenders which are inappropriate in most of the cases.
+ <i>Access to Low-Cost Funds Outside:</i> large and well-established banks have easier means to obtain external funds for MFIs and at lower costs.	- <i>Trend toward Automation:</i> growing automatization of banking procedures reduce face-to-face transactions; while for most of the microfinance lending frequent personal contacting borrowers is critical factor to ensure repayment.
+ <i>Low Cost Structure:</i> most of the banks have lower operating cost that traditional microfinance.	- <i>Conservative Corporate Culture:</i> large bureaucratic banks that preserve conservative banking business might burden microfinance with policies thus hindering their success.

Adapted from: Rhyne and Lopez (2003)

TABLE 3. MICROFINANCE INDICATORS SUMMARY STATISTICS, 1995-2009

MFI indicators	Unit of measure:	No. of obs.	Mean	Minimum	Maximum
1. Assets	in USD	6750	29 884 941	0	6 450 881 016
2. Loan portfolio, gross	in USD	6781	20 318 896	0	3 472 617 229
3. Equity	in USD	6743	5 055 636	-22 037 595	625 576 022
4. Deposits	in USD	3258	21 530 885	0	4 869 679 235
5. Borrowings	ratio, %	3428	12 489 990	0	1 411 216 394
6. Capital/asset ratio	ratio, %	6733	36,21%	-1835,26%	200,38%
7. Debt to equity ratio	ratio, %	6520	10,28076227	-3567,28	21050,21
8. Average loan balance per borrower (in USD)	ratio, %	6645	1062,516629	0	171473
9. Average loan balance borrower per borrower / GNI per capita (in USD)	ratio	6641	0,907354359	0,0001	124,354
10. Average deposit balance per depositor (in USD)	ratio, %	1751	2204,188464	0	916109
11. Average deposit balance per depositor / GNI per capita (in USD)	ratio, %	1687	0,911760522	0,01	246,85
12. Return on assets	ratio, %	5324	0,43%	-213,67%	100,89%
13. Return on equity	ratio, %	5323	6,28%	-4554,19%	8657,28%
14. Financial revenue/ assets	ratio, %	5324	27,17%	-14,52%	377,49%
15. Yield on gross portfolio (nominal)	ratio, %	3195	34,41%	0,02%	188,36%
16. Financial expense/ assets	ratio, %	4969	5,14%	-2,92%	367,99%
17. Provision for loan impairment/ assets	ratio, %	4815	2,01%	-24,09%	83,87%
18. Operating expense/ assets	ratio, %	5332	19,75%	0,01%	221,54%
19. Operating expense/ loan portfolio	ratio, %	5333	31,71%	0,01%	2218,04%
20. Cost per borrower	in USD	5216	188,0985429	0	9084
21. Borrowers per staff member	in USD	6631	134,3667622	0	13709
22. Depositors per staff member	in USD	2961	213,463357	0	5602
23. Portfolio at risk <30 days	%	5320	422,91%	0,01%	2021088,93%
24. Write-off ratio	ratio, %	3228	2,56%	-12,68%	76,27%
25. Personnel	number of people	6755	291,223094	1	38545
26. Number of active borrowers	number of people	6666	47068,58611	1	6707000
27. Total women borrowers	number of people	5865	35729,75823	1	6497000
28. Number of depositors	number of people	2962	160403,209	1	32252741

Source: Microfinance Information eXchange (MIX), 2009.

TABLE 4. REGIONAL DISTRIBUTION OF BORROWERS AND MFIS

Region		Borrowers (mill.)	Number of MFIs	Countries		
				Covered	Total	Percentage
EAP	East Asia and Pacific	15.4	189	9	26	35 %
EECA	Eastern Europe and Central Asia	1.8	196	20	22	91 %
LAC	Latin America and the Caribbean	11.2	584	24	29	83 %
MENA	Middle East and North Africa	1.8	51	10	13	77 %
Asia	South Asia	38.9	670	6	8	75 %
Africa	Sub-Saharan Africa	7.7	517	31	46	67 %
Total		76.9	2,207	100	144	70%

Source: Microfinance Information eXchange (MIX), Microcredit Summit Campaign (MCS), Inter-American Development Bank (IADB).

FIGURE 1. MICROFINANCE INDUSTRY WORLD-WIDE: GROWTH BY MAIN INDICATORS AND REGIONS

