An empirical study on the impact of microfinance institutions on development

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Abstract

This paper examines the impact of microfinance institutions on development in an empirical setting, and therewith aims at filling a gap in econometric assessments of microfinance institutions. Using data of MFIs operating in selected African and Asian countries and choosing average savings and loan balances per client as proxies for development, there is empirical evidence for significant positive impact of microfinance institutions on development. Microcredit is the most robust mechanism to enhance development in recent years. While an MFI's size is mostly irrelevant, its experience was found to be especially enhancing for the amount of credit granted to the poor. Savings is found to be the best estimator for development in recent years, yet a structural break between 2003 and 2006 is possible. While African development is generally in arrears compared to Asia, there is no statistical evidence for differences in the marginal impact of microfinance institutions subject to geographical positions, which allows for the conclusion of environment independent positive impact of microfinance institutions on development in low-income countries.

Contents

1 Introduction

The field of microfinance institutions (MFIs) is still a fairly recent topic in economic research. Although the first MFIs have already been established in the 1980s such as the Grameen Bank founded by 2006 Nobel Peace Prize Laureate Muhammad Yunus (Yunus 2003), the extend to which they have been profoundly analysed in economic research is still small.

In general, analyses of MFIs in qualitative impact studies and quantitative empirical, econometrics-based studies are distinguished. While the former covers qualitative case studies of an individual MFI, the latter aims at detecting general patterns to draw conclusions about common characteristics. Halfway between qualitative impact studies and quantitative econometric assessments, social performance measurements combine both mainstream analyses. Pilot studies are the most frequent embodiment thereof.

Using impact studies to study one MFI in all detail may reveal useful results for this individual case, but conclusions cannot be generalised, and even transferring insights to similar institutions in the same geographic region is difficult. As control groups are completely missing, it may prove to be difficult to disentangle effects of microfinance itself.

In fact, if the chosen MFI bears atypical characteristics that other MFIs do not have in common, this is clear sign of selection bias which leads to false conclusions if the findings are applied to make predictions about other MFIs. Purely qualitative assessments are not able to account for reverse causation or spurious correlations, which further stresses the arguments above.

Though, impact studies have constituted the most frequent method to analyze MFIs so far. As, for example, emphasised by Murdoch (1999), the scarcity of data was the main reason for significant underrepresentation of econometric-based empirical studies on any topic on MFIs. This field of study is not only worth to turn one's attention to due to the claim of scientific evaluation. But the results obtained from in-depth empirical analyses may reveal important insights into MFIs and their impact on economic development.

This paper aims at filling part of the described empirical gap in research on microfinance institutions and their impact on development processes. In chapter 2, I explain the origin and idea of microfinance institutions. In chapter 3, I elaborate on theoretical implications of microfinance institutions that can be derived from economic theory. Chapter 4 concentrates on both descriptive (see section 4.3) and econometric (see section

4.4) empirical analyses of a selected set of MFIs in Africa and Asia and draws conclusions from the obtained results. Chapter 5 concludes.

2 The idea of microfinance institutions

Microfinance institutions provide small-scale financial services to poor people who are otherwise "excluded from the formal banking sector" (Morduch, 1999, p. 1569) and standard financial systems. Operating merely in developing and emerging countries, they have specialised in offering loans of minor scale to enable individuals to start small productive businesses and enhance entrepreneurship. Especially in rural areas of developing countries, the development of financial systems is often poor, sometimes they have not fully emerged at all. In this case, microfinance institutions often represent a first opportunity for the local population to participate in financial systems and to benefit from access to business and capital.

The idea to establish microfinance institutions traces back to Muhammad Yunus, who developed it as a way to eradicate poverty in his home country Bangladesh. In 1983, he founded Grameen Bank, the first institution which realised this concept and started to operate in the microfinance business in the proper sense. Together, Yunus and Grameen Bank were laureates of the 2006 Nobel Peace Prize awarded "[f]or their efforts through microcredit to create economic and social development from below" (The Norwegian Nobel Committee, 2006).

Although there have been organisations concentrating on offering loans and saving opportunities to needy people before (Counts, 2008, p. 3), Grameen Bank is known for successfully implementing the system of group-lending. In particular, it has proposed a number of indicators to measure the impact of poverty elimination methods (Yunus, in: Counts, 2008, p. viii). These consider primarily basic needs similar to the definition of the International Labour Organisation in 1976 (in: Schubert, 2007), and the financial situation of the poor. The latter refers to weekly loan repayment rates and average annual balance of saving deposits. Similar indicators for development are discussed in chapter 4.4.1.

Yunus (2007) argues that global poverty does not emerge from market failures, but from capitalism as a theoretical concept which does not fully model real economic structures in general and economic behaviour of each individual in particular (pp. 18–19). Access to capital is indeed crucial for development (p. xii), and the concept of free markets has also the capacity to contribute to poverty reduction (p. 6). But the idea still missing is to incorporate a social component into economic systems to meet observed behaviour (pp. 18–19).

The idea of microfinance institutions meets both requirements. They provide access to capital on smallest scales, and ideally act as social businesses realising economic behaviour augmented by social preferences[1]. They enable poor people to engage in productive economic activities and thus contribute to development in low income population strati. According to Masanjala (2002), their mechanisms constitute a for a long time missing link between the "arbitrariness of informal lenders" (p. 97) and the problems related to standard banking institutions.

[1]For the idea of social preferences, see Fehr and Fischbacher (2002).

3 Theoretical implications of the benefits of microfinance institutions

In the following, I first present the concept of group-lending as a means to avoid classical economic problems associated with lending to poor people (see chapter 3.1). Thereupon, I elaborate on a rather new approach first presented by Sachs et al. (2004), arguing for saving traps as a major reason for ongoing drawbacks in development, and propose MFIs as a mechanism to overcome the prohibitive level of income and to initiate sound long-term growth on a micro-base.

3.1 A Game-Theoretical Approach to Group-Lending

Classical financial institutions typically require the existance of collateral as security before granting loans to a client. However, low income levels and the lack of assets would exclude most people in developing countries from obtaining credit from standard banks.

In contrast, microfinance institutions apply the concept of *group-lending*. Instead of requiring collateral from each individual, they use peer pressure and social selectivity to increase repayment rates and hedge against default risk. Several individuals are grouped, where each person receives a specific loan, but still the whole group is responsible for repaying credit. As groups form voluntarily, no group is willing to accept a member whose reputation is questionable and who is likely to take too high risks in investing the loan and risks to be unable to repay by hindsight. In case of Grameen Bank, the sanction for default is lasting credit denial for all group members (Morduch, 1999, p. 1575). By this means, a microfinance institution substitutes collateral with the mechanism of social reputation within a group (p. 1570). This mitigates the risk of default due to adverse selection through asymmetric information in the detriment of the MFI.[2] In addition, group-lending decreases transaction costs, another cause for standard banks to refain from lending to the poor (Sachs, 2005, p. 13). At the same time, poor individ-

[2]Guttman (2006) distinguishes a total of three major problems which are responsible for low credit provision for the poor in standard banking systems. First, adverse selection (as discussed above). Second, ex ante moral hazard which occurs when a borrower has incentives to take too high risks in investing the loan, given the knowlegde that the MFI will not raise any repayment claims in case of failure as collateral is not given. And third, ex post moral hazard respectively strategic default, when a borrower decides to deny possible profits to avoid loan repayment (pp. 1–2).

uals are granted the possibility to access local financial markets and to invest in small businesses. This approach is also interesting to encounter the often assumed insufficient creditworthiness of the poor, which is one of the main arguments to explain why contracts between standard banking institutions and poor people are often said to be not feasible. Yunus argues that "[o]ne major institution that needs to be redesigned is the financial institution", and in fact criticises that poor people are often not assumed to be credit-worthy (Romanes Lecture, 2008).

The design of group-lending by Grameen Bank described above can be formalized by means of a game-theoretical approach. In fact, the design involves a trigger strategy. All players (hence, the MFI and a group of five borrowers) cooperate, until one group member defaults. The result is that the MFI denies any further loan to any group member, which is the trigger here.

I assume that lending is made simultaneously to all group members. Player 1 is the microfinance institution, player 2 is the group.[3] The basic play resembles a prisonner's dilemma: the social optimum is achieved if both players cooperate, that is, if the microfinance institution grants credit and all group members eventually repay. However, one or more group members may defect and use the loan to invest in too risky projects that bear higher profit, but are also more likely to fail. In the latter case, I assume that the exclusion from further loans is the only sanction, but no repayment claims on the part of the MFI are made.

Figure 1 shows the normal form for a 2×2 payoff matrix in a repeated game.

		Player 2 (group)	
		cooperate	defect
Player 1 (MFI)	cooperate	a_1, a_2	b_1, b_2
	defect	c_1, c_2	d_1, d_2

Figure 1: *Payoff matrix for group-lending (microfinance game)*

To ensure long-term cooperation on the part of the group and continuous repayment of loans, the sum of discounted profits in every period for cooperating for player 2 (and in fact, for every group member) has to exceed the sum of discounted profits from defecting

[3] To keep structures simple, the group of m players is perceived as one single player, as no member ever receives credit again if one of them ever defaults and all group members share common characteristics in behaviour.

once, hence from cooperating until period $T-1$, plus the profit from defecting in time T, plus the sum of discounted profits after time T. The former are profits generated trough small businesses realised by means of microcredit, net from interest. While the middle is the expected profit generated from the risky project with probability p of breaking even, the latter consists solely of alternative income generated without the support of microloans. Assuming that player 2 can not receive credit from other microfinance institutions after being denied further credit from the MFI,

$$\pi_2^c > \pi_2^d \tag{1}$$

must hold, where

$$\begin{aligned}\pi_2^c &= a_2 + a_2\delta + \ldots + a_2\delta^{T-1} + a_2\delta^T + a_2\delta^{T+k} \\ &= a_2 \sum_{t=0}^{T-1} \delta^t + a_2\delta^T + a_2 \sum_{t=1}^{k} \delta^{T+t} \\ &= a_2 \sum_{t=0}^{T-1} \delta^t + a_2\delta^T + a_2\delta^{T+1} \sum_{t=0}^{k-1} \delta^t \end{aligned} \tag{2}$$

and

$$\begin{aligned}\pi_2^d &= a_2 + a_2\delta + \ldots + a_2\delta^{T-1} + b_2\delta^T + d_2\delta^{T+1} + \ldots + d_2\delta^{T+k} \\ &= a_2 \sum_{t=0}^{T-1} \delta^t + b_2\delta^T + d_2 \sum_{t=1}^{k} \delta^{T+t} \\ &= a_2 \sum_{t=0}^{T-1} \delta^t + b_2\delta^T + d_2\delta^{T+1} \sum_{t=0}^{k-1} \delta^t. \end{aligned} \tag{3}$$

a_2 is the payoff from cooperating if the MFI cooperates, as well. b_2 is the payoff in time T when a group member defects with the loan received from the MFI. d_2 is the payoff for each period after time T when subsequent credit from the MFI is denied due to defection in period T. $\delta \in (0, 1)$ is the discount factor. Substituting for (2) and (3)

in equation (1), the following inequality is obtained:[4]

$$
\begin{aligned}
\pi_2^c &> \pi_2^d \\
a_2 \sum_{t=0}^{T-1} \delta^t + a_2\delta^T + a_2\delta^{T+1} \sum_{t=0}^{k-1} \delta^t &> a_2 \sum_{t=0}^{T-1} \delta^t + b_2\delta^T + d_2\delta^{T+1} \sum_{t=0}^{k-1} \delta^t \\
a_2\delta^T + a_2\delta^{T+1}\Big(\frac{1-\delta^{k-1+1}}{1-\delta}\Big) &> b_2\delta^T + d_2\delta^{T+1}\Big(\frac{1-\delta^{k-1+1}}{1-\delta}\Big) \\
a_2\delta^T(1-\delta) + a_2\delta^{T+1}(1-\delta^k) &> b_2\delta^T(1-\delta) + d_2\delta^{T+1}(1-\delta^k) \\
a_2\delta^T - a_2\delta^{T+1} + a_2\delta^{T+1} - a_2\delta^{T+k+1} &> b_2\delta^T - b_2\delta^{T+1} + d_2\delta^{T+1} - d_2\delta^{T+k+1} \\
a_2 - a_2\delta^{k+1} &> b_2 - b_2\delta + d_2\delta - d_2\delta^{k+1} \\
a_2 - a_2\delta^{k+1} &> b_2 - (b_2 + d_2)\delta - d_2\delta^{k+1}. \qquad (4)
\end{aligned}
$$

Depending on the value of k, different scenarios regarding the future income generation of the individual can be distinguished.

Suppose $k = 0$. In this case, the individual severely depends on credit from the MFI, as there are no opportunities to generate alternative income (hence, $d_2 = 0$). Though, if the borrower is aware of his dependency, he would act irrational if engaging in too risky investment projects where he runs the risk to default. For $k = 0$, inequality (4) becomes $\delta < \frac{a_2 - b_2}{a_2 - b_2 - 2d_2}$ and for $d_2 = 0$, $\delta < 1$, which is true as long as positive interests from accepting microcredit exist.[5] Thus, the borrower will not default.

Suppose $k \to \infty$. This implies that an individual can always generate alternative income through outside-options if he is denied further access to microcredit. Inequality (4) then reduces to $\delta > \frac{b_2 - a_2}{b_2 + d_2}$. For $\delta \leq 1$, we get $a_2 > -d_2$: as long as the profit from receiving microcredit exeeds the opportunity costs from alternative income, the borrower decides not to default.

Summarising these findings, a trigger strategy in group-lending is efficient if $\delta < 0$ or if the individual's profit generated through microcredit exceeds opportunity costs of alternative income. As both scenarios are sensible, lending by microfinance institutions is in fact efficient and may improve economic welfare of the poor.

Note that standard trigger strategies in game theory assume that both players are

[4] Note that $\sum_{i=0}^{n} a_0 q^i = a_0\Big(\frac{1-q^{n+1}}{1-q}\Big)$ for geometric series.

[5] Note that $\delta = \frac{1}{1+r}$, where r is the real interest rate.

credible to threaten their counterpart. In a repeated game with $t \to \infty$, this results in a Nash equilibrium. However, the players in the microfinance game are extrinsicly asymmetric — the microfinance institution on the one side, the group of borrowers on the other. In her position as credit institution, the MFI's potential to threaten is distinct, but the group of borrowers' is not clear at first sight. Yet, the presented unilateral trigger strategy results still in a modified equilibrium as the borrower has incentives not to default in the two scenarios discussed above. In this regard, the microfinance game eventually also proves not to be a prisonner's dilemma as the equilibrium is identical to bilateral cooperation instead of defection, although initial reasoning suggested the opposite.

Guttman (2006) studies a similar situation with groups of two borrowers, though without game-theoretical approach. He argues that 'assortative matching', that is to say the process of group formation separating risky from safe borrowers, would only occur in absence of 'dynamic incentives' (p. 2) such as the proposed trigger strategy. This would imply that if a trigger is applied, groups would be composed of both types of borrowers, which actually contradicts the hypothesis that this strategy would ensure secure investments in the long run by separating risky from safe clients. In a numerical simulation, Guttman shows that, ceteris paribus, the marginal benefit of having a safer partner would decrease with higher income and with higher success probability of one's investment project. However, he assumes throughout the feasibility of side payments between both borrowers, where one pays a certain amount to share costs if his own project succeeds and that of his partner fails. In absence of this assumption, which has not to be observed necessarily in reality, the result of assortative matching holds also for the dynamic setting (p. 9). Hence, a trigger strategy is also stable in non-game-theoretical analyses, which supports its robustness.

3.2 Saving Traps in Macroeconomic Growth Models

Why are many low income countries developing relatively slowly, sometimes not at all, and sometimes even contracting? And, once disposing of a convincing and plausible theory to explain those circumstances, what can be done to overcome obstacles to development?

The poverty trap is one approach to explain economic stagnation or very slow growth at most in least developed countries. Models incorporating poverty traps contrast clas-

sical growth models where, in case of a stable overall environment, negative economic shocks are followed by periods of prosperous growth and not by stagnation (Sachs et al., 2004). By means of a poverty trap adjusted Solow model (Sachs et al., 2004), it can be shown that a country does not grow in the long run unless it has passed a lower bound capital accumulation level k_0, where capital per worker is denoted by k (see Figure 2). It can be shown that both $\tilde{k}_{SS}$ and k_{SS} are stable steady state equilibria (depending on $k < k_0$ or $k > k_0$), but not k_0. The reasons are twofold: on the one hand, the production function $f(k)$ can be S-shaped while the saving rate is constant at rate s. On the other hand, $f(k)$ can incorporate decreasing returns to scale, such that $\frac{\partial f}{\partial k} > 0$ and $\frac{\partial^2 f}{\partial k^2} < 0$, while the saving rate depends on the level of accumulated capital. In this case, the saving function $g(k) = s(k)f(k)$ is S-shaped, which leads to the same result as in case of an S-shaped production function.

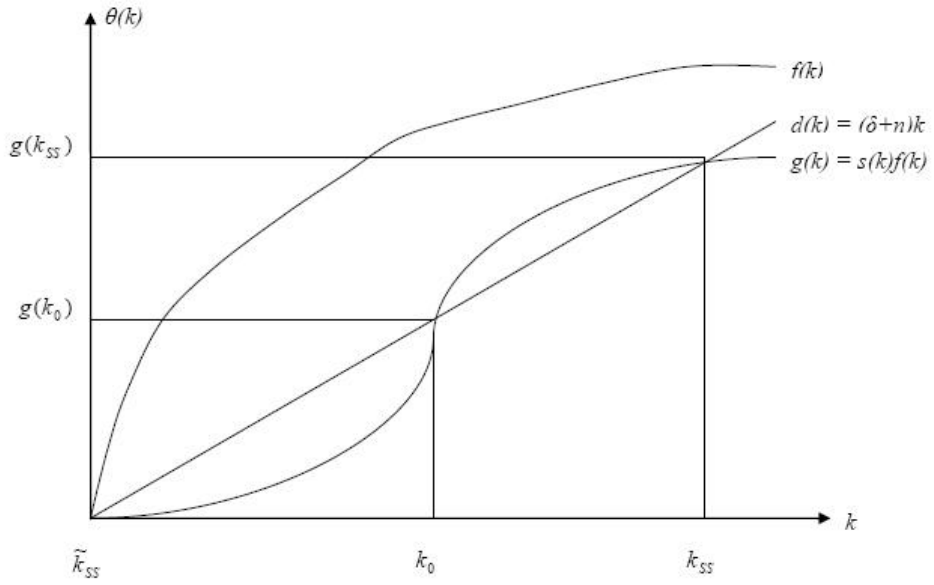


Figure 2: *Poverty trap adjusted Solow model with two stable steady states*

For all levels of capital accumulation below k_0, the sum of depreciation and population growth rates, $(\delta + n)$, exceeds marginal savings and initiates convergence towards the lower steady state equilibrium $\tilde{k}_{SS}$ with $g(k) = f(k) = 0$. High population growth rates enforce the velocity of convergence and therefore reinforce the negative effect on economic growth. Sachs et al. (2004) have described the phenomenon and implications

of s being a function of k as the "saving trap" (see Figure 3 in Sachs et al., 2004). Accelerated convergence towards $\tilde{k}_{SS} = 0$ in case of high population growth rates have been referred to as the "demographic trap" (see Figure 4 in Sachs et al., 2004).

Based on a study of the Bank of Uganda where the saving and borrowing behaviour of more than 300 Ugandan households was analysed, Musinguzi and Smith (2000) found that 76.2 % of rural Ugandan households did not save at all, compared to 64.6 % in urban areas. On average, 85.4 % claimed low income as the main reason, another part indicated difficulties in accessing financial institutions as a binding constraint (p. 9). Low income is likely to remain low if individuals do not have the opportunity to access financial institutions — in order to save at least a minor part of income with positive interest yield, or to obtain credit of minor scale to start small businesses, for example. But this is exactly the point where the idea of microfinancial institutions applies. By providing the opportunity to save and borrow in smallest scales, the vicious circle of low income, low saving, and poor growth can be intermitted at microeconomic levels. If the poverty trap model applies in a given country, then the presence of well functioning microfinance institutions may not only enhance aggregate growth by supporting the poor with credit, but it can also increase confidence of foreign investors, for instance. They may be attracted by a sound base for development and take advantage of increasing returns to scale for low levels of capital accumulation in developing areas. This, in turn, can reinforce complementary industrial growth. Honohan (2004) argues that the existance and functioning of sound financial institutions may further poverty reduction especially well compared to alternative mechanisms (p. 43). Microfinance may be one such promising mechanism alleviating poverty and contributing to aggregate growth at the same time.

3.3 From Macro- to Microeconomic Levels

Economic problems are often categorised in either merely microeconomic or merely macroeconomic issues and analysed accordingly. Poverty is, however, a phenemenon that requires the involvement of both perspectives to be studied in all detail and to be understood comprehensively.

Yunus (2007) addresses the issue that intermediary systems of all kind, notably governments, non-profit organisations, and multilateral institutions such as the World Bank, with the aim to eradicate poverty, in fact fail to do so in an efficient and comprehensive

manner due to system-inherent inefficiencies (pp. 9–11). Overall poverty in a country results as the sum of individual neediness. However, multilateral institutions "focus exclusively on pursuing this goal [of poverty eradication] through large-scale economic growth" (p. 11). The problem is that development on an aggregate level does not necessarily imply welfare improvement for individuals in the poorest part of a population. The challenge is thus to identify a mechanism that defines poverty alleviation as its main goal and achieves overall growth by focusing on individuals at the microeconomic level. I argue that microfinance institutions are an example of such a mechanism. Through simple yet sophisticated lending schemes, they support poor people by granting microcredit and enhance private savings. Increases in savings and/or saving rates can, in turn, enable an economy to pass a prohibitive level of capital accumulation and associated level of income and, hence, to evade stagnation caused by saving traps.

4 Empirical Analyses

4.1 MixMarket Data Base

Together with the Microbanking Bulletin, the MixMarket data base is provided by the Microfinance Information eXchange (MIX). This platform provides a transparent source of information on MFIs, their funding sources, and background information regarding the countries they are operating in. For performance data on microfinance institutions, this is the most accurate and complete base available at this time.

The establishment of the MixMarket data base was encouraged by the United Nations Conference on Trade and Development and is now intended to provide data and information on MFIs in terms of demand, investors in terms of supply, and other stakeholders. 1406 microfinance institutions are currently included[6] and new MFIs are added continuously. The data covers all geographic regions of the developing world, including MFIs in Africa, East and Central Asia, Latin America, the Caribbean, the Middle East, North America, and South Asia. Microfinance institutions are also classified according to their legal institutional form and network affiliation. As such, MFIs operate as banks, cooperatives, credit unions, non-bank financial institutions, non-profit organizations (including NGOs), or rural banks.

In the following, if nothing else is specified, all data related to microfinance institutions are gathered from the MixMarket data base.

4.1.1 Description of MixMarket Variables

For each microfinance institution, available data include descriptive statistics, financial data, and data on outreach.

Descriptive statistics cover the year of the MFI's establishment, if it is regulated, a verbal statement of the institution's goal, key notes on its historic background and development process, products provided, its main funding sources, the percentage of operations comprised by microfinance, a list of MixMarket funds investing in the MFI, possible investment opportunities, as well as individual presentations of internal reports.

Financial data describe the internal structure of each MFI, and include data of fields such as balances, financing structure, returns and revenues on assets and equity, profit margins, costs, and risk.

[6] www.mixmarket.org, retrieved on June 16, 2009.

Outreach data provide information on direct interaction with clients. This covers data on average loan and savings balances per borrower/saver, the number of active borrowers, savers, and personnel, the distribution of male and female borrowers, and the ratio of average loans/savings per borrower/saver to per capita gross national income. To limited extend, there are also data on the distribution of clients living below the line of moderate (up to 2 USD per day) respectively extreme (up to 1 USD per day) poverty, as well as the percentage of clients starting a microenterprise for the first time.

Data is published for a maximum of twelve subsequent years. Most microfinance institutions provide data for the period between 2000 and 2007, although some of them are already founded decades earlier. Apparently, data for earlier periods have either not been collected or not published yet.

Research in the field of development economics is often confronted with imperfect quality and scarcity of data. Though, the presented MixMarket data form the best available set for large sample sizes so far.

4.2 Choice of microfinance institutions in different geographic regions

Although today MFIs are present in nearly all developing and emerging countries, I focus on a number of selected institutions operating in Africa and Asia. Apart from examining the impact of microfinance institutions on development per se, I am also interested in probable differences in impact in regions with fairly asymmetric basic conditions. Compared to other developing countries, those in Africa often show greatest difficulties to catch up with the world's more industrialised part. In contrast, Asia has been experiencing a thriving period of rapid growth in recent years. In order to make reliable statements on the MFIs' past impact on development and to make predictions on future impact, long time series are crucial. The quality of data has yet to be as good as possible, taking into consideration the aforementioned general difficulty to obtain reliable data from developing countries.

To fulfil these criteria, I have chosen two countries each in Africa and Asia where a number of MFIs with high quality data of substantive time series operate. For Africa, these are six MFIs in Ethiopia and five in Uganda. For Asia, I have chosen six in Cambodia and three on the Philippines.

Probable differences in the impact of microfinance induced by differences in geograph-

ical position may be traced back either to economic, political, or cultural determinants, as well as any combination thereof. It is, however, not the purpose of this paper to identify distinct causes for probable differences in either marginal impact and/or basic levels, but to give an idea about the general importance of microfinance institutions and to show if there is evidence to suspect differences subject to geography.

For the purpose of detailed insight into the development of microfinance institutions over time, I first analyse selected MFIs descriptively (see chapter 4.3). Chapter 4.4 proposes an in-depth econometric analysis.

4.3 Descriptive Analysis

As being said, selected MFIs provide the longest time series available for a given country, such that descriptive trend analyses can generate reliable performance results. To embed each analysis in the relevant framework, I precede each time with a short summary of the respective country's economic conditions over the last decades.

4.3.1 Basic Economic Conditions in selected African Countries

Ethiopia, a landlocked developing country in East Africa, is classified as a low-income economy by the World Bank. In 2007, its PPP-adjusted per capita gross national income (GNI) was 780 international USD, compared to 220 USD in current dollars (World Bank). The country has experienced high volatility in real gross domestic product per capita (GDP p.c.) growth rates since 1951. With an average growth rate of 1.62%, their range reaches from -21.38% in 1987 to 27.22% in the year thereafter. This example also shows that annual fluctuations in growth can attain important dimensions in Ethiopia. Between 1951 and 2003, the country has experienced negative growth in 18 years.[7] The current real growth rate of GDP per capita is 8.5% in 2008 (World Factbook), which indicates that volatility is still substantial.

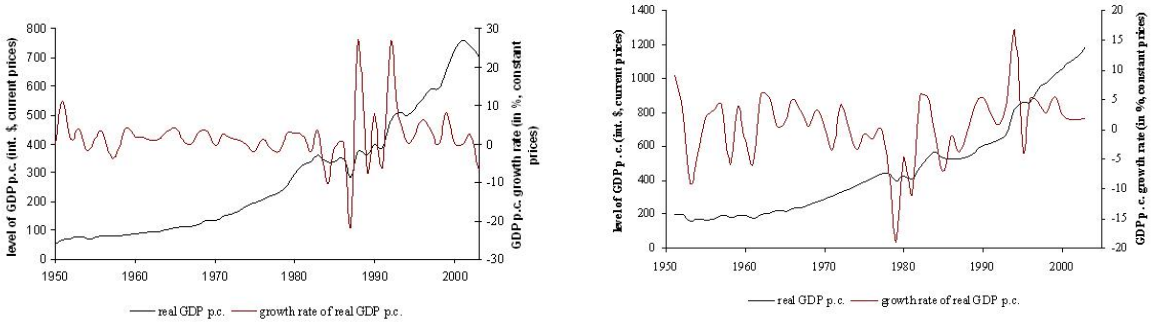
In 2003, approximately 66.6 million people lived in Ethiopia. As in most developing countries, population has been growing fast with an average rate of 2.28% between 1950 and 2004[8], implying that it needs 30.3 years that to double.[9] In the period between 1967

[7] Numbers computed from Penn World Table data.

[8] Numbers computed from Penn World Table data.

[9] The exact formula to derive the number of years n it takes for a variable to double is derived from $x_1 = x_0(1+g)^n$, where $x_1 = 2$ and $x_0 = 1$. It follows that $n \approx \frac{69}{g}$, where g is the growth rate of the underlying variable. The rule of 69 has proved to be more accurate than the more frequently used

to 1995, growth was extremely volatile with values strongly oscillating between 1.08% in 1980 and 4.15% in 1991.[10] Though, continuous decline in recent years may indicate a trend reversal. Current life expectancy at birth is 53 years, the total fertility rate is 5.3 children per woman in 2007. In 2000, 44.2% of population lived below the national poverty line (World Bank).



(a) Ethiopia (b) Uganda

Figure 3: *Levels and growth rates of per capita GDP in Ethiopia and Uganda (1950/51–2003) (Data: Penn World Table)*

Uganda is classified as a low-income economy by the World Bank, as well. With a per capita GNI of 370 USD respectively 1040 international PPP USD in 2007 (World Bank), this landlocked African country has experienced similarly high volatility in real GDP per capita growth rates as Ethiopia. Between 1951 and 2003, growth rates have reached a minimum of -19.05% in 1979 versus a maximum of 16.6% in 1994.[11] Though, since 1989, growth has mostly turned positive, but poverty in Uganda remains high. In 2000, 33.8% of Uganda's population lived below the national poverty line (World Bank).

With an average growth rate of 2.95% per year since 1951, the population in Uganda has been growing even faster than in Ethiopia and evolved from ca. 5.5 million in 1951 to 26.5 million in 2003.[12] At this rate, the population doubles approximately every 23.4 years. In 2007, the total fertilty rate is still 6.7 children per women and thus higher than in Ethiopia, while life expectancy at birth is comparable with 51 years (World Bank).

rule of 72 here. Although resulting values are slightly underestimated, it provides better results for any growth rate. This applies also to chapter 4.3.3.

[10]Numbers computed from Penn World Table data.

[11]Numbers computed from Penn World Table data.

[12]Numbers computed from Penn World Table data.

4.3.2 Microfinance Institutions in selected African Countries

For Ethiopia, I have chosen six microfinance institutions, which are the Specialized Financial and Promotional Institution (SFPI), Wisdom, the Amhara Credit and Savings Institution (ACSI), Buusaa Gonofaa (BG), Poverty Eradication & Community Empowerment (PEACE), and Wasasa. These are all non-bank financial institutions.

The majority of these institutions were relatively small in size in 2001, with approximately 10 to 60 employees. ACSI is though an exception, as it was 40 times as big as the average institution in 2001. Without significant temporary decreases, all MFIs have increased their staff continuously. Until 2007, all MFIs have at least doubled in size. To point out the largest relative growth, Wasasa achieved an increase from initially 13 to eventually 127 employees, which corresponds to an average annual growth rate of 46.21%.

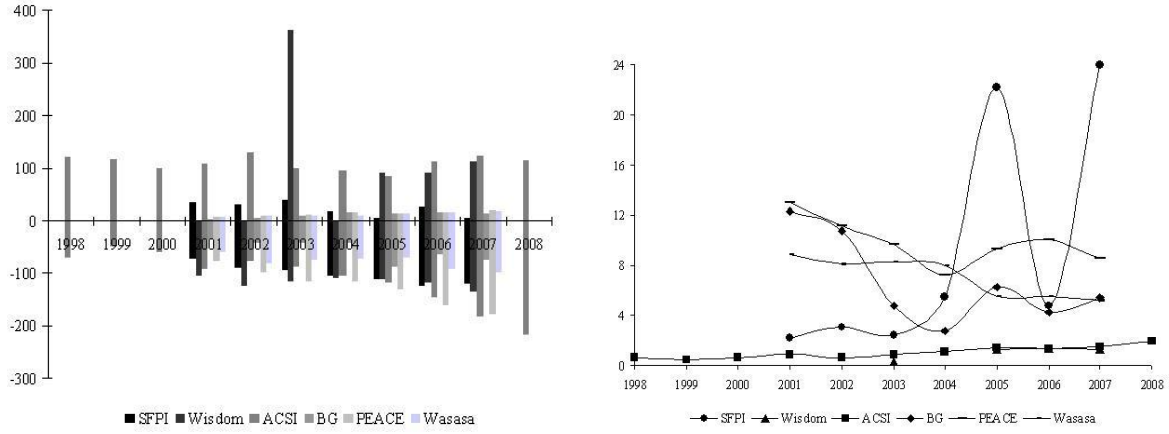
This pattern implies that the demand for microfinance services has steadily risen in recent years. Consistenly, one should expect a similar pattern in the number of clients over time and, in fact, one can observe a positive trend in the number of borrowers and savers. One may also induce that this positive overall trend in microcredit may partially be traced back to successful group-lending schemes whose stability was shown by means of the microfinance game in chapter 3.1. For BG, PEACE, and Wasasa, the ratio of borrowers to savers is approximately one for most of the time. For ACSI, it steadily decreases over time, starting with 5.47 borrowers per saver in 1998 and converging to 1.66 in 2008. SFPI and Wisdom also dispose of more borrowers than savers, though with higher and also more volatile ratios of up to 5.86 (SFPI, 2001) respectively 16.46 (Wisdom, 2003).

A considerable part of borrowers in Ethiopian MFIs is female. The percentage mostly lies above 50%, yet high volatility across institutions and time is observable. ACSI has experienced the largest decrease between 1999 and 2003, where the percentage of female borrowers has fallen from 72.1% to 29.4% within four years. A similar pattern applies to Wasasa, where the number declined from 61% in 2003 to 36.2% in 2007. An overall trend is difficult to estimate here, though it is worth pointing out that more women borrow that men in general.

Figure 4 shows average savings and credit balances per borrower/saver and an according ratio for each MFI over time.[13] Savings are presented as positive, loans as negative

[13] All MFIs are still operating today. Missing data does not indicate their closing, but that no informa-

values. One can observe that average loans generally exceed average savings. Only until 2003, ACSI had a loan to savings ratio smaller than one, implying a stronger focus on savings than on credit. Since then, loans are continuously larger than savings. While Wisdom showed ratios roughly around one over time, those of SFPI have been highly volatile since 2004, with loan to savings ratios between 5.47 and 24, though with increasing trend. For the remaining three MFIs, BG, PEACE, and Wasasa, average credit has declined relatively to savings over time, where the drop between 2001 and 2004 was especially sharp.



(a) Average loan/savings balance per borrower/saver

(b) Loan to savings ratio

Figure 4: *Average loans and savings in Ethiopian MFIs (in USD)*

For Wisdom and ACSI, data on the clients' economic situation is available. In 2003, 46% of Wisdom's clients lived in households where each member earned less than 1 USD per day on average. According to the threshold of 1.25 USD per day and person (in 2005 PPP) as a measure for the poverty line proposed by the World Bank, this fraction lived well below. For ACSI, the value was equal to 100% between 2001 and 2003.

Selected microfinance institutions in Uganda are the Micro Enterprise Development Network (MED-Net), Commercial Microfinance Limited (CML), Faulu Uganda, FINCA Uganda, and Uganda Finance Trust Limited (U-Trust, UWFT). Apart from MED-Net being a non-profit NGO, these are non-bank financial institutions, as well.

As Figure 5 shows, the number of personnel working with microfinance institutions in Uganda has increased steadily over time, and thus matches the development in Ethiopia.

tion was published for the respective years. The same applies to all subsequent figures.

As one of the largest MFIs, FINCA has still experienced a considerable increase between 2003 and 2004. Graphically seen, there is no clear evidence of declining numbers within the selected institutions.

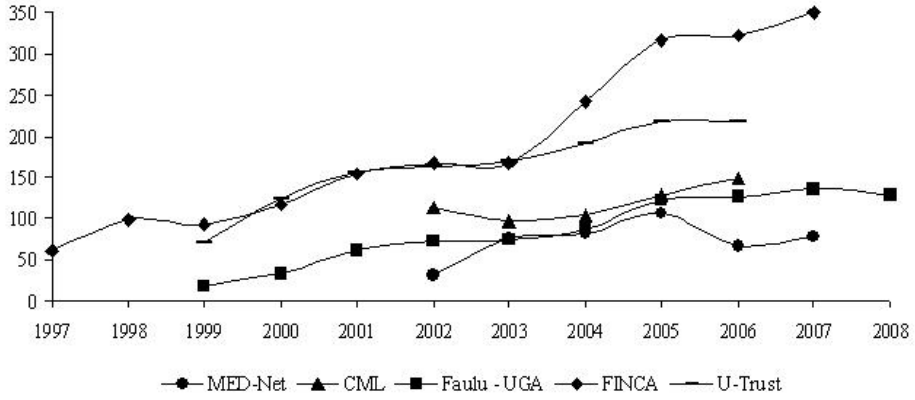


Figure 5: *Personnel working with microfinance institutions in Uganda*

The overall pattern in Figure 6 indicates both increasing trends in the number of borrowers and savers. Interestingly, from 2004 to 2005 both U-Trust and FINCA have experienced a sudden decrease in the number of savers of -42.46% respectively -42.94%. Whereas U-Trust retied in immediately with its previously high number of savers from 2006 on, FINCA needed three more years until 2008 to recover, but hardly reached its maximum number from 2004 again.

Both U-Trust and CML have had more savers than borrowers at all times. For CML, the ratio of savers to borrowers rose from 3 in 2002 to 7.33 in 2006, while the respective ratio for U-Trust increased from initially 1.67 in 1999 to 5.96 in 2006. MED-Net seems to focus to great extent on microcredit business, as the percentage of savers on total clients is only about 2% in 2003/4. These are also the only two years where positive numbers of savers for this MFI are reported at all. In case of Faulu, the ratio changed from 2002 to 2003. While the number of savers exceeded that of borrowers, it was the opposite onwards. Lastly, FINCA experienced a steady increase in the number of borrowers since 1997. With an increase of 103%, the strongest expansion took place from 1997 to 1998. Later, annual growth rates reached from -2.39% to 26.32%, but were mostly positive. FINCA increased its number of borrowers by factor 5.84 within eleven years. In 2003, they started to serve savers as well; though these were mostly below the number of

borrowing clients.

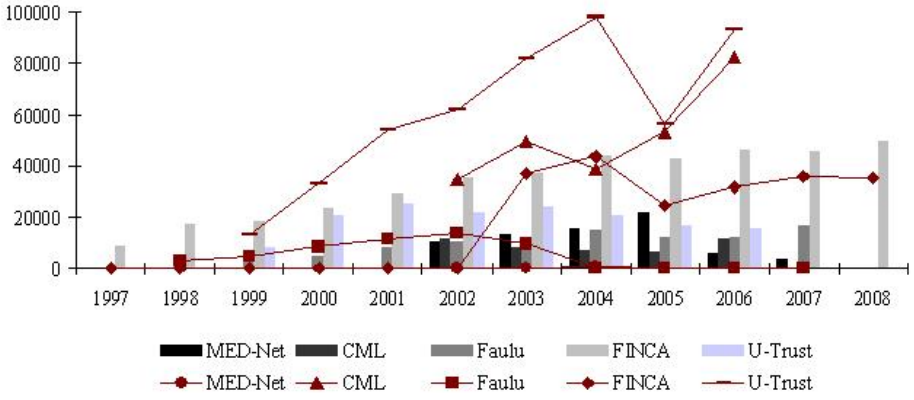


Figure 6: *Number of active borrowers and savers in Ugandan MFIs*

It is remarkable to observe that the percentage of female borrowers lies again well above 50% in most cases. While the trend is on average increasing for MED-Net and CML, it is declining for U-Trust, FINCA, and Faulu. Although these trends have different signs, they seem to converge to roughly 70% across institutions.

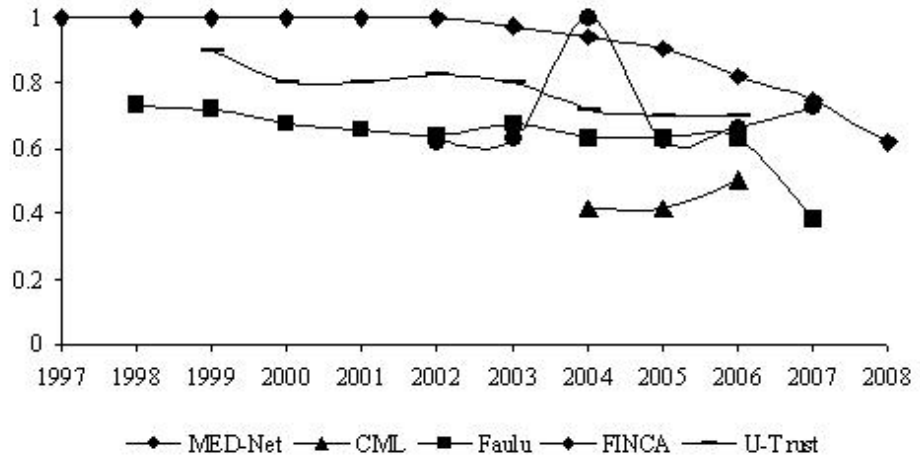


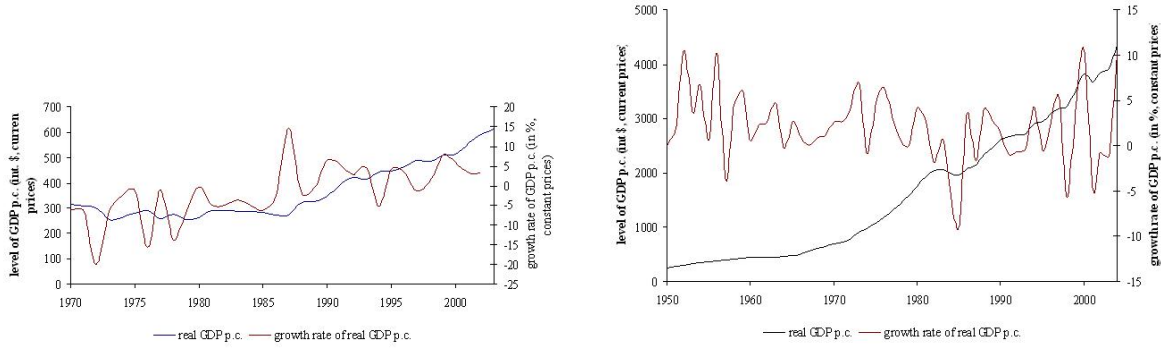
Figure 7: *Percentage of female borrowers in Ugandan MFIs*

Analysing the relation between average loan balances per borrower and average savings balances per saver in each institution over time, one sees that microcredit business is

predominant for most selected MFIs. Especially for CML and U-Trust, average loan balances per borrower are increasing between 2003 and 2006: for CML by factor 4.19, for U-Trust by factor 2.71. Only MED-Net obviously focuses strongly on savings on a remarkable high level.

4.3.3 Basic Economic Conditions in selected Asian Countries

As Ethiopia and Uganda, the East Asian country of Cambodia is classified as a low-income country by the World Bank. Cambodia's growth rate of real GDP per capita has experienced high volatility at least since 1970, though with a positive trend. Between 1970 and 1986, growth rates were constantly negative which caused a negative or at most stagnating development. Since 1987, the trend reversed: an increase by factor 2.26 until 2003 was observable. While actual growth rates remained highly volatile, they were merely positive since 1988.[14] In 2007, GNI per capita in PPP-adjusted terms reached up to 1720 international USD compared to 550 USD in current USD (World Bank).



(a) Cambodia (b) Philippines

Figure 8: *Levels and growth rates of per capita GDP in Cambodia (1970–2003) and the Philippines (1950–2004) (Data: Penn World Table)*

In contrast to many other developing countries, Cambodia showed a declining trend in population growth. Between 1950 and 2004, the average growth rate was 1.59% with only 0.96% in 2003. On average, Cambodia's population would thus double approximately every 43.4 years. However, the number rised sharply to 1.97% in the following year,

[14] Numbers computed from Penn World Table data.

which constitutes an outlier in a way.[15] In 2007, life expectancy at birth was 60 years and total fertility rate was 3.2 children per woman (World Bank), which underlines a sounder population development than in Ethiopia or Uganda.

Unlike the three countries described before, the Philippine islands are one stage further in development, as the World Bank classified them as a lower-middle-income country. Despite, again, extremely high volatile growth rates with a standard deviation of 3.97%, there is a clear positive overall trend in the development of real GDP per capita. Though, growth has been less rapid since the beginning of the 1980s. This is partly due to the fact that the Philippines have experienced negative growth rates in 52.17% of all years between 1982 and 2004, compared to only 16.13% between 1950 and 1982. This high frequency seemed, however, to be compensated partially by a high average growth rate of 2.04% over the whole period.[16] In 2007, the Philippines achieved a GNI per capita of 1620 USD in current dollars respectively 3710 international USD in PPP-adjusted terms (World Bank).

Besides positive development trends in economic terms, the Philippines also show a decline in population growth rates over time. Beginning with a growth rate of 3.05% in 1951, the number has decreased to 1.81% in 2004. This implies a drop of the number of years necessary for the population to double from 22.6 to 38.1 years.[17] In 2007, the total fertility rate was 3.2 children per women (as in Cambodia), and life expectancy at birth was 72 years, which is relatively high compared to other developing countries (World Bank).

4.3.4 Microfinance Institutions in selected Asian Countries

For Cambodia, I have chosen AMRET Co. Ltd., CHC-Limited Micro Finance Institution (CHC-Ltd.), Hattha Kaksekar Ltd. (HKL), PRASAC MFI Ltd., SATHAPANA LIMITED, and VisionFund Cambodia Ltd. (VFC). As most of the preceding MFIs, these are also non-bank financial institutions.

Also for Cambodian MFIs, one observes a clear positive development in the number of employees (see Figure 9), which applies to clients, as well. Again, the number of borrowers is mostly well above that of savers. It seems characteristical that the percentage of female borrowers lies mostly well above 50%, yet the internal development is

[15] Numbers computed from Penn World Table data.
[16] Numbers computed from Penn World Table data.
[17] Numbers computed from Penn World Table data.

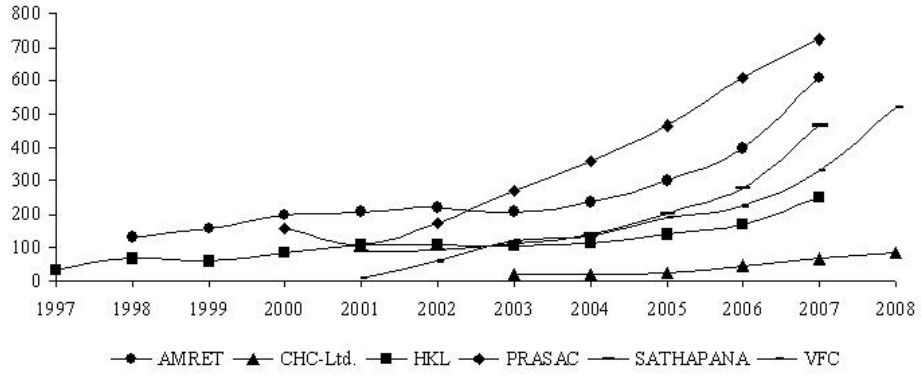


Figure 9: *Personnel working with microfinance institutions in Cambodia*

more heterogenous here (see Figure 10). While high volatility can be observed for HKL and PRASAC, VFC's percentage of female borrowers is, for example, mostly stable. SATHAPANA initially served female borrowers only, but accepted men since 2006, such that the ratio reached 2.7 women per male borrower in 2008. While AMRET shows a slightly positive development, CHC-Ltd. shows a negative trend.

AMRET obviously occupies a special position as it comes to the relation of average credit to savings. Here, savings are clearly higher than loans by factors up to 29.9 (2002). The lowest ratio of credit to savings was reached in the year 2000, when an average of 6.26 USD of saving deposits per dollar of granted loan was obtained. While VFC used to reveal the typical pattern of loans exceeding savings, this trend has inverted in recent years. HKL shows a convergence towards one. For CHC-Ltd. and SATHAPANA, however, the trend seems such that the ratio of loans to savings still increases over time.

For the microfinance institution SATHAPANA, data on the percentage of clients starting a microenterprise for the first time and on percentages of clients living in moderate poverty were published for the period from 2001 and 2004. 60–65% of the MFI's clients disposed of less than 2 USD per day, and up to 50% lived in the bottom half below this poverty line. Nevertheless, a fairly high percentage of around 40% of the poor started small businesses for the first time. Despite living in deep poverty, microfinance incentives seem to encourage great part of the poor to start their own small businesses. Indeed, Yunus (2007) argues that enhancing private entrepreneurship contributes more to poverty reduction than standard employment does (p. 85), supporting selfhelp on local levels. This is based on the belief that every human being may act as potential

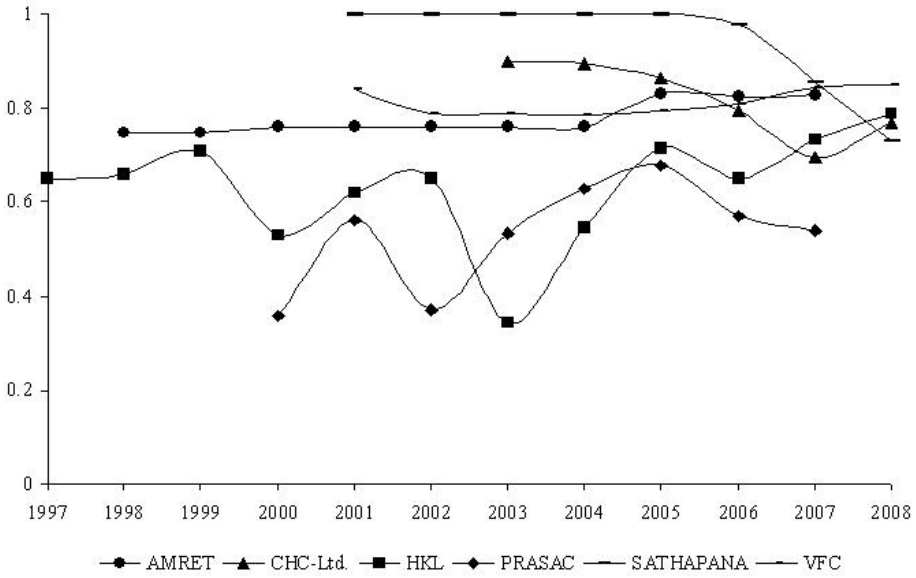


Figure 10: *Percentage of female borrowers in Cambodian MFIs*

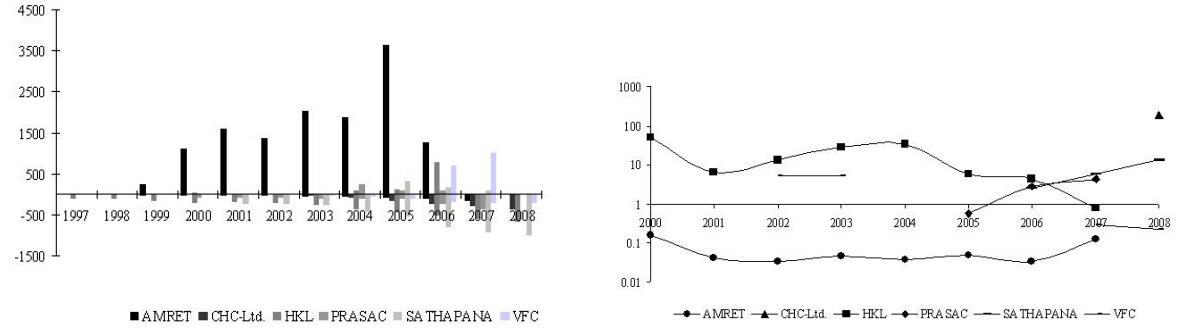
entrepreneur taking advantage of his economic capacity as a vehicle to surmount poverty (Yunus, p. 207, 2003).

As Philippine microfinance institutions, I have selected the Life Bank Foundation, Inc., the Negros Women for Tomorrow Foundation, Inc. (NWTF), and the TSPI Development Corporation. In contrast to the majority of institutions discussed so far, these are exclusively non-profit NGOs.

Also here, a clear positive trend in the size of microfinance institutions is apparent. While formerly smaller institutions such as Life Bank grew by factor 20.1 from initially 39 employees in 2003 to 782 in 2007, those being already quite large in the beginning of the period of observation grew less, but by partially important factors. TSPI had 205 employees in 1998, and reached a number of 1224 ten years later. NWTF still increased in size by 58%.

TSPI focuses on borrowers only and grew by factor 16.7 between 1997 and 2008 in this regard. Also NWTF shows clear positive trends in the number of debtors, however the largest increase is observable within Life Bank where the number of borrowers multiplied by factor 31.1 within four years only.

Different from the distribution of female borrowers in other countries, Philippine MFIs



(a) Average loan/savings balance per borrower/saver

(b) Loan to savings ratio

Figure 11: *Average loans and savings in Cambodian MFIs (in USD)*

display a convergence to 100% female debtors over time. As the focus on female clients is especially obvious here, one should also note the discussion on gender inequality to which attention was drawn by Barsoum (2006), for instance. If a woman occupied the position of an intermediary between an MFI granting credit to her and her male relatives actually having the loan at command, she would not benefit — which would be counterproductive. Excluding microfinance services are hence regarded as not sustainable in the long run.

Although Life Bank and NWTF have shown positive developments in the number of savers since 2002 at about the same absolute level as with borrowers, the actual amounts being saved always remained below 10 USD, while granted loans ranged between 50 and 290 USD over time and institution. The focus on microcredit is especially clear here, which might either be due to the fact that the economic situation of microfinance clients does not yet allow for higher saving deposits, or that the institutions's focus really is on lending. Also, large numbers of borrowers and relatively large amounts of average credit compared to savings may again be traced back to stable outcomes of group-lending schemes as discussed in the setting of the microfinance game.

4.4 Econometric Analysis

In order to assess the impact of microfinance institutions econometrically, one has to consider several aspects which directly affect the value of empirical results. First, a response variable that represents a suitable proxy for development within a country must be specified and its justification, advantages and disadvantages should be discussed

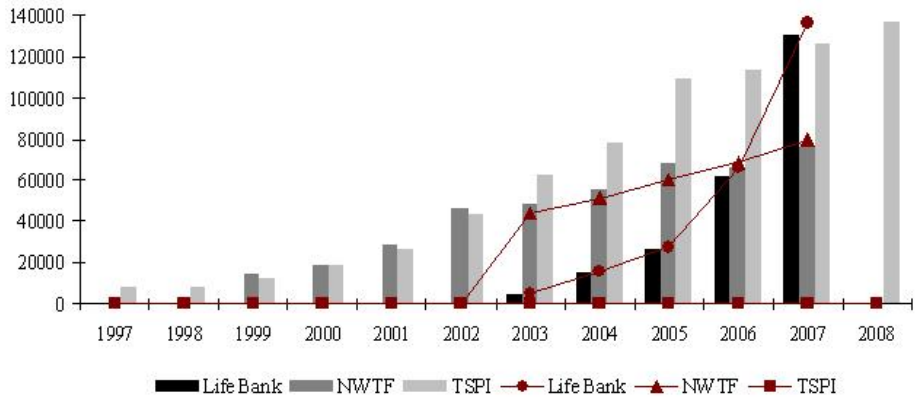


Figure 12: *Number of active borrowers and savers in Philippine MFIs*

carefully (see chapter 4.4.1). Next, a set of explanatory variables has to be chosen (see chapter 4.4.2). Finally, an econometric model which is able to capture effects on development in an appropriate way has to be specified (see chapter 4.4.3). Subsequent to the presentation of results obtained from empirical analyses in chapter 4.4.4, I conclude with a brief discussion of caveats and arguable aspects in chapter 4.4.5.

4.4.1 Discussion of Appropriate Response Variables

Development has a broad dimension and so are its definitions. The challenge is to find a variable which reflects development appropriately, which has a direct link to microfinance institutions and which is feasible within the given data set described in chapter 4.1.1, and whose variation depends on changes in key factors of microfinance institutions. In other words: relevant explanatory variables from MFIs have to show a causal relationship with the response variable which, in turn, has to be a valid estimator for development.

One such outcome variable is savings. In chapter 3.2, I argued that adverse saving behaviour and low savings present a crucial reason for a country being kept in a poverty trap. Sustainable long-term development implies convergence to a positive steady state $k_{SS} > 0$, where $k_{SS} > k_0$ (see Figure 2). Assuming a concave production function $f(k)$, a saving rate s depending on the level of capital accumulation and hence, income, creates an S-shaped saving function $g(k)$. As long as $k_i < k_0$, the equilibrium to which a country converges is $\tilde{k}_{SS} = 0$. But as soon as $k_i > k_0$, the equilibrium is $k_{SS} > 0$. The inherent problem is that passing k_0 from below towards a positive steady state capital

accumulation level k_{SS} can not be explained endogenously by the given model. The goal and challenge is thus to find feasible mechanisms that enable a country to pass the critical lower bound capital accumulation level k_0 despite the described adverse dynamic effects. This can be achieved, for example, by changing the functional form of $g(k)$ from S-shape to concavity. This implies that s becomes constant over time ($\forall k \geq 0$) and independent from the level of capital accumulation as in the standard Solow model. If appropriate mechanisms work at any level of income, a constant saving rate may be realised.

Microfinance institutions represent one such mechanism to increase both capital accumulation and savings despite a low initial level of both in a saving trap model. They can offer incentives to save through different channels. MFIs can direct their clients' saving behaviour through the provision of microcredit and small loans which positively affect disposable income and hence savings. Also, a way to achieve positive and increasing savings and/or saving rates is to guarantee the opportunity to save within a secure environment provided by an MFI's authority. The image of a microfinance institution produced by experience can increase local trust, which can enhance the willingness to accept credit and therefore promote savings, as well. If these factors (and first and foremost microcredit) have a significant effect on savings, then microfinance institutions do contribute to development within a country.[18]

More precise results might be obtained if data on savings were available on individual base rather than averaged values. But as the number of microfinance institutions studied in the econometric part of this paper is sufficiently large, major trends and patterns should be observable equally well.

Savings are hence one possible response variable which is available in the MixMarket data base and which links microfinance institutions to economic development.[19] It takes one step further than Armendáriz and Morduch (2005) who used borrowers' income for impact measurements.

A second possible outcome variable is the amount of credit. However, this approach

[18] Note that high population growth rates lead to an increased slope in the depreciation function $d(k)$. This does not only imply an increased speed towards $\tilde{k}_{SS}$ for $k_i < k_0$, but also an increased convergence to k_{SS} for $k_i > k_0$. As developing countries often have high population growth rates, this pattern proves to be a crucial aspect of the velocity of development depending on which side of k_0 a country stands. Once having passed k_0 and converging towards a positive steady state, high population growth can be interpreted as positive and supportive for economic growth.

[19] Also Masanjala (2002) points out that it is primarily the ability to save from profits obtained in small microfinance businesses which contribute to poverty alleviation, not the grant of credit itself (p. 98).

is more controversial than savings, as an increase in average loans granted to individuals can reflect both positive contributions to development and contrary causes. If microloans are effectively used for economic activities generating revenues, disposable income of individuals increases and so does their solvency. Subsequent to a successful business project enabled through microcredit, a second loan may be provided which is likely to exceed the precedent amount. This higher loan can be used for larger projects in turn, and so on — suggesting a positive correlation between credit level and development.

However, high loans may also stem from a relatively wealthier target group of a microfinance institution, obtaining higher loans due to better solvency from the beginning, which does not necessarily reflect an improvement of the economic situation of the a population's poorest part through microcredit itself. In this context, higher credit would not serve as an appropriate estimate for development. Besides, available data is restricted such that repeated loans to the same (group of) individuals can not be separated, and thus the effects of repeated loans on saving behaviour can not be studied explicitely.

Therefore, it is sensible to interprete results involving credit as response variable with more caution.

4.4.2 Discussion of Relevant Explanatory Variables

After the discussion of possible response variables as estimates for development in the previous chapter, the next step is to identify factors within a microfinance institution which may affect development. First, I discuss variables whose causal relation to savings can be justified theoretically. Then, the theoretical appropriateness of previously selected variables with respect to credit as second response variable is reviewed. Possible deviations and other relevant explanatory variables are examined.[20]

The absolute size of a microfinance institution may affect the decision of individuals whether to sign a financial contract with an MFI. The size can be estimated by the number of personnel working with or being significantly engaged with an MFI, denoted by p. The larger an MFI, the more experience it may have acquired and the higher the probability for an individual to join as client. If the attractiveness of joining depends on the MFI's level of familiarity within a region, the number of years, n, during which an MFI has already operated there may also affect saving behaviour.

[20] For the time being, actual data availability across MFIs is ignored for the purpose of consistent theoretical reasoning.

Obtaining microcredit can enable borrowers to initiate small projects and engage in productive economic activities, which in turn can increase disposable income and the opportunity to save part of it. A number of clients also start microenterprises. In order to examine if granted loans affect savings (within the same microfinance institution where loans were obtained), the variables b and FME have to be considered, where b is the average loan balance per active borrower and FME denotes the percentage of clients who established a microenterprise for the first time. An interaction term ($b \times FME$) captures a possible dependence between the decision to establish a small business and the average loan that is granted by the microfinance institution.

Microfinance institutions are associated with targeting poor parts of a population. The range of granted loans' size should reflect the actually targeted group. The percentage of loans below 300 USD granted on microlevel can mirror the income development of especially poor segments: if a considerable part of small amounts of credit is observable, savings of the very poorest individuals can be enhanced. In this regard, the image of the concerned microfinance institution can contribute to poor people's affirmative attitude towards savings. The smaller the available loan, the more likely poorest individuals can start productive economic activities.

Country-specific factors can result in possible differences between an MFI's impact on development, as well. Analysing countries in Africa and Asia, a continent dummy A should be considered, where $A = 1$ if an MFI operates in Africa and $A = 0$ if it operates in Asia. Instead, a set C_i of country dummies could be employed in case it is reasonable to assume significant differences in country-specific impacts. As there are more than two countries to be studied, an appropriate dummy variable would have to be constructed such that perfect multicollinearity is avoided. By defining a separate dummy for each country, that is

$$C_i = \begin{cases} 1 & \text{if MFI is operating in country } i \\ 0 & \text{otherwise} \end{cases}$$

($\forall i \in [0, 1, 2, 3]$) and including C_1, C_2, and C_3 into the regression equation, the problem of perfect multicollinearity would not occur (Carter Hill, Griffiths, & Judge, 2001, pp. 206–207). Ethiopia (for $i = 0$) would appear as reference group here. However, it is more sensible to to presume significant differences in a broader geographical dimension, as the economic environment of selected African respectively Asian countries are similar.

The continent dummy A can capture part of the variation in response variables that is not gauged by MFI-related explanatory variables. Moreover, it is reasonable to assume that gross domestic product per capita, $GDPpc$, affects the general level of savings in a country and should therefore be included as economic control variable. Although it is averaged and can be biased if income is distributed highly unequally, it is still commonly perceived as a good choice.

A variable which is often discussed in the setting of development studies is inequality. Based on the Lorenz Curve describing cumulative national income as a function of cumulative population, one can calculate the Gini coefficient with a range between 0 and 1 and use it as an estimate for inequality. However, I refrain from including the Gini coefficient as a control variable here, as there is no logical explanation why the degree of inequality in a country should affect individual saving behaviour. Saving depends on necessity and income level, but a correlation to national income distribution is not convincing.

Saving and credit are closely related. It is sensible to verify if changes in a variable for which a theoretical causal relation to savings is reasonable is also able to explain changes in credit.

Both size and experience of a microfinance institution are likely to have an effect on average credit balances per borrower. For example, larger MFIs could revert to larger funds from investors resulting in larger and/or more loans which can be granted to the poor. Increased experience may define loans more precisely. Credit may vary depending on the business idea proposed by microfinance clients and also on the percentage of clients engaging in small businesses for the first time. Different amounts of credit may be observed in this group due to missing experience, for instance. It is not sensible to consider the interaction term ($b \times FMI$) and the percentage of loans smaller than 300 USD, however the economic control variable $GDPpc$ as well as the continent dummy A shall remain.

Yet, another variable should be included into statistical analysis of credit. As shown in chapter 4.3, the ratio of female to male borrowers is relatively high for most microfinance institutions. In fact, many have specialised in lending to women only (Counts, 2008, p. 3). He implicitly argues that it is more probable for women to repay loans compared to men. They would concentrate on employing generated surpluses to improve the standard of living of their children and foster their business further (p. 3). High percentages of female borrowers and the general mission of microfinance suggest that female clients are

especially encouraged. An MFI may adapt its lending policies to the needs of women, for example concerning the amount of credit needed. In this regard, changes in the percentage of female borrowers, f, can have an impact on loans and should be considered, as well.

4.4.3 Statistical Regression Analysis by Ordinary Least Squares

The response variables discussed in chapter 4.4.1 have both advantages and disadvantages. To analyse which one is a robust estimate for development in empirical analyses, I run different regression models for each response variable, but with the same explanatory variables where possible. The first set of models is truly linear, the second has a double logarithmical form. Although an econometric time series approach would be interesting to estimate a distinct development in time, this would be inappropriate here, as data is only available for a maximum of twelve consecutive years. However, $T_i^{max} \leq 12$ does not fulfil the assumption of a sufficient number of observations to obtain reliable regression results. Instead, a cross-sectional analysis for two different points in time ($t_0 = 2003$ and $t_1 = 2006$) are chosen. The intention is to provide cross-sectional results in the first place, and to give an idea about possible differences in the variables' marginal impact on development over time by comparing the findings from t_0 to t_1. For the purpose of fulfilling the assumption of $n \geq 50$, data from all microfinance institutions operating in Ethiopia, Uganda, Cambodia, and the Philippines are used for the following regression analyses. All models are estimated by ordinary least squares.[21]

As a result from the discussion in chapters 4.4.1 and 4.4.2, model (5) describes a theoretically sensible relationship with average savings balance per saver in USD, s, as dependent variable. Model (6) is the corresponding equation with average loan balance per active borrower in USD, b, as dependent variable. Although data on FME and $loans_{<300}$ is considered in the MixMarket data base in general, the extent to which registered MFIs have collected or published these data is very low. Hence, FME, $(b \times FME)$, and $loans_{<300}$ can not be included into regression analyses.[22]

$$s_i = \alpha + \beta_1 n_i + \beta_2 p_i + \beta_3 b_i + \delta A_i + \gamma GDPpc_i + \epsilon_i \tag{5}$$

[21] For alternative empirical methodologies, see chapter 4.4.

[22] See chapter 4.4.5 for possible problems occuring when excluding relevant variables.

$$b_i = \alpha + \beta_1 n_i + \beta_2 p_i + \beta_4 s_i + \beta_5 f_i + \delta A_i + \gamma GDPpc_i + \epsilon_i. \quad (6)$$

An other approach is to assume a Cobb-Douglas structure, where exponents can be interpreted as constant elasticities with respect to the base. As such, the initial models (5) and (6) can be rewritten as

$$s_i = \alpha + n_i^{\beta_1} + p_i^{\beta_2} + b_i^{\beta_3} + \delta A_i + GDPpc_i^{\gamma} + \epsilon_i \quad (7)$$

$$b_i = \alpha + n_i^{\beta_1} + p_i^{\beta_2} + s_i^{\beta_4} + f_i^{\beta_5} + \delta A_i + GDPpc_i^{\gamma} + \epsilon_i \quad (8)$$

and, taking natural logarithms where possible[23],

$$ln(s_i) = ln(\alpha) + \beta_1 ln(n_i) + \beta_2 ln(p_i) + \beta_3 ln(b_i) + \delta A_i + \gamma ln(GDPpc_i) + \epsilon_i. \quad (9)$$

$$ln(b_i) = ln(\alpha) + \beta_1 ln(n_i) + \beta_2 ln(p_i) + \beta_4 ln(s_i) + \beta_5 ln(f_i) + \delta A_i + \gamma ln(GDPpc_i) + \epsilon_i. \quad (10)$$

In models (5) and (7) respectively (9), positive incremental changes in credit are assumed to have a positive impact on savings, thus $\beta_3 > 0$. If loans are invested in small businesses which generate profits, part of the additional disposable income can be saved. Though, it is not clear a priori to which extent an additional dollar of credit is able to increase savings. Due to the generally more faible economic position of African countries, average savings in Africa may be smaller than in Asia. This implies the hypothesis of $\delta < 0$. A marginal increase in gross domestic product per capita should enhance savings, hence $\gamma > 0$.

Concerning the number of personnel per MFI as a proxy for its size and the number of years since its foundation I argued that these parameters may have a positive impact on savings. The longer a microfinance institution is operating, the more experience it gains in its field which may support the population's trust in the institution and convince them to engage in a financial relation with the MFI. A large MFI can regionally be better known and induce further people to start saving. Although the according assumptions of $\beta_1 > 0$ and $\beta_2 > 0$ are plausible, note that these variables may increase savings only given that people are able to save in economic terms. Suppose they would like to save and open a savings account, but their income is still too low to allow for savings at all.

[23] Note that $ln(A_i)$ is not defined, because $A \in [0, 1]$.

In this scenario, it is likely that $\beta_1 = \beta_2 = 0$. The direction and significance of p and n is thus ambiguous in the first place.

Which direction should the signs of estimated coefficients have if credit is used as a response variable?

As emphasised earlier, credit is ambiguous as development indicator. In contrast to savings, the microfinance institution's role is also more important: the decision to open a savings account is widely independent from one's economic behaviour and should be granted by the MFI at any time. However, in order to obtain credit, a client must prove to be creditworthy, which basically will be determined by the individual's choice of joining a lending group with specific characteristics. The amount of savings is eventually determined by the client, yet the amount of credit is eventually settled by the MFI. Its funds are composed by donors' contributions and savings deposits. The size of a microfinance institution can relate to larger funds from both sources. From the merely technical point of view, an MFI should be able to issue higher loans when being larger compared to other institutions. This results in the hypothesis of $\beta_2 > 0$. A similar proxy is the number of years that an MFI has already operated locally. The more experience it has accumulated over time, the more likely it has achieved both better knowledge of how to assess a client's default rate and local development to a certain extend. This implies the ability to issue higher credit as a consequence and hence, justifies the assumption of $\beta_1 > 0$. Higher average savings also indicate relatively higher welfare of a client and enables him to obtain larger credit. Of course, large amounts of credit can both be traced back to either high initial loan levels or to increased loans due to successful microcredit supported businesses before. Still positive changes in savings can induce (further) increase of granted credit, as a direct consequence of increased income. The hypothesis is thus $\beta_4 > 0$. As argued in chapter 4.4.2, an MFI may focus in lending to women and adapt its policies accordingly. Nevertheless, it is not clear a priori if a higher percentage of female borrowers induces the MFI to offer smaller or larger loans. It may offer larger amounts of credit with the aim to support women especially well. Or it may offer smaller loans if the businesses of female clients would require less financial support than those of their male counterparts. Although the first option is more reasonable, no clear a priori judgement on the sign of β_5 can be made. The assumed signs of δ and γ should not change in this setting, as better economic conditions should enhance the general financial situation and, therefore, both savings and credit.

4.4.4 Empirical Results

Maintaining the structure of the previous chapter, the empirical results for 2006 of the linear and double logarithmic models with savings as response variable are presented first. Then, corresponding results for credit as dependent variable are discussed. In the subsequent and final part, the procedure is applied to data from the year 2003.

The regression of the linear ordinary least squares model (5) is run with a total of 71 observations across countries. To obtain reliable results, the data set first has to be adjusted by eliminating two outliers indicated by Cook's distance[24]. The results of this modified data set are reported in Table 1. The estimated coefficients of both b and A as well as the intercept are significant at the 1%-level. n and $GDPpc$ are significant at the 10%-level. However, p is insignificant for any common value of α. The model explains 19.22% of the variation in savings, s, and is significant at the 1%-level according to an F-test.

Plotting the regression's residuals against fitted values of s, one may argue in favour of slight heteroscedasticity. Conducting a Breusch-Pagan test with homoscedasticity under the null ($H_0 : \sigma_i^2 = \sigma^2(\forall i)$) and heteroscedasticity under the alternative ($H_0 : \sigma_i^2 = f(\sigma_i^2)$), the null is rejected at the 1%-level, but accepted at the 5%-level. Hence, depending on the chosen level of significance, standard errors obtained from this regression are considered either valid or not valid.

Note, however, some aspects regarding the validity of a Breusch-Pagan test. According to Long and Ervin (2000), it is difficult to detect heteroscedasticty for sample sizes smaller that 250 (pp. 222–223), which is applicable in this paper. In 1979, Breusch and Pagan argued that the test's power was appropriate for samples larger than 40, however only for $\alpha = 0.05$ or $\alpha = 0.10$ (p. 1293). At the 1%-level, power is not as high and the test more often falsely accepts the null of homoscedastcity. Greene (2003) argued that the Breusch-Pagan test is not as powerful in the presence of not normally distributed residuals (p. 224). In fact, the normal quantile diagramme for residuals shows slight heavy tails for the estimated model, which applies to all subsequent estimations, as well. For the sake of comparison, regression results are reported for both standard and heteroscedasticity adjusted standard errors. Larger values of p and n may induce increasing variance in savings. The client base of larger MFIs may be more diversified

[24] Cook's distance is a joint measure for outliers in terms of extreme observations of explanatory variables and fitted values of the dependent variable with large residuals. The distinct reason for an observation being classified as an outlier by Cook's distance is not directly identified.

in terms of saving capacity than within smaller institutions, and so may it be due to experience of longer existing MFIs to which a broader range of clients may come. An increase in per capita gross domestic product may evoke higher volatility in savings via inequality as proposed by Kuznets (1955). However, there are neither convincing explanations why larger average credit should contribute to heteroscedasticity, nor why volatility should be higher in Africa than in Asia. As there are both arguments in favour and against heteroscedasticity, I prefer not to interpret test results too strictly, and refrain from rejecting homoscedasticity at the 1%-level already. If homoscedasticity is however rejected, I use HC3 heteroscedasticity consistent standard errors.[25] Even if the existence of heteroscedasticity would be inconclusive, estimates would remain conservative (p. 223). Only the estimated coefficients' standard errors are affected by using HC3, involving a possible change in significance levels. Here, b remains significant (though only at the 5%-level), but all other estimates become insignificant.

Throughout regression adaption procedure, p is never significantly different from zero. Hence, if changes in this variable do not seem to have a significant impact on savings, it is sensible to estimate a reduced model without p, thus

$$s_i = \alpha + \beta_1 n_i + \beta_3 b_i + \delta A_i + \gamma GDPpc_i + \epsilon_i. \tag{11}$$

Based on the data set adjusted for outliers in this model, each estimated parameter has the same level of significance as in model (5). Also here, interpretation of the residual's variance is ambiguous. Plotting residuals against fitted values of s, one could possibly argue in favour of heteroscedasticity. A Breusch-Pagan test again accepts the null of constant variance of residuals at the 5%-level, but rejects at the 1%-level. Using HC3 estimates for the coefficients' standard errors would again induce a considerable drop in significance levels as before.

The overall best estimation is provided by model (11) without HC3, considering that homoscedasticity was accepted at the 5%-level. A total of 20.38% of the variation in savings is explained. Taking into consideration that the equation includes both micro- and macroeconomic variables, which suggests generally smaller respectively larger adjusted R^2, this percentage is fairly satisfactory. On average, an increase in credit of 1 USD

[25] Note that $\hat{\sigma}_i^2 = \frac{\hat{e}_i^2}{(1-r_{ii})^2}$ under HC3, where r_{ii} is the diagonal element of the projection matrix $R = X(X'X)^{-1}X'$.

Variable	Model (5)	Model (5) *(HC3)*	Model (11)	Model (11) *(HC3)*
intercept	1009.21***	1009.21	970.19***	970.19
	(379.53)	(906.04)	(352.54)	(765.18)
b	0.48***	0.48**	0.47***	0.47**
	(0.17)	(0.21)	(0.16)	(0.20)
n	-8.42*	-8.42	-8.43*	-8.43
	(4.96)	(6.24)	(4.92)	(6.23)
p	-0.03	-0.03		
	(0.11)	(0.12)		
A	-756.92***	-756.92	-739.08***	-739.08
	(276.73)	(627.86)	(267.93)	(558.96)
$GDPpc$	-0.23*	-0.23	-0.22*	-0.22
	(0.14)	(0.30)	(0.13)	(0.25)
degrees of freedom	63	63	64	64
adjusted R^2	0.1922	0.1922	0.2038	0.2038
F-statistic	4.24	4.24	5.35	5.35
p-value (F)	0.0022	0.0022	0.0009	0.0009
Significance codes:	***: $\alpha = 0.01$,	**: $\alpha = 0.05$,	*: $\alpha = 0.10$	
Standard errors in brackets.				

Table 1: *Results for linear ordinary least squares regressions with savings as response variable ($t_1 = 2006$)*

increases savings by 0.47 USD. The hypothesis of $\beta_3 > 0$ is hence strongly supported, as the estimated coefficient is significant at the 1%-level. Also, δ shows the expected negative sign — savings in Africa are smaller than in Asia. However, the estimated coefficient of $GDPpc$ shows the opposite sign of what was expected initially. An increase of per capita gross domestic product by 1 USD decreases average savings by 0.22 USD. If per capita GDP increases on the base of price mechanisms instead of a rise in the value of goods, then inflation is likely to be addressed by reducing saving deposits temporarily. As being said, p has proven to be totally insignificant at all stages, whereas n is significant at the 10%-level, though with unexpected negative sign.

Do these results change if a Cobb-Douglas functional form is assumed?

The according regression results are reported in Table 2. The outlier-adjusted regression of model (9) shows that p remains insignificant in the double logarithmic model, and so becomes n (being still significant at the 10%-level in the linear equation). The

other estimated coefficients are however highly significant. The percentage of variance in savings explained by this model increases to 36.17% and hence almost doubles compared to the truly linear model. A Breusch-Pagan test rejects homoscedasticity at the 1%-level. Significance slightly decreases for A and $GDPpc$ under HC3 estimation, but no further variable becomes insignifiant.

In correspondence to the linear model, I leave out the two variables with insignificant effects on logarithmised savings. The explained variance of $ln(s)$ of the reduced model

$$ln(s_i) = ln(\alpha) + \beta_3 ln(b_i) + \delta A_i + \gamma ln(GDPpc_i) + \epsilon_i \tag{12}$$

slightly increases from 36.17% to 38.08%. Here, all estimated parameters are significant at the 1%-level. Under HC3 estimation, coefficients are still significantly different from zero at least at the 5%-level.

According to this estimation, an increase in credit by 1% causes an increase in savings of 1.04% and as such, affirms the hypothesis of $\beta_3 > 0$. Also, δ shows the expected negative sign and supports that average savings in Africa are smaller than in Asia. The estimated coefficient of $GDPpc$ is again negative. An increase of per capita gross domestic product by 1% decreases savings by 2.06% on average.

In particular, there is no evidence for differences in the marginal impact of variables across continents. Including not only a single continent dummy as in the above estimations, but also interaction terms between the continent dummy and each variable, none of these ever becomes significant. That allows the conclusion that a difference in development exists due to different geographic positions. However, the marginal impact of several microfinance variables does not differ subject to different environments. Hence, and unlike Masanjala (2002) implying cultural differences as a reason for the difficulty transfer the microfinance concept once developed in Asia to other continents, it does seem to enhance development also in African countries.

How well can development be explained by credit as a proxy? To answer this question, I apply the previous regression procedure to models (6) and (8) respectively (10).

The data set is enlarged by the percentage of female borrowers. As fewer microfinance institutions have published data on this variable, the number of observations declines to 49, though remains appropriate for econometric estimations. Table 3 presents the results obtained for the linear model and Table 4 for the double logarithmic approach.

Variable	Model (9)	Model (9) *(HC3)*	Model (12)	Model (12) *(HC3)*
$ln(intercept)$	15.72**	15.72*	15.37***	15.37**
	(6.25)	(8.49)	(5.50)	(7.03)
$ln(b)$	1.04***	1.04***	1.04***	1.04***
	(0.21)	(0.21)	(0.18)	(0.19)
$ln(n)$	-0.004	-0.004		
	(0.30)	(0.38)		
$ln(p)$	-0.02	-0.02		
	(0.14)	(0.14)		
A	-2.99***	-2.99**	-2.96***	-2.96**
	(0.96)	(1.29)	(0.92)	(1.18)
$ln(GDPpc)$	-2.09***	-2.09*	-2.06***	-2.06**
	(0.78)	(1.09)	(0.71)	(0.90)
degrees of freedom	64	64	66	66
adjusted R^2	0.3617	0.3617	0.3808	0.3808
F-statistic	8.82	8.82	15.15	15.15
p-value (F)	0.0000	0.0000	0.0000	0.0000
Significance codes:	***: $\alpha = 0.01$,	**: $\alpha = 0.05$,	*: $\alpha = 0.10$	
Standard errors in brackets.				

Table 2: *Results for double logarithmic regressions with savings as response variable ($t_1 = 2006$)*

In contrast to previous results from the truly linear model, the years of experience is the only variable with significant (positive) effect on credit. Model (6) explains 19.19% of the total variance in credit, though the whole model per se would not be statistically significant at the 1%-level. Implementing heteroscedasticity consistent standard errors[26] results in insignificance even of n.

To examine if a reduced model is more appropriate, I propose to eliminate p only, as this variable has proven not to be significant in any regression so far. Running an according outlier-adjusted regression of the modified model

$$b_i = \alpha + \beta_1 n_i + \beta_4 s_i + \beta_5 f_i + \delta A_i + \gamma GDPpc_i + \epsilon_i \tag{13}$$

[26] A Breusch-Pagan test rejects the null of homoscedasticity at any common level of significance α here. A plot of residuals against fitted values of the response variable also shows non-constant variance of residuals.

Variable	Model (6)	Model (6) *(HC3)*	Model (13)	Model (13) *(HC3)*
intercept	433.38	433.38	402.50	402.50
	(357.49)	(302.73)	(322.00)	(323.75)
s	0.07	0.07	0.13**	0.13
	(0.06)	(0.08)	(0.07)	(0.10)
f	-446.67	-446.67	-337.40	-337.40
	(267.60)	(296.77)	(255.70)	(258.95)
n	10.61**	10.61	12.67**	12.67**
	(4.69)	(6.37)	(4.80)	(6.17)
p	-0.17	-0.17		
	(0.12)	(0.13)		
A	-61.18	-61.18	-147.00	-147.00
	(217.37)	(239.28)	(208.90)	(247.73)
$GDPpc$	0.04	0.04	-0.01	-0.01
	(0.10)	(0.14)	(0.10)	(0.13)
degrees of freedom	41	41	42	42
adjusted R^2	0.1919	0.1919	0.2414	0.2414
F-statistic	2.86	2.86	3.99	3.99
p-value (F)	0.0202	0.0202	0.0047	0.0047
Significance codes:	***: $\alpha = 0.01$,	**: $\alpha = 0.05$,	*: $\alpha = 0.10$	
Standard errors in brackets.				

Table 3: *Results for ordinary least squares regressions with credit as response variable ($t_1 = 2006$)*

shows that besides n remaining significant, s becomes significant now, as well. The adjusted R^2 increases to 24.14% and the overall fit becomes significant at the 1%-level, too. However, only n is robust under HC3 estimation. In model (13), changes in n show the assumed positive marginal effect on credit. An additional year of experience of the MFI increases credit by 12.67 USD on average. An increase in average savings by 1 USD results in an increase in credit by 0.13 USD on average and is also positive as assumed. However, this result becomes insignificant in case of HC3 estimation.

It is striking that neither A nor $GDPpc$ seem to have an impact on credit, nor does f. Taking into consideration the earlier discussion about the presence of heteroscedasticity, one should prefer the HC3 estimation of model (13) as reliable and more conservative result from the linear model here.

To rule out an inappropriate functional specification as done before, the double log-

arithmic model (10) is estimated, as well (see Table 4). The overall fit of the model improves and a fairly higher adjusted R^2 of 38.64% is achieved. The coefficient of savings becomes significant at the 1%-level, n remains significant as well. Though, the coefficients of all other explanatory variables remain insignificant. As the logarithmic specification has not achieved their significance as it did for savings, the model will once again be estimated without A, $GDPpc$, p, and f, hence

$$ln(b_i) = ln(\alpha) + \beta_1 ln(n_i) + \beta_4 ln(s_i) + \epsilon_i. \tag{14}$$

This specification leads to significance at the 1%-level for all coefficients including intercept, and the percentage of variance in credit explained by the reduced model slightly increases to 39.28%. According to this last and fully HC3-robust estimation, an increase in savings by 1% induces an increase in credit by 0.27%. An increase in the MFI's experience by 1% results in an increase in credit by 0.47%. Both signs are positive as assumed.

As being said, these findings are based on data from 2006. If the same procedure is applied to data from 2003, results change.[27]

With savings as response variable, an ordinary least squares regression of the truly linear model (5) becomes completely insignificant. The same applies to the double logarithmic model, where only the HC3 estimator of credit is significant ($\hat{\beta}_3 = 0.73^{**}$).

However, with credit as development indicator, results become much better: the OLS estimation of the linear model (6) reveal significant and HC3-robust coefficient estimates for f and n at the 1%-level, with $\hat{\beta}_5 = -387.67$ and $\hat{\beta}_1 = 12.27$. With this model specification, 68.34% of the variation in loans can be explained. In addition, the double logarithmic specification of model (10) yields an estimate of the coefficient of size at the same level of significance ($\hat{\beta}_2 = -0.20$). The adjusted R^2 decreases to 61.18%, though this is still a fairly good result compared to the respective value of the estimation with data from 2006, being only 38.64%.

All estimated coefficients have the expected sign, except $\hat{\beta}_2$ for p in the double logarithmic model with credit as response variable. In 2003, the marginal effect of institutional size on granted credit seemed to be negative. The influence of the percentage of fe-

[27] Explicit tables with regression results are not reported, but the main and significant results are discussed in the following.

Variable	Model (10)	Model (10) *(HC3)*	Model (14)	Model (14) *(HC3)*
$ln(intercept)$	-0.65	-0.65	2.72***	2.72***
	(3.92)	(4.37)	(0.51)	(0.47)
$ln(s)$	0.27***	0.27***	0.27***	0.27***
	(0.07)	(0.08)	(0.06)	(0.07)
$ln(f)$	-0.53	-0.53		
	(0.37)	(0.33)		
$ln(n)$	0.47**	0.47***	0.55***	0.55***
	(0.19)	(0.17)	(0.18)	(0.16)
$ln(p)$	-0.08	-0.08		
	(0.09)	(0.09)		
A	0.31	0.31		
	(0.61)	(0.74)		
$ln(GDPpc)$	0.49	0.49		
	(0.48)	(0.56)		
degrees of freedom	41	41	45	45
adjusted R^2	0.3864	0.3864	0.3928	0.3928
F-statistic	5.93	5.93	16.20	16.20
p-value (F)	0.0002	0.0002	0.0000	0.0000
Significance codes: Standard errors in brackets.	***: $\alpha = 0.01$,	**: $\alpha = 0.05$,	*: $\alpha = 0.10$	

Table 4: *Results for double logarithmic regressions with credit as response variable ($t_1 =$ 2006)*

male borrowers on credit proves to be significantly negative on average. That is, the hypothesis of a need of smaller loans could be supported.

Contrasting the findings from 2003 and 2006, the following can be summarised:

First, savings as development indicator can only be explained in 2006 with the presented models. Both a truly linear and a double logarithmic approach are appropriate and most coefficients show the expected sign. On average, a marginal increase in credit has a positive impact on development. Ceteris paribus, Afican countries apparently seem to experience less development than Asian countries, as indicated by the negative sign of the continent dummy A. Small changes in gross domestic product per capita also show a negative impact on development in terms of savings accounts, which may be traced back to price mechanisms.

Second, the proposed models to estimate the effects on development in terms of credit

provide good results for both years. The most important effect is the MFI's experience, measured by n, which has a positive effect at all times. In 2006, savings have a positive influence in either model, but not in 2003. Though, the percentage of female borrowers is significantly negative in 2003, but not in 2006. The institutional size is prevailingly insignificant, though has clear negative impact in 2003.

Third, economic control variables (here, a continent dummy and per capita gross domestic product), are only significant in 2006 in regressions involving savings as response variable. Basic economic conditions rather have an impact on individual savings behaviour than on the amount of credit granted by an MFI, which may explain these findings. Yet, these only seem to matter in recent years.

4.4.5 Caveats

The main difference between model (5) and (6) (respectively model (9) and (10)) is that, ceteris paribus, average savings and loans are used as both dependent and independent variables in turn. If both s and b are considered as appropriate proxies for development and one assumes a mutually interdependent relation between both of them, then the equations should be considered as simultaneous equation system to obtain unbiased estimates for β_j, δ, and γ. The scatterplot in Figure 13 shows the correlation between these two variables. Microfinance institutions operating in selected African countries are highlighted in orange, those working in Asia in black. As argued earlier, the positive correlation between average savings and loans is obvious, yet one still has to decide whether the causality runs in both directions or not. As this paper studies different ways to estimate development and aims at proposing the best and most consistent method, simultaneity is implicitly precluded.

Loans exceed savings in most cases, as depicted by the majority of observations lying to the left of the line of 45° in Figure 13. Part of the data is quite large in its magnitude, especially for Asia. As noted in chapter 4.4.3, this may either refer to particular outliers raising the average, or to a relatively wealthier target group of clients of the corresponding MFIs. If the latter can be traced back to extraordinary performance of microfinance institutions, the result would be perfectly in lign with successful realisation of microfinance objectives. If the target group is however intrinsicly richer even prior to the institution's support, the MFI would not actually operate in the microfinance business in the narrow sense. The data base does not allow for an answer of the nature of

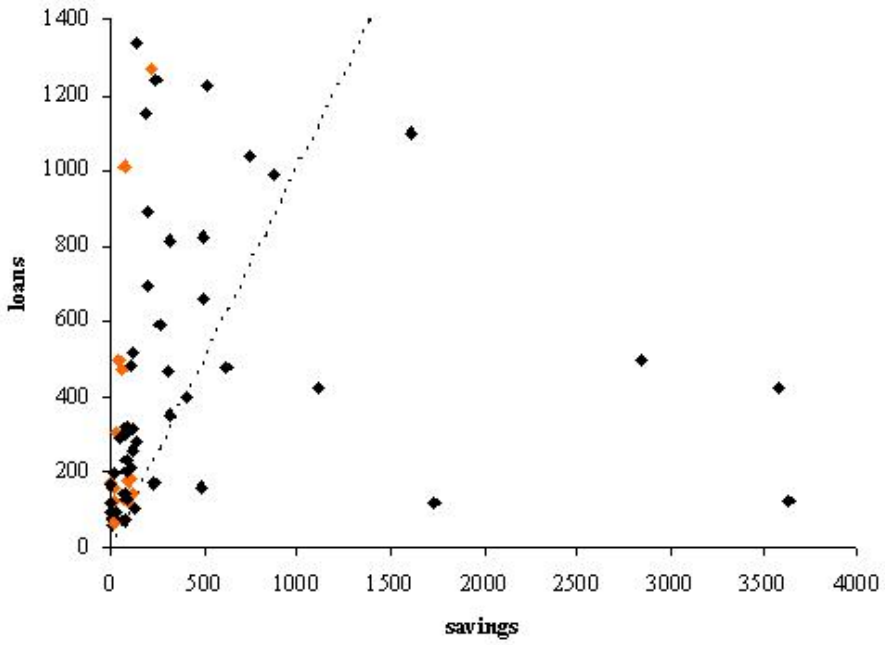


Figure 13: *Correlation between savings and loans across MFIs in Ethiopia, Uganda, Cambodia, and the Philippines in 2006*

this question. However, as only part of the data is involved into this issue and statistical outliers were eliminated from analyses, possible influences on results are negligible.

Another point of interest are interest rates on loans and savings. These are likely to influence saving and borrowing bahaviour in developing countries in almost the same manner as in industrialised countries, taking into consideration the specific circumstances associated with economic behaviour of individuals with low income. On the part of microfinance institutions, one might expect higher interests due to higher risk of default. Yet, in the microfinance business it is argued that creditworthiness is not considered as major problem.

The MixMarket data base is not encompassing, and interest rates of any kind are not available. If incremental changes in interest rates would nonetheless have a significant effect on the response variable, but are not included into statistical regression analyses, then the results would be impaired by an omitted variable bias (Greene 2003).

Suppose the true model includes interest rates and other possibly relevant variables, which are though not included in regression models. Then the true model can be for-

malised by

$$y_i = \beta X + \gamma Z + \epsilon_i,$$

whereas the estimated model is in fact

$$y_i = \hat{\beta} X. \tag{15}$$

X is a matrix including all variables taken into consideration for regression analyses and Z is a matrix including all further relevant, though omitted, variables. ϵ_i is i.i.d. with $\epsilon \sim N(0, 1)$. Regressing the incomplete model (15) leads to the following problem:

$$\begin{aligned}
\hat{\beta} &= (X'X)^{-1}X'y \\
&= (X'X)^{-1}X'[\beta X + \gamma Z + \epsilon_i] \\
&= \beta(X'X)^{-1}X'X + \gamma(X'X)^{-1}X'Z + (X'X)^{-1}X'\epsilon_i \\
&= \beta + \gamma(X'X)^{-1}X'Z.
\end{aligned}$$

As long as $X'Z \neq 0$, that is, unless X and Z are orthogonal to each other, all estimates for β are biased and inconsistent. The bias' direction depends on the covariance between omitted variable and response variable, e.g. on $cov(r, y)$ where r is the interest rate and y the outcome variable such as savings or credit. If $cov(r, y) > 0$, then β is overestimated. For $cov(r, y) < 0$, β is underestimated.

This problem remains immanent, however there is some evidence mitigating its severity. In a qualitative survey among Malawian microcredit clients of the Foundation for International Community Assistance (FINCA), an international microfinance network, Masanjala (2002) finds that only 1% of all interviewees identified interest rates as the major drawback concerning their financial needs. Collateral requirements were reported as the far more important reason to refrain from standard banking institutions' services (p. 100).

4.5 Alternative Approaches to Empirical Analyses

4.5.1 A Fixed-Effects Model as Panel Design

As pointed out earlier, data on microfinance institutions is only available for a short and recent time period. In the MixMarket data base, the longest time series traces back to 1997 (as for example in case of FINCA in Uganda). With annually published data since that time, no reliable time series analysis can be carried out. Though, given that data is in fact regularly collected by an MFI, ideally monthly since its foundation, and given that the institution would provide access to these data for the purpose of empirical research, one could obtain results either from a time series analysis per individual microfinance institution, or from an (im)balanced panel analysis across several MFIs and time. Using a fixed-effects model, one would then obtain results from a panel regression which could yield more detailed insights into the effects of MFIs on development than it is possible with simple cross-sectional analyses. For example, country-specific effects at any point in time can be compared.

4.5.2 Ideas for a Binary Choice Approach

Both chapter 4.4 and the idea discussed in the previous subchapter are based on response variables with variance larger than one, and a model specification that allows for direct interpretation of estimated marginal effects β_j for any explanatory variable x_j. This method was chosen to answer the question whether a variable related to microfinance institutions had an significant effect on development and, according to the estimation, how large its average magnitude was.

But the question on how and to which extent a microfinance institution can influence development may not only be formulated in terms of real marginal effects, but also in terms of marginal probabilities. That is, one can restate the question as: how does a marginal change in an MFI-related variable affect the probability of changes in development? This is a rather unusual, yet interesting approach to assess the impact of microfinance institutions on development. By using a non-linear econometric binary choice model with either Probit or Logit specification, the response variable would become binary with values 0 or 1. Hence, the probability for positive development can be described as

$$p = P[z \leq \beta_1 + \beta_2 x] = F(\beta_1 + \beta_2 x)$$

where p is the probability that a value z is observed, given the explanatory variables 1 and x with their respective marginal effects β_1 and β_2. By numerical optimisation, a maximum likelihood estimator of β_1 and β_2 can be obtained. As the sample size of MFIs is sufficiently large, this procedure is valid. The fact that "the maximum likelihood estimator is normally distributed, consistent, and *best*, in the sense that no competing estimator has smaller variances" (Carter, Griffiths & Judge, 2001, p. 373), supports the adequacy of this choice. A variance samller than one[28] of the response variable does not necessarily have to affect results in a negative way. Binary choice models have different properties than common ordinary least squares regressions, but are nonetheless consistent in themselves.

The challenge of this alternative approach is to find — or define — a response variable with properties described above, which is able to describe development in an appropriate way.

[28] $VAR(x) = \frac{1}{n-1}\sum_{i=1}^{n}(x_i - \bar{x})^2$, where $\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i = \frac{1}{n}[0k+1(n-k)] = 1-\frac{k}{n}$ if n is the total number of observations and k is the number of outcomes equal to zero. From $VAR(x) = E(x^2) - [E(x)]^2$ and $\bar{x} = 1 - \frac{k}{n}$ follows that $VAR(x) = \frac{k(n-k)}{n^2}$. For $VAR(x) < 1$ follows $k(n-k) < n^2$ as a true statement $(\forall k, n)$.

5 Conclusions

Yunus argues that "[w]hen the time is right, a new idea is capable of transforming the world" (Grameen Foundation), implying that an idea implemented at convenient time may be a key element of poverty reduction. The empirical analyses carried out in this paper suggest that microfinance institutions have in fact a positive influence on development in the developing world.

Based on descriptive analyses of selected microfinance institutions, it is striking that the numbers of employees as well as clients have been strongly increasing during the past decade, implying increasing demand for microfinance services. Women are especially encouraged in engaging in microfinance businesses. Augmented loan portfolios may also be evoked by the success of group-lending schemes where a trigger strategy in repeated microfinance games is responsible for well functioning repayment systems despite the lack of standard collateral requirements.

Modelled after the idea of a poverty trap adjusted Solow model, average savings per saver as development indicator prove very suitable in 2006. This approach is also the most self-consistent and moreover theoretically well founded concept. According to a cross-sectional estimation of the linear model, an increase in microcredit by 1 USD results in an increase in savings by 0.47 USD on average. A microfinance institution's experience strongly affects average amounts of granted credit.

The perspectives for microfinance institutions in the future can thus be gauged as fairly positive. Their contribution to development of the poor functions in their continent of origin, Asia, as well as in African countries. The concept therefore is most likely independent from differences in economic, political, and cultural factors. Particularly against the background of great heterogeneity in the roots of weak development and the lack of theories to explain them comprehensively, microfinance institutions are a good mechanism to enhance development despite imperfect knowledge of the interdependence of underlying reasons.

Further studies on this topic should focus on gathering more encompassing data on microfinance institutions, inlcuding longer time series, and use them to conduct panel studies, for instance. The main task here is to collect data from microfinance institutions that have not been published yet and to compare results with respect to significance and robustness.

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