The impacts of microcredit on poverty reduction: evidence from Cambodian rural villages

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This paper attempts to assess the poverty impact of microcredit for a panel of 827 households surveyed in 2001, 2004, and 2008 using propensity score matching (PSM) and the difference-in-difference (DID) method. The result shows that the poverty headcount in the microfinance institution (MFI) sample, which was highest in 2001, dropped faster compared to those in two other samples. This finding suggests that using loans from MFIs may have a positive effect on poverty reduction. The result of regression analysis based on the sample with the common support using the DID approach confirms the same results reflecting in higher per capita consumption expenditure, higher food expenditure, higher education expenditure, and higher healthcare expenditure over 2001-2004. Over a longer term 2001-2008, however, the effect of using MFI loan is still found to be significant and positive on only per capita consumption and per capita food consumption.

1. Introduction

The United Nations' Millennium Development Goals (MDGs) have galvanized the development community with an urgent challenge to improve the welfare of the marginal people. Donor agencies are orienting their programming around the attainment of the MDGs and are mobilizing new resources to reduce hunger and poverty. Microfinance has been recognized as one of the effective and powerful tools to fight poverty and to achieve MDGs as the impact it produces goes beyond just business loans. The poor use financial services not only for business investment in their microenterprises, but also to invest in health and education, to

manage household emergencies, and to meet the wide variety of other cash needs that they encounter.

The role of microfinance in expanding financial access and economic opportunity is also well documented in many Cambodian government policy papers (First Socioeconomic Development Plan 1996-2000, Second Socioeconomic Development Plan 2001-2005, National Poverty Reduction Strategy). According to those papers, microfinance is needed to replace exploitative consumption loans covering household rice deficit and to facilitate and improve rice production and yield by providing money for necessary productive farm inputs, such as fertilizers and seeds. These loans will help provide food security among poorer groups allowing more productive, sustainable farming. Loans are also needed for income diversification through small-scale enterprise/business activities and petty trades.

The importance of microfinance and its role in alleviating poverty attracted great attention from Cambodian policy makers. The Cambodian government declared "the Year of Microfinance," only a year after it was declared by the United Nations. In his opening remarks at the National Conference on Cambodian Microfinance in 2006, the Cambodian prime minister said: "For Cambodia, the number of people living on less than one dollar per day has declined from 36% in 1998 to only 28% in 2005... However, we are not satisfied with this, and we remain committed to further reducing this number. To achieve this objective, the microfinance sector should be the priority... Thus, to attract more attention to this sector, I would proudly announce 2006 as the Year of Microfinance in Cambodia" (EIC 2006).

Since then, microfinance companies have spread across the country. As of 2009, microfinance in Cambodia consisted of 20 licensed institutions, of which 4 possessed saving mobilized licenses, and 26 rural credit operators were registered with the National Bank of Cambodia (Table 1). The network coverage and offices have been extended to almost all provinces, districts, communes, and villages. The number of village offices increased from 13,316 in 2005 to 42,729 in 2009. In term of MFIs' employment, the demand for employment increased gradually from 1,793 staff in 2005 to 6,330 staff in 2009.

At the same time, microfinance institutions provided outstanding loans of approximately US$308 million to 904,298 borrowers in 2009. These figures show an increase of 492.2 percent in outstanding loans and 147.0 percent in number of borrowers compared to 2005 (Table 1). During the same period, microfinance institutions mobilized total deposits of around US$10.8 million USD from 171,190 depositors. These figures illustrate an increase of 458.5 percent in total deposits and 24.4 percent in number of depositors.

Cambodian microfinance has attracted confidence from investors, especially foreign investors who make their efforts in developing this sector through shareholding participation or through providing funds for capital. Table 1 shows that the funding sources generally come from large foreign social investors or FDI.

TABLE 1. Overview of Cambodia's microfinance, 2002-2009

selected indicators	2002	2003	2004	2005	2006	2007	2008	2009
number of operators								
licensed MFIs	3	5	10	15	16	17	18	20
registered NGOs	27	29	28	23	24	25	27	26
number of offices								
district	510	449	532	533	655	838	1,046	1,277
commune	2,912	2,299	3,128	3,128	4,152	5,314	6,820	8,189
village	12,594	8,841	13,316	13,316	19,450	26,471	33,963	42,726
number of employees								
male				1,332	1,906	2,810	3,873	4,701
female				461	597	988	1,275	1,629
total				1,793	2,503	3,798	5,148	6,330
loans and borrowers								
loans (in million USD)	51.3	32.6	40.9	52.1	92.2	160.4	284.7	308.4
borrowers	328,295	265,044	322,056	366,107	471,009	624,089	852,090	904,298
deposits and depositors								
deposits (in million USD)	7.1	2.5	2.0	1.9	2.9	6.1	6.4	10.8
depositors	107,150	88,474	122,984	137,624	113,316	147,966	155,291	171,190
share holdings								
Cambodian (%)				27.0	25.0	29.0	26.0	30.0
foreigners (%)				73.0	75.0	71.0	74.0	70.0
average monthly lending interest rate								
Riel				3.4	3.4	3.2	3.2	3.0
USD				2.7	2.6	2.3	2.4	2.3
others				3.2	3.1	3.1	3.1	3.1
average yearly lending interest rate								
Riel				12.1	8.2	7.7	6.8	5.9
USD				6.6	6.7	5.5	5.2	4.3
others				8.8	8.8	8.4	7.7	7.2

Source:Author's compilation based on Kim 2010

Although assumptions are plentiful regarding the potential effects of microfinance on poverty reduction, quantitative studies to measure those effects remain scarce in the Cambodian context. This paper attempts to fill the gap by addressing three main questions:

1. What are the characteristics and poverty status of households taking loans from microfinance institutes compared to other households?
2. How are those loans used compared to loans from other sources?
3. How can microfinance reduce poverty?

To answer the first and second questions, simple cross-tabulation will be conducted and poverty incidence by household characteristics will be computed, based on an updated multiple poverty lines and poverty formula proposed by Foster, Greener, and Thorbecke.

To answer the third question, two techniques, propensity score matching (PSM) and the difference-in-difference (DID) method, will be employed. The first technique is used to match households with similar characteristics measured by propensity score between treatment group and control group. The second technique is used to investigate the impact of microfinance on per capita consumption. Household survey data from 2001 to 2008 in nine rural villages collected by Cambodia Development Resource Institute will be used for analysis.

The remaining sections of this paper are organized as follows. Section 2 reviews the evolution of microfinance in Cambodia. Section 3 discusses methodology to assess impacts of microfinance on poverty reduction. Section 4 describes how data is collected and examines the poverty profile of households in those rural villages and analyses the sources of loans and how those loans are used by household characteristics. Section 5 provides notes on the regression techniques used in the paper and discusses the effects of microfinance on per capita consumption and poverty reduction. Section 6 is the conclusion and policy recommendation section.

2. Evolution of microfinance in Cambodia

Microfinance has had a relatively short history in Cambodia. Despite many challenges, a few organizations started experimenting with microfinance, primarily in the form of credit with the assistance of microcredit promoters and external aid, in the early 1990s [Kang 2002]. These organizations included the Group de Recherché et D'Echanges Technologiques in 1991, World Relief in 1992, and the Association of Cambodian Local Enterprise Development Agencies (ACLEDA) and Catholic Relief Services in 1993. Most loans were small-scale and were provided together with humanitarian aid to refugees living along the Thai border. These loans tried to target specific disadvantaged groups, focusing on providing enterprise development training to returnees, demobilized soldiers, the disabled and widowers, and they were intended to serve as a "carrot" to attract participants to business training courses.

By 1994, some 25 to 30 nongovernment organization (NGO) microfinance programs were already reaching approximately 44,000 clients, yet they felt that they were meeting only a fraction of the demand for microfinance services. As a result, the major programs began to think of themselves not as temporary projects but as permanent MFIs. They started recasting their operations, eliminating or de-emphasizing non-financial services in order to focus increasingly on providing sustainable financial services. At about the same time, severe problems arose with those programs trying the poverty targeting approach, which both reduced program scale and quality of the portfolio. ACLEDA's changes were the most drastic. It ceased the strategy of targeting groups and instead developed a broader-based approach of serving whole communities instead of just the specific groups therein. In a two-year period, from the end of 1995 to the end of 1997, ACLEDA

increased its operational self-sufficiency from 23 percent to 110 percent and its number of active clients from 6,500 to 44,500.

Changes in relations with the Cambodian government also occurred over time. The government was initially suspicious of NGOs charging usurious interest rate. In addition, several pyramid schemes emerged and subsequently collapsed in the early 1990s, casting aspersion on all financial activities and suggesting a need for better financial regulation. Consequently, the government attempted to increase oversight and control of microfinance operations. The NGOs resisted this, since they were equally suspicious of any government interference and felt that the government would impose measures appropriate for commercial banking but not for microfinance. They successfully advocated for deferment of restrictive policies and regulations.

In 2000, with the banking system reform program in place, the law on banking and financial institutions promulgated at the end of 1999, and with the inactivity and risks related to unsupervised NGO financial services, the National Bank of Cambodia decided to issue a number of regulations to transform NGOs into microfinance institutions under the bank's supervision (Economics Institute of Cambodia 2006).

TABLE 2. Prakas issued by the National Bank of Cambodia for microfinance institutions to implement

No	Prakas No	Date	On
1	B7-00-06	Jan 11 2000	Licensing of MFIs
2	B7-01-115	Aug 14 2001	Calculation of Interest Rate
3	B7-02-45	Feb 25 2002	Reserve Requirement
4	B7-02-47	Feb 25 2002	Reporting Requirement
5	B7-0-48	Feb 25 2002	Liquidity Ratio of Licensed MFIs
6	B7-02-49	Feb 25 2002	Registration and Licensing of MFIs
7	B7-02-186	Sep 13 2002	Loan Classification and Provisioning
8	B7-02-189	Feb 25 2002	Implementation of Chart of Accounts

Source: Tai Nay Im (2006), "Role of the National Bank of Cambodia and Regulation for Microfinance", Presented at Microfinance Conference, January 11–13, 2006

As of December 2005, eight prakas were issued by the National Bank of Cambodia for MFIs to implement (see Table 2). Among them, the prakas number B7-02-49 on the registration and licensing of MFIs requires microfinance operators that meet a certain scale to register with the National Bank of Cambodia. Those with a larger scale must apply for licenses from the bank or reduce their scale of activity. Registered NGOs and licensed MFIs must report to the National Bank of Cambodia on a regular basis. However, these parkas did not seem to prevent the Cambodian microfinance industry from enjoying robust growth. The number of MFI operators kept increasing together with the activity expansion of non-

registered NGOs (Table 2). One of the large MFIs has even transformed itself into a commercial bank by including non-poor and non-rural clients. ACLEDA was no longer an MFI from 2003, although it continues to serve large numbers of its traditional clients with both loan and deposit services. Among all MFI operators (excluding ACLEDA), AMK serves has the largest number of clients, followed by AMRET, VFC, TPC, PRASAC, HKL, CREDIT, and Sathapana Limited (Figure1). These MFI operators serve each more 35,000 clients.
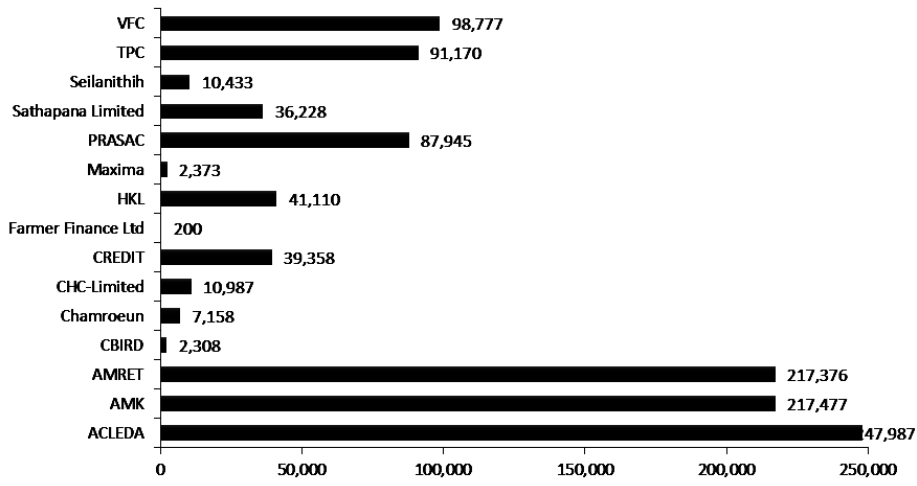
Source: Cambodia Microfinance Association (http://cma-network.org)

FIGURE 1. Number of microfinance institutions and MFI borrowers in 2010

Due to the fact that the financial sector is still underdeveloped, lacks rural development banks, and is limited by a weak rural finance network, and given that poverty is a rural phenomenon, MFIs can play complementary role with the banking systems, a role which is crucial for improving rural livelihood through expanding income generation activities. The benefits received by the family members of microfinance's clients also positively secure food, health, education, and social engagement of the rural citizens. This is the depth of outreach where the microfinance proves its inclusive services for reducing poverty in the country. In this respect, the review on the roles of MFIs in poverty reduction is important.

3. Impact of microfinance on poverty

A perfect impact evaluation needs to answer a counterfactual question: how does the status of participants in the program compare with how those same individuals would have fared in the absence of the program? Or alternatively, how would non-participants have fared in the presence of a program? The problem with

cross-sections of data (observations on many individuals at a given point in time) is that at any given point in time individuals are observed to be either participants or not. Even panels of data (observations on many individuals through time) are problematic since over time many events have occurred in an individual's life in addition to program participation, and it is nearly impossible to separate out the impact of the program from all the other influences. In reality, researchers must settle for estimates of the average impact of the program on a group of participants (the treatment group) relative to a credible comparison group (the control group). The ideal control group consists of individuals who would have had outcomes similar to those in the treatment group had they not participated in the program.

However constructing a control group comparable to the treatment group is not straightforward. Participants in the program are usually different from non-participants in many ways: programs are usually carefully placed in specific areas participants within those areas may be screened for participation, and the final decision on whether or not to participate is usually voluntary. To the extent that these factors are known and can be measured, they can be controlled for in the empirical analysis, but in most cases the placement of the program and self-selection of participants in those areas are based on unobservable factors. These unobservable factors lead to at least two kinds of bias in any empirical impact evaluation: program placement bias and self-selection bias.

Controlling for this bias—determining the effects of just microfinance and separating out the impact of microcredit from what would have happened to the same household without credit—is often the most difficult part of careful empirical impact studies. Well-run microfinance institutions do not randomize either the location of their operations or their selection of clients. If MFIs tend to operate in areas that have relatively better or worse infrastructure such as access by road, or more or less active markets, then estimates of the impacts of the program on participants do not measure the effects just of microfinance, but of these other factors as well. Even within a given village, if, as studies by Coleman [2002], Alexander [2001], and Hashemi [1997] suggest, microfinance clients already have an initial advantage over non-clients, then the impact of microfinance will be overestimated if these initial biases are not taken under consideration. Similarly, if these biases are not accounted for, the impact of microfinance programs that deliberately target relatively disadvantaged households in the areas in which they operate may find impacts underestimated.

Despite the importance of thinking carefully about these issues, few studies have addressed them rigorously and for good reason, as rigorous quantitative studies, among other limitations, are costly and time consuming. Few MFIs have the resources in terms of funds or staff to conduct these studies. There is a movement in the industry to create practitioner-friendly assessment tools, but these assessments, while very useful to the institutions themselves in refining their targeting, products, and marketing, are not rigorous quantitative measures of impact and do not adequately address the issue of selection bias.

Armentdariz de aghion and Morduch [2005:238-239] provide a compelling argument to make the substantial investments required to conduct careful impact studies that control for these potential biases. Unfortunately, this is not an esoteric concern that practitioners and policy makers can safely ignore. It is not just the difference between obtaining "very good" estimates of impacts versus "perfect" estimates; the biases can be larger. In evaluating the Grameen Bank, for example, Signe-Mary McKernan [2002] finds that not controlling the selection bias can lead to overestimation of the effect of participation on profits by as much as 100 percent. In other cases, controlling for these biases reverses conclusions about impacts entirely.

There are a handful of studies that rigorously address the issues of selection bias and endogeneity. The approaches of Pitt and Khandker [1998], Hulme and Mosly [1996], and work in progress by Banerjee and Diflo are discussed below.

3.1. Exogenous eligibility requirement

In an innovative approach to controlling for selection bias, Pitt and Khandker [1998] combine the use of a quasi-natural experiment and eligibility requirements to study the impacts of the Grameen Bank. The authors sample 1,538 participants and 260 non-participants in a number of "treatment" villages where group-lending programs are operating as well as randomly selected households from "control" villages without a program. They use village fixed effects to correct for endogeneity of program placement and take advantage of the fact that microcredit programs impose eligibility requirements on participants (households with land holdings of more than half an acre are ineligible) to construct eligible households and between program and non-program villages. After controlling for other factors, such as various household characteristics, any remaining difference was attributed to the microfinance program.

The study draws a number of conclusions, but the main one is that the programs had a positive effect on household consumption, which was significantly greater for female borrowers. On average, a loan of 100 taka to a female borrower, after it is repaid, allows a net consumption increase of 18 taka. In terms of poverty impact it is estimated that 5 percent of participant households are pulled above the poverty line annually.

The accuracy of the original results as presented in Pitt and Khandker [1998] has been disputed on the grounds that the eligibility criteria of low land holdings were not enforced strictly in practice. In a reworking of the results focusing on more directly comparable households, no impact on consumption from participation is found [Morduch 1999:1605]. This debate, which in part centers on details of econometric estimation, has not been resolved. An unpublished paper by Pitt reworks the original analysis to address the concerns of Morduch and is said to confirm the original results [Khandker 2003, footnote 1].

3.2. Prospective client as control group

Another approach to controlling for self-selection and placement bias, used by Hulme and Mosley [1996] and Coleman [1999], is to include a sample of microcredit clients who have formed solidarity groups but have not yet received loans, as the control group. In this approach, participating and non-participating households within treatment villages where the microcredit program is already operating and has already given loans are again surveyed. The control villages are those where the microcredit program will operate and households from the village have already been self-selected to participate in the program but have not yet actually received loans.

Hulme and Mosly [1996] employ this approach in their study of programs in a number of countries including the Grameen Bank in Bangladesh and the Bank Rakyat Indonesia. In general, a positive impact is found on borrower income of the poor, with an average increase in the control group ranging from 10-12 percent in Indonesia, to around 30 percent in Bangladesh and India. Gains are found to be larger for non-poor borrowers, however, and within the poorest group gains are negatively correlated with income.

However, despite the breadth of the study and its use of control group techniques, Hulme and Mosley's study fails to control placement bias. Thus part of the advantage of program participants relative to the control group may be due to unmeasured village attributes that affect both the supply and demand for credit.

Coleman [1999], in his study of a village-banking program in Thailand, further develops the literature by expanding on the concept to control for self-selection bias and introducing both observable village characteristics and village fixed effects to control for program placement bias. Using data on 455 households, including participating and non-participating households in treatment villages where a village bank is already offering microcredit, and selected future participants and non-participants in control villages that have been identified to receive a bank program but have not yet actually received funds, Coleman uses a DID approach that compares the difference between income for participants and non-participants in program villages with the same difference in the control villages, where the programs were introduced later. Coleman's study measures the effect of access rather than participation in a microcredit program, and it finds no evidence that months of access to a village bank program has an impact on any asset or income variables and that access to village bank loans increased productive activity. Coleman cautions, however, against extrapolating these results to other contexts since Thailand is a wealthy developing country. One of the reasons there is a weak poverty impact is that there was a tendency for wealthier households to self-select into village banks, and the relatively small sizes of loans may mean that they are largely used for consumption.

This approach is not perfect either. Karlan [2001] points out that this approach may still fail to account for possible "attrition bias"—the fact that the control

group includes potential future dropouts (or graduates) of the program, while the treatment group of older borrowers (who have in fact remained active borrowers) does not. Depending on the reasons for attrition, attrition bias can be positive or negative. If attrition is due to successful clients graduating out of microfinance into the formal financial sector, then impact will be underestimated. If attrition is due to dropouts who find the program unhelpful or whose micro-enterprises fail, for example, then impact will be overestimated. Armendariz de Aghio and Morduch [2005] review a number of studies that find dropout rates range between 3.5 to 60 percent per year in various microfinance programs worldwide. Even the lower-end estimates can add up to a substantial effect over time.

3.3. Randomized program design

There are a few recent impact studies currently in progress that use randomized study design to control for selection bias. Duflo and Kremer [2003] describe the use of this type of evaluation for an educational program in Mexico. Banerjee and Duflo [in progress] are applying this approach to a microfinance impact assessment for the Center of Micro Finance Research. This approach eliminates selection bias by randomly selecting treatment groups from a potential population of participants. With this type of study design, the researcher can be assured that on average those who are exposed to the program are no different from those who are not, and thus, that a statistically significant difference between the groups' outcome can be confidently attributed to the program, not to selection bias.

Well-designed studies of this sort have the potential to rigorously address all kinds of potential biases, although they are limited by the fact that they can only estimate partial equilibrium effects, which may differ from general equilibrium treatment effects. In the case of microfinance, this means that if, for example, microfinance is introduced on a large scale, the program could eventually affect the functioning of financial markets and thus have a different impact from the necessarily smaller scale program that is the subject of the impact study.

A more practical concern in attempting to apply randomized study design is that such studies require tremendous cooperation from the institutions being evaluated; they must be willing to allow researchers to randomize implementation of their services. Such studies must also allow longitudinal data, making them costly, and it can be difficult to conduct research over a time period long enough for some impacts to appear. In the case of Banerjee and Duflo's study, the time frame between base line and final study is one year, which may not be long enough for some of the impacts of microfinance to appear quantitatively. For these reasons randomized studies are likely to continue to constitute only a tiny fraction of all microfinance evaluations.

4. Data and characteristics of households and loans

4.1. Data

Data analysis will be based on the household survey on 827 households conducted by Cambodia Development Resource Institute for 2001, 2004, and 2008 in nine rural villages as shown in Table 3. The panel data set is constructed within 827 households over the 3 rounds of surveys in 2001, 2004, and 2008. Table 3 describes the size of the panel sample in each study village. It also describes the characteristics of each selected village. The nine villages were purposively selected to represent the four agro-climatic zones in Cambodia: the Tonle Sap region, the Mekong Plain, the Plateau region, and the Coastal region since 2001.

TABLE 3. Sample size and villages characteristics

Village	Total households	Sample households	Characteristics
Tonle Sap			
Tuol Krasaing	196	86	wet season rice and migration work
Andong Trach	234	61	wet season rice
Khsach Chiros	339	87	dry season rice and fishing
Mekong Plain			
Prek Khmeng	343	110	dry season rice and fishing
Babaong	543	110	dry season rice
Plateau			
Kanhchor	267	106	dry season rice and forestry resources
Dang Kdar	420	107	wet season rice and forestry resources
Trapeng Prey	75	51	wet season rice and labour sale
Coastal			
Kompong Thnoat	363	109	wet season rice and fishing
Total	2780	827	

Source: Chan and Acharya (2002)

4.2. Basic characteristics of MFI households, 2001-2008

Table 4 discusses the basic characteristics of MFI households *vis-à-vis* other types of households prior to performing any statistical matching. In this table, MFI households refer to the households in the panel sample that obtain loans from MFIs or NGOs. Table 4 shows that among the MFI sample, around 30.4 percent are headed by female. The figures for other female-headed households who obtained loans from other sources and those who took no loan are relatively much smaller, suggesting that there can be some effort made by MFIs to provide loans to female-headed households. In 2001, poverty rates in the MFI sample stood at 79.6 percent for male-headed households and 96 percent for female-headed households, the highest poverty rate among the three samples. It worth noting that during initial

year 2001, compared to that of male-headed households, the poverty rate of female-headed households is constantly higher across samples and highest in MFI groups. However, the poverty rate for female household decreased more rapidly than any male-headed households across samples over 2001-2004 and 2001-2008.

It is very likely that MFIs also gave some weight to households whose head are either divorced or widow/widower. According to the survey results shown in Table 3, the percentage of these households taking loans from MFIs is 21.7 percent compared to only 13-16 percent of the same categorized households accessing from other sources or taking no loan. In terms of poverty, the figures show similar trends in the case of gender breakdown. Across all samples, poverty rates were consistently higher for single-headed households over the period of the survey and were highest for MFI samples during the initial year of 2001. The poverty rates, however, decreased faster compared to households with a married head over 2001-2004 and 2001-2008.

By age of the household head, the survey results show that the majority of households have a head aged below 60 years old. Only around 11 percent of households are headed by a member older than 60 years old. The percentage of households led by these members in the MFI sample is lower than any other sample during the survey period. This may be partly due to the complicated procedures which prevent elders from accessing MFI loans or due to their full understanding regarding the severe consequence which might happen if they cannot afford to repay debts by its strict deadline.

By level of education, the percentage of households with illiterate heads included in MFI samples are found to be relatively higher than those of any other samples. MFIs might also have policies to facilitate how such households obtain loans from their institutions. In terms of poverty of the MFI sample in 2001, all illiterate households are poor compared to 81.6 percent of households whose heads have some education and 61.5 percent of households whose heads completed at least secondary education. However, the poverty reduction over 2001-2004 and 2001-2008 is found to be the largest among the illiterate households.

By household size, the survey revealed that of the total sample, 47 percent had 1-5 members, 51 percent had 6-10 members, and 2 percent had 11-15 members in 2008. Of the MFI sample households, it was found that 31 percent had 1-5 members, 62 percent had 6-10 members, and 8 percent had 11-15 members. Comparing the two samples shows that the percentages of households with 6-10 and 11-15 members are higher in the MFI sample, indicating that having a larger family is likely to be an advantage in accessing formal loans from MFIs. Poverty rates are found to increase with the family size within the total sample, but the pattern is unobserved within the MFI households.

By agricultural land-holding size, it is generally found that the percentages of landless and land-poor households have been decreasing while those of the large holders have shown the opposite trend. This is likely related to the facts that more

forest land has been converted into agricultural land due to increasing demand for domestic agricultural products, namely cassava, which encouraged large land holders to acquire more land, coupled with increasing population pressure which forced landless and land poor households to invade forest land. From the total sample, agricultural land holding size appears to be a reliable predictor of poverty from 2001 to 2004 as poverty rates dropped when the size of land increased. However, such patterns are not observable in 2008. As mentioned earlier, this may be because an increase in forest conversion in 2008 caused by population pressure and external demand, which in turn invited households to use forest land. Of the MFI sample, except for the case of land-rich households in 2004, the percentage of poor households across groups declined significantly in 2004 and in 2008.

Access to common pooled resource (CPR) shows more than 95 percent of households of the total sample could access to it across all years. CPR refers to the natural resources in the nine villages of the sample. It includes products which can be collected from the river, forest, and sea. Except for the initial year, all households in the MFI sample had that access. This could mean that households who participated in MFI scheme were able to benefit from diversification of income sources offered by access to CPR. It is found that the poverty headcount dropped from 42 percent to 31 percent in the total sample and from 82 percent to 31 percent in the MFI sample over 2001-2008 reinforcing the hypothesis that households with access to MFI and CPR experienced fast poverty reduction.

With regard to shocks, which refer to unfavorable events that happen unpredictably, such as the death of household members, thievery, and natural disaster, the survey found that the percentage of households in the total sample reporting having that experience dropped from 85 percent in 2001 to 54 percent in 2004 and to 44 percent in 2008. However, the movement of that in the MFI sample was unpredictable.

TABLE 4. Poverty profile and trends, 2001-2008

Household Characteristics	MFI			Other loans			No loan			All		
	2001	2004	2008	2001	2004	2008	2001	2004	2008	2001	2004	2008
Population Share												
Sex												
Male	69.6	63.2	69.2	81.1	81.1	80.5	82.0	81.3	81.2	80.7	80.7	80.7
Female	30.4	36.8	30.8	18.9	18.9	19.5	18.0	18.7	18.8	19.3	19.3	19.3
Status												
married	78.3	68.4	76.9	85.1	86.7	85.9	84.8	83.6	83.8	84.5	84.5	84.5
others	21.7	31.6	23.1	14.9	13.3	14.1	15.2	16.4	16.2	15.5	15.5	15.5
Age												
30 & below	19.6	26.3	15.4	16.0	14.4	16.2	12.3	13.8	13.3	14.4	14.4	14.4
31–40	21.7	31.6	15.4	34.6	37.8	39.4	32.0	28.2	28.5	32.3	32.3	32.3
41–50	28.3	15.8	46.2	22.6	23.0	20.3	23.1	23.9	24.3	23.2	23.2	23.2
51–60	26.1	21.1	15.4	20.7	16.3	16.2	16.5	21.0	20.9	19.0	19.0	19.0
61 & above	4.4	5.3	7.7	6.2	8.5	7.9	16.1	13.2	13.1	11.0	11.0	11.0

TABLE 4. Poverty profile and trends, 2001-2008 (continued)

Household Characteristics	MFI			Other loans			No loan			All		
	2001	2004	2008	2001	2004	2008	2001	2004	2008	2001	2004	2008
Education												
Illiterate	34.8	42.1	30.8	28.0	28.5	24.9	28.2	27.9	30.8	28.6	28.6	28.6
Some education	45.7	47.4	53.9	50.6	48.5	51.5	50.6	51.7	49.4	50.2	50.2	50.2
Secondary and above	19.6	10.5	15.4	21.5	23.0	23.7	21.2	20.4	19.8	21.2	21.2	21.2
Household size												
1–5	45.7	42.1	30.8	44.4	44.4	40.3	49.7	54.3	52.2	47.1	49.8	47.3
6–10	47.8	57.9	61.5	54.2	51.1	56.0	48.7	44.3	46.7	51.0	47.6	50.6
11–15	6.5	NA	7.7	1.2	4.4	3.7	1.6	1.4	1.0	1.9	2.7	2.2
Agri land												
Landless	6.5	10.5	30.8	22.9	20.0	27.8	13.0	10.9	15.9	16.8	14.8	20.7
Less than 0.5 ha	21.7	47.4	15.4	25.5	17.8	12.5	24.4	20.7	15.1	24.7	20.3	14.1
0.5–1 ha	21.7	15.8	15.4	19.6	17.8	12.0	22.2	19.0	14.6	21.0	18.4	13.7
1–2 ha	19.6	21.1	NA	14.9	24.4	16.6	20.6	27.6	21.2	18.1	26.1	19.0
2–3 ha	10.7	NA	15.4	9.8	12.6	14.5	11.1	11.1	14.6	10.5	11.6	14.6
3 ha & above	19.6	5.3	23.1	7.3	7.4	16.6	8.9	10.3	18.5	9.0	9.0	17.9
CPR												
No	11.4	NA	NA	3.0	1.5	2.1	5.4	4.3	7.8	4.8	3.0	5.5
Yes	88.6	100.0	100.0	97.1	98.5	97.9	94.6	95.7	92.2	95.2	97.0	94.5
Shock												
No	39.1	52.6	38.5	9.5	44.4	50.2	15.5	47.7	60.6	14.6	46.5	56.2
Yes	60.9	47.4	61.5	90.6	55.6	49.8	84.5	52.3	39.4	85.4	53.5	43.8
Poverty Headcount (%)												
shock												
Sex												
Male	79.6	58.3	22.5	35.8	39.9	21.9	36.6	37.4	30.2	38.5	38.9	27.2
Female	96.0	75.0	25.0	45.8	39.8	37.0	53.5	43.8	42.2	54.5	43.9	39.8
Status												
married	81.4	60.0	22.2	36.8	39.8	23.0	36.0	36.6	31.0	38.8	38.5	28.1
others	95.0	72.7	28.6	43.2	40.3	34.5	59.8	48.8	40.6	56.6	47.5	38.4
Age												
30 & below	71.4	75.0	25.0	19.5	39.2	24.7	37.3	29.9	19.2	31.5	35.9	21.7
31–40	94.7	72.7	16.7	42.5	41.5	22.6	36.8	41.3	41.0	42.2	42.2	33.0
41–50	87.0	57.1	26.7	45.7	39.7	21.8	39.6	32.1	28.1	45.9	35.8	26.4
51–60	78.9	28.6	14.3	32.4	30.7	27.0	41.7	40.6	32.6	40.5	37.2	30.6
61 & above	100.0	100.0	50.0	40.9	51.2	36.4	45.7	50.0	35.0	45.7	51.4	35.7
Education												
Illiterate	100.0	56.3	37.5	45.8	49.7	31.8	60.0	43.8	41.5	56.6	46.7	38.5
Some education	81.6	75.0	14.8	39.7	37.2	22.5	38.4	39.3	30.4	41.6	39.4	27.2
Secondary and above	61.5	50.0	22.2	21.7	32.7	21.1	17.5	30.8	25.1	21.5	31.9	23.7
Household size												
1–5	87.9	62.5	30.0	29.0	35.7	21.5	37.1	36.2	31.3	36.5	36.6	28.6
6–10	80.5	65.0	13.8	43.5	44.1	25.1	42.5	42.3	33.7	45.4	44.0	29.6
11–15	100.0	0.0	66.7	71.4	50.0	58.3	41.7	57.1	46.2	64.5	52.4	53.6

TABLE 4. Poverty profile and trends, 2001-2008 (continued)

Household Characteristics	MFI			Other loans			No loan			All		
	2001	2004	2008	2001	2004	2008	2001	2004	2008	2001	2004	2008
Agri land												
Landless	88.9	73.7	23.3	37.6	40.6	26.3	40.3	37.3	33.4	41.4	39.5	30.7
Less than 0.5 ha	100.0	66.7	50.0	52.9	37.5	23.3	45.5	55.6	32.8	52.2	49.6	30.0
0.5–1 ha	60.0	0.0	0.0	37.0	43.8	31.0	42.9	45.5	33.9	41.8	43.6	32.2
1–2 ha	100.0	50.0		26.8	34.8	25.0	41.5	36.5	30.9	40.9	36.1	28.9
2–3 ha	80.0	0.0	50.0	29.6	41.2	17.1	34.3	30.0	23.2	35.8	35.1	21.5
3 ha & above	66.7	100.0	0.0	20.0	40.0	17.5	10.7	25.0	35.2	22.8	31.6	28.1
CPR												
No	97.4			25.0	0.0	0.0	11.8	0.0	13.3	30.0	0.0	11.4
Yes	82.1	57.9	30.8	36.9	38.7	22.9	41.3	42.0	36.0	42.0	41.1	30.7
Shock												
No	97.4	100.0	29.2	40.2	41.6	22.9	42.3	44.1	34.9	48.1	44.8	31.3
Yes	73.2	31.6	17.9	37.1	38.5	26.9	38.7	34.2	28.0	39.4	35.8	27.0

Source: Author's calculation based on CDRI 2001–2008 household's surveys

4.3. Loan characteristics

4.3.1. Type of loan

There are two forms of loan taken by households in the sample villages: loan in cash or in kind, such as seeds, fertilizers, and the like. The percentage of loans in cash increased from 77 percent in 2001 to 81 percent in 2004 and a further 91 percent in 2008. In contrast, loans in kind decreased from 21 percent in 2001 to 19 percent in 2004 and to 7 percent in 2008.[1] This may partly reflect the increasing availability of MFIs throughout the country during the period studied. Those institutions provide loans in cash rather than in kind.

4.3.2. Source of loans

The source of loans are categorized into two groups: informal and formal sources. Informal sources include relatives, friends, and private money lenders; formal sources include NGOs MFIs, and ACLEDA. Table 5 lists sources of loans, average loan size, and average monthly interest rates by sources and by various household characteristics over 2001-2008. In general, the growth of average loan sizes were very strong, while that of average interest rates were on a declining trend over the same period. The source of loans shifted from the informal to the

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[1] These are the author's calculations based on Cambodia Development Resource Institute's 2001-2008 surveys.

formal, as the proportion of informal loans *vis-à-vis* formal loans changed around from 90:10 in 2001 to around 50:50 in 2008. Interestingly, despite the increasing share of loans from formal sources, the interest rates charged by informal sources remained sticky and higher than those charged by the formal lenders, and the interest rate differential between the two sources increased significantly in 2008.

Breaking down the data by poverty status, the average loan size for both poor and non-poor groups is found to grow by three times over 2001-2008. Nevertheless, the size of loans for the poor group was nearly three times smaller than that of the non-poor. Interest rates charged on the poor persistently went up and overtook that for the non-poor in 2008, mainly stemming from the increase of interest rate of informal loans for the poor over 2001-2008. Several factors can explain why the poor paid higher interest rates when taking informal loans, which consisted of loans from relatives, friends, and private money lenders. The rise of interest rates for the informal loans for the poor group was driven mainly by a higher rate charged by business-oriented money lenders who needed to take default risk into account when providing loans to the poor who usually do not have durable asset as collateral.

By purpose of loan use, it is found that the share of loans from informal sources for both productive and non-productive purposes narrowed down notably but remained significant, and the breakdown seems to suggest that productive loans came mostly from formal sources while the non-productive loans came from the informal sources in 2008. It also found that the interest rate from informal source for the productive and non-productive loan rose fairly, but the increase of the former is higher than that of the later. By contrast, on the average the interest rate from formal sources for both purposes declined and converged to 3.1 percent in 2008. It seems the formal source applied uniform interest rate to all groups regardless of the background or other characteristics. Regarding the loan amount, on average the productive loan is found to have larger size than the non-productive loan.

By gender of household head, despite the share of informal loans, the group was on decreasing trend. Female-headed households remained reliant on informal sources, while male-headed households depended equally on both sources. The average loan size from both sources continued to grow for both household groups except for informal loans in 2001, the average loan size for the male-headed group was always relatively larger. Regarding the interest rate for the informal loan which was paid by both groups, there is no clear pattern over time, but the female-headed group paid less than their male counterparts in 2008. For formal loans, there appeared to be no gender discrimination since the interest rates were charged almost equally to both groups.

TABLE 5. Source of loan, 2001-2008

Household Characteristics		Informal			Formal			Total		
		2001	2004	2008	2001	2004	2008	2001	2004	2008
Total	% of row	88.9	71.4	50.4	11.1	28.6	49.6	100.0	100.0	100.0
	Amount (10 thousand Riel)	25.7	38.0	146.5	25.8	57.4	150.9	25.7	43.6	148.7
	Interest rate (monthly)	4.8	4.4	5.1	3.5	3.6	3.1	4.7	4.2	4.1
Poverty										
Non poor	% of row	92.4	71.6	50.1	7.7	28.4	49.9	100.0	100.0	100.0
	Amount (10 thousand Riel)	30.1	45.5	178.3	40.0	64.9	166.6	30.7	51.0	172.5
	Interest rate (monthly)	5.8	4.8	4.8	4.0	3.7	3.1	5.7	4.5	3.9
Poor	% of row	83.7	71.1	51.5	16.3	28.9	48.5	100.0	100.0	100.0
	Amount (10 thousand Riel)	18.4	24.4	39.3	15.9	44.2	94.9	18.0	30.1	66.2
	Interest rate (monthly)	3.2	3.7	6.3	3.3	3.3	2.9	3.2	3.6	4.7
Purpose										
Productive	% of row		62.0	44.7		38.0	55.3		100.0	100.0
	Amount (10 thousand Riel)		44.0	202.9		63.1	168.4		51.3	183.8
	Interest rate (monthly)		4.2	5.3		3.6	3.1		4.0	4.1
Non-productive	% of row		80.2	60.8		19.8	39.2		100.0	100.0
	Amount (10 thousand Riel)		33.7	70.9		47.3	106.0		36.4	84.7
	Interest rate (monthly)		4.5	4.8		3.4	3.1		4.3	4.1
Sex of household										
Male	% of row	90.5	70.8	49.8	9.5	29.2	50.2	100.0	100.0	100.0
	Amount (10 thousand Riel)	25.4	39.7	159.1	28.0	62.2	152.9	25.6	46.2	156.0
	Interest rate (monthly)	5.0	4.1	5.6	3.5	3.6	3.1	4.9	4.0	4.3
Female	% of row	81.9	74.6	53.3	18.1	25.4	46.7	100.0	100.0	100.0
	Amount (10 thousand Riel)	27.1	30.4	91.9	21.0	30.8	141.1	26.0	30.5	114.8
	Interest rate (monthly)	4.0	5.6	3.0	3.6	3.5	3.0	3.9	5.1	3.0
Agricultural land size										
Landless	% of row	94.7	79.5	59.9	5.3	20.5	40.1	100.0	100.0	100.0
	Amount (10 thousand Riel)	34.1	35.6	83.0	17.3	70.6	126.9	33.2	42.8	100.6
	Interest rate (monthly)	6.9	7.4	10.0	4.3	3.7	3.0	6.7	6.6	7.0
< 0.5 ha	% of row	88.3	61.3	45.9	11.7	38.7	54.1	100.0	100.0	100.0
	Amount (10 thousand Riel)	20.3	36.9	93.0	24.4	38.3	106.8	20.7	37.4	100.5
	Interest rate (monthly)	4.1	2.6	4.9	4.4	3.7	3.1	4.1	3.0	3.9
0.5–1 ha	% of row	86.2	67.4	42.2	13.8	32.6	57.8	100.0	100.0	100.0
	Amount (10 thousand Riel)	20.2	29.9	89.1	15.9	65.7	84.0	19.6	41.6	86.1
	Interest rate (monthly)	5.0	4.9	2.7	3.7	3.6	3.0	4.9	4.5	2.9
1–2 ha	% of row	88.9	75.0	49.5	11.1	25.0	50.6	100.0	100.0	100.0
	Amount (10 thousand Riel)	27.5	36.3	146.7	599.8	73.5	151.2	30.9	45.6	149.0
	Interest rate (monthly)	4.4	3.4	1.6	2.5	3.3	3.0	4.2	3.4	2.3
2–3 ha	% of row	90.4	80.4	58.5	9.6	19.6	41.5	100.0	100.0	100.0
	Amount (10 thousand Riel)	33.2	60.0	258.4	14.0	34.5	230.9	31.4	55.0	247.0
	Interest rate (monthly)	2.5	3.0	2.2	3.0	3.5	2.9	2.5	3.1	2.5
> 3 ha	% of row	83.6	68.4	38.4	16.4	31.6	61.6	100.0	100.0	100.0
	Amount (10 thousand Riel)	24.0	53.1	391.5	16.2	59.8	268.7	22.8	55.2	315.8
	Interest rate (monthly)	5.1	1.8	2.5	2.8	3.3	3.4	4.7	2.3	3.1

Source: Author's calculation based on CDRI 2001–2008 household's surveys

By agricultural land size, the pattern of informal loans showed the same trend for all land holding groups. Across all groups the share of informal loans decreased around 31-45 percent over 2001-2008. In 2008, the landless group was the most reliant on informal sources to adjust their spending borrowing 60 percent of their loan from those sources followed by the 2-3 hectare household group, then the 1-2 hectare household group.

Although most of the landless and relatively land-abundant households depended largely on the same informal sources, the reasons differed as the two groups was different. The agricultural landless lacked other options besides access informal source for loans because they may not be able to fulfill the requirements to access formal loans. In contrast, the land-abundant may still depend on informal sources to borrow large amounts for capital adjustment which formal sources alone may not be able to provide. Aside from the ability to easily access formal loans, the land abundant may also have relatives or friends, who are better-off and who have money to lend with no or low interest rate upon requested.

4.3.3. Loan use

Table 6 illustrates how loans were used classified by poverty status and by other household characteristics, including whether or not a household is taking loans from MFI, gender of household head, household size, age of household head, and agricultural land size. The purpose of loans is regrouped into two main categories: productive and non-productive loans. The former refers to loans that are used for the purchase of agricultural inputs, business input, and land, as well as expenses used in job searching activities. The latter refers to those loans that are used to cover food shortage, medical cost, old debt repayment, and social ceremonies. There are no figures for 2001 since questions regarding the use of loans were only introduced in 2004 survey.

The average size of loans shot up significantly while the average borrowing cost dropped only slightly from 2004 to 2008. Meanwhile the share of productive loans increased significantly from 48.2 percent to 64.5 percent, at the expense of the non-productive loans. The average borrowed amount increased by more than three times for productive loans and by more than double for non-productive ones. The monthly interest rate for both loan types adjusted slightly and converged to 4.1 percent in 2008. The rising food prices in 2008, which created incentives for rural households to invest more in farming and other related businesses, could account for a surge of both shares and the average amount of productive loans, while the competition over limited loans could be the factor explaining the convergence of borrowing costs for productive and non-productive loans.

Comparing the use of loans by poverty status reveals that the average loan size is relatively smaller for the poor *vis-à-vis* the non-poor and that the difference in loan sizes between the two groups was further increased by a much faster growth of loan size among the non-poor. Both the poor and the non-poor are found to

be able to use the loan more for productive purposes over time, but again the percentage of productive loans and average loan size was higher for the non-poor group. It is worth noting that the average borrowing cost was down for the non-poor, but it went up considerably for the poor, particularly for loans used for non-productive purposes. This could largely reflect the fact that the non-poor who are more credit worthy than the poor could borrow more at lower interest rates, and they may be able to use credit more productively.

TABLE 6. Use of loan, 2004-2008

Household Characteristics		Productive		Non-Productive		All	
		2004	2008	2004	2008	2004	2008
Overall	% of row	48.2	64.5	51.8	35.5	100.0	100.0
	Amount (14 thousand Riel)	51.3	183.8	36.4	84.7	43.6	148.7
	Interest rate (monthly)	4.0	4.1	4.3	4.1	4.2	4.1
Poverty							
Non poor	% of row	51.7	67.8	48.3	32.2	100.0	100.0
	Amount (10 thousand Riel)	57.4	204.6	44.1	104.8	51.0	172.5
	Interest rate (monthly)	4.3	4.1	4.7	3.5	4.5	3.9
Poor	% of row	41.8	53.0	58.2	47.0	100.0	100.0
	Amount (10 thousand Riel)	37.5	92.1	24.9	37.1	30.1	66.2
	Interest rate (monthly)	3.5	3.8	3.6	5.7	3.6	4.7
MFI							
Non-MFI	% of row	47.7	61.9	52.3	38.1	100.0	100.0
	Amount (10 thousand Riel)	57.6	172.2	37.4	92.6	47.1	141.9
	Interest rate (monthly)	4.1	4.7	4.6	4.8	4.4	4.7
MFI	% of row	50.0	69.7	50.0	30.4	100.0	100.0
	Amount (10 thousand Riel)	28.2	203.8	32.4	65.4	30.3	161.8
	Interest rate (monthly)	3.7	3.1	2.9	2.7	3.3	2.9
Gender							
Male	% of row	50.5	65.7	49.5	34.3	100.0	100.0
	Amount (10 thousand Riel)	52.7	190.1	39.6	90.6	52.7	190.1
	Interest rate (monthly)	4.0	4.3	3.9	4.3	4.0	4.3
Female	% of row	36.8	59.1	63.2	41.0	100.0	100.0
	Amount (10 thousand Riel)	41.5	151.5	24.1	61.9	41.5	151.5
	Interest rate (monthly)	4.1	2.8	5.7	3.3	4.1	2.8
Agricultural land size							
Landless	% of row	39.7	54.7	60.3	45.4	100.0	100.0
	Amount (10 thousand Riel)	60.0	113.7	31.5	84.8	42.8	100.6
	Interest rate (monthly)	5.7	6.9	7.2	7.1	6.6	7.0
< 0.5 ha	% of row	41.0	61.2	51.0	38.8	100.0	100.0
	Amount (10 thousand Riel)	49.0	117.0	34.0	74.4	37.4	100.5
	Interest rate (monthly)	2.9	4.5	3.0	2.9	3.0	3.9
0.5–1 ha	% of row	45.7	61.1	54.3	38.9	100.0	100.0
	Amount (10 thousand Riel)	61.0	112.4	25.2	44.7	41.6	86.1
	Interest rate (monthly)	4.6	3.0	4.3	2.8	4.5	2.9

TABLE 6. Use of loan, 2004-2008 (continued)

Household Characteristics		Productive		Non-Productive		All	
		2004	2008	2004	2008	2004	2008
1–2 ha	% of row	49.3	69.2	50.7	30.8	100.0	100.0
	Amount (10 thousand Riel)	38.9	168.3	52.1	105.5	45.6	149.0
	Interest rate (monthly)	4.3	2.7	2.5	1.5	3.4	2.3
2–3 ha	% of row	60.8	73.9	39.2	26.2	100.0	100.0
	Amount (10 thousand Riel)	69.1	295.7	33.1	109.4	55.0	247.0
	Interest rate (monthly)	3.1	2.5	3.2	2.5	3.1	2.5
> 3 ha	% of row	65.8	82.2	34.2	17.8	100.0	100.0
	Amount (10 thousand Riel)	55.2	352.9	60.2	144.5	315.8	52.6
	Interest rate (monthly)	2.1	3.2	2.5	2.4	2.3	3.1

Source: Author's calculation based on CDRI 2001–2008 household's surveys

By MFI status, it is found that there is a significant growth of average loan size of MFI and non-MFI borrowers over 2004-2008, but that the growth of the former is relatively stronger. The discrepancy in interest rates between the two groups widened as the low borrowing cost for MFI households continued to drop while that of non-MFI continued to rise. The proportion of productive loans versus non-productive loans, which were at 50:50 for the MFI group and 48:52 for the non-MFI group in 2004, changed to 70:30 for the MFI group and 62:38 for the non-MFI group in 2008. This suggests that more MFI households were able to direct loans for productive purposes related to non-MFI households. This, in part, accounts for MFI policies to encourage borrowers to use loans towards this objective in addition to the relatively lower interest rate they provided.

By gender of household head, the average loan size is found to increase significantly for male-headed group and female-headed group, but the interest rate charged for the former is found to be higher while that for the latter group becomes less expensive. This is likely because households headed by females, who seemed to be more risk averse, were unlikely to take high-interest loan for whatever purpose from those who would charge high borrowing cost such as private money lenders. On the contrary, households headed by males may involve a more risk-bearing business which was expected to yield high returns, and hence they were charged higher borrowing cost. Table 5 shows that the percentage of productive loans taken by the male-headed group is significantly higher and grew significantly faster compared to the female- headed group. It also shows that the average amounts borrowed by the male-headed households were always larger and the interest rates they paid were always higher.

By agricultural land holding size, it is found that average loan size significantly increased across all groups, but that the interest rates rose only for the landless, near landless groups, and those households possessing land of more than 3

hectares. However, there is likely a negative relationship between land size and interest rates in the sense that lower interest rates were charged for households with larger agricultural land. This is because land is an asset that is widely used as collateral by rural households to obtain loans from formal and informal sources alike. Lenders might evaluate risks involving their loans and charge interest rates according to the size of land that was put as collateral. This argument is supported by the evidence presented in Table 6 showing that agricultural landless households always paid the highest interest rates amongst all groups, and in 2008 they paid more than double compared to those who possessed agricultural land of more than 0.5 hectares. Not only could the large land holders obtain loans at lower cost, but they could also use it more for productive purposes. Table 6 also indicates that the share of productive loans grew notably as the size of agricultural land increases.

5. Effects of microfinance: methodology and regression results

5.1. Methodology

In this paper, the DID method, which has been widely used in non-experimental evaluations, will be employed to detect the effect of the use of microcredit on poverty reduction. This method estimates the difference in the outcome during the post-intervention period between a treatment group and comparison group relative to the outcomes observed during a pre-intervention baseline survey. The DID method assumes that unobserved heterogeneity in participation is present, but that such factors are time-invariant. With data on project and control observations before and after the program intervention, therefore, this fixed component can be differenced out.

Even though DID implementation through regression (OLS or fixed effects) controls for household-and-community-level covariates, the initial conditions during the baseline survey may have a separate influence on the subsequent changes in outcomes or assignment to the treatment. Ignoring the separate effect of initial conditions therefore may cause bias in the DID estimates. Combining PSM with the DID method can help resolve this problem by matching units in the common support. Controlling for initial area conditions can also resolve non-random program placement that might cause bias to the program effect.

A combined approach using PSM and the DID method is taken to assess the effect of the use of MFI on poverty reduction. The merit of PSM is that it can match each participant with an identical non-participant in order to reduce bias based on observable characteristics during the baseline survey, while that of DID is that it can eliminate unobserved variable bias provided that it does not change over time.

A potential source of endogeneity bias is that initial conditions are likely to determine project placement and to influence the subsequent growth path and

prospects of the communes, as emphasized by Jalan and Ravallion [1998]. This combined methodology of DID and PSM aims to correct these potential sources of selection bias. A conventional DID gives unbiased estimates based on the assumption that selection bias is constant over time. However, if there are time-variant factors that influence placement, then MFI placement is still correlated with the error term in the differenced equation. To allow for the possibility of time-variant selection bias due to initial observables, the predicted probability of participating in the MFI (the propensity score) to match the comparison groups in the DID estimates is used. PSM is implemented using logit, which includes initial conditions that may affect subsequent trajectories as explanatory variables. These impact estimates are then constructed by comparing the before and after MFI changes in outcome measures for the treatment groups with those for the matched comparison groups.

Specifically, the average impact for the use of microcredit (DID) can be written as

$$DD = \sum_{T} DD_i / N_T$$

Where

$$DD_i = (Y_{i1}^T - Y_{i0}^T) \sum W_{ij} (Y_{j1}^C - Y_{j0}^C)$$

is the impact estimate for group i, T denotes treatment groups, and C denotes comparison groups respectively, $(Y_{i1}^T - Y_{i0}^T)$ is the change in the outcome measure for treatment group i, $(Y_{j1}^C - Y_{j0}^C)$ is the change in outcome for comparison group j, and W_{ij} is the weight given to the jth controlled household in making a comparison with i^{th} treatment household. N_T in the first equation is the total number of households using microcredit in 2001. We apply non-parametric kernel matching in which all the non-participants are used as comparison households and weights are assigned according to a kernel function of the predicted propensity score, following Heckman, Ichimura, and Todd [1997].

The key assumption of PSM or weighted DID in this context is that the selection bias is conditional on the observed placement covariates in the baseline. The estimates will be biased if there are unobservables that affect both treatment and outcome changes. Since all treatment households were selected based on initial conditions, there is no need to consider the latent factors that might influence changes both in treatment and outcome overtime. In the logit model used to calculate the propensity scores, we control for an array of initial conditions that may subsequently affect changes in the households. However, one must consider the possibility of omitted initial conditions that are correlated with placement and

outcome changes overtime.

In terms of a regression framework, Hirano, Imbens, and Ridder [2003] show that a weighted least squares regression, by weighting the control observations according to their propensity scores, yields a fully efficient estimator:

$$Y_{it} = \alpha + \beta T_i + \gamma \Delta X_{it} + \varepsilon_{it}, \beta = DD$$

The weight is the above equation is equal to 1 for the treated and to $\hat{P}(X)$ / $(1 - \hat{P}(X))$ for comparison households.

5.2. Regression results

5.2.1. Microcredit participation

The probability of a household's participation in microcredit is estimated using a logit model. The detailed results, including a list of the initial households characteristics included in the logit, are reported in Table 7.

TABLE 7. Microcredit participation, logit regression

mfl2001	Coef.	Std. Err.	z	P>z	[95%Continterval]	
married 2001	0.14123	0.35005	0.4	0.69	-0.5446	0.8273
gender of head 2001	0.49074	0.30072	1.63	0.10	-0.0987	1.0801
age of head 2001	-0.01089	0.00753	-1.45	0.15	-0.0256	0.039
edu of head 2001	-0.00044	0.02990	-0.01	0.99	-0.0590	0.0582
dependency ratio 2001	-0.02925	0.05712	-0.51	0.61	-0.1412	0.0827
onfarm job 2001	-0.13052	0.27442	-0.48	0.63	-0.6684	0.4073
total agricultural land size 2001	0.16309	0.04512	3.61	0.00	0.0747	0.2515
log of per capita asset 2001	0.01083	0.05902	0.18	0.85	-0.1049	0.1265
ratio of irrigated land on total land 2001	-0.83073	0.34073	-2.44	0.02	-1.4985	-0.1629
access to CPR 2001	-0.39945	0.27344	-1.46	0.14	-0.9354	0.1365
shock 2001	-0.79370	0.19368	-4.1	0.00	-1.1733	-0.4141
constant	-0.81568	0.79830	-1.02	0.31	-2.3803	0.7490
N	637					
Pseudo-Rsquare	0.1463					

Consistent with selection criteria, households with larger agricultural land size and male-headed households were more likely to participate in microcredit schemes. The coefficient on the ratio of irrigated agricultural land overall is negative and significant, suggesting that households with larger irrigated land size seem to not participate in credit schemes. This seems counterintuitive,

but reflects the fact that households which can access irrigation are either non-poor or located in a remote village where MFI service is not widely available yet. With respect to access to CPR, it is found that in the initial year 2001, households who had access to it opted not to join MFI schemes as they were too poor to be optimistic about loan repayment. Nevertheless, the coefficient of access to CPR is not statistically significant. Similarly, the coefficient of shock is negative and significant, suggesting that shocks decreased the probability of participation. This may reflect the fact that the sudden death of a bread winner or the occurrence of a natural disaster decreases the capability of households to generate incomes, which makes them encounter difficulty in finding people to set up a group of four guarantors in order to obtain a loan from an MFI or NGOs.

As there is an imperfect overlap in the estimated propensity score for the treatment and controlled group, we limit the sample to the common support, ending up with 46 treated households and 591 controlled households for the rest of the analysis. Using the predicted propensity scores to match households, we achieve a close balancing of the initial observed household characteristics of the two samples. (Annexes 1-5 provide details)

5.2.2. Average treatment effect

We assess the impact of microcredit on two important outcome variables, namely per capita expenditure and per capita food expenditure. The richness of the current panel data set enables the separation of the effect into short term (2001-2004) and medium term (2001-2008) effects.

Table 8 displays the mean values of those indicators across treated and controlled groups in the baseline and for subsequent survey rounds. These generally moved in the expected direction over time, with a tendency to increase over the period in both treated and controlled groups. The key question then is whether there was a differential impact attributable to the use of credit by the treated households.

Table 8 presents DID estimates of the mean impacts using weightening methods discussed ealier as well as simple DID estimates. The estimates are given for two time periods, namely 2001-2004 (short term) and 2001-2008 (medium term). Under our assumptions, these estimates reflect causal effects of the use of microcredit. One, two, and three asterisks indicate whether each change is significantly different from zero at ten-, five-, and one-percent significance level respectively.

TABLE 8. Effect of microcredit on outcome variables

outcome indicators	2001–2004		2001–2008		2001–2004		2001–2008	
	DD	t-test	DD	t-test	DD	t-test	DD	t-test
per capita consumption	0.64	***	0.57	***	0.63	***	0.59	**
per capita food consumption	0.48	***	0.44	***	0.51	***	0.45	**
per capita health expenditure	0.48	**	0.44	*	0.38	*	0.34	
per capita education expenditure	0.19	*	0.36	*	0.14	*	0.32	

Focusing on the weighted DID, and starting with impacts by 2004, we see that across the examined indicators mean impacts are statistically significant in the short term. The results change slightly when we track impacts from 2001. Despite exerting positive impacts, per capita health expenditure and per capita education expenditure now exhibit insignificant impacts. As a result of using microcredit from MFIs, per capita consumption increased by 59 percent and per capita food consumption rose by 45 percent from 2001-2008. However, these impacts are relatively smaller compared to those occurred during 2001-2004.

6. Summary and conclusion

The results from poverty profile, loan characteristics and use, and PSM-DID analysis showed that microcredit helped reduce poverty by financing households with productive investment (purchasing agricultural inputs, start-up business and expansion, and migration) and that it increased per capita food consumption and consumption of the households that joined the microcredit scheme in 2001, during the following surveys in 2004 and 2008. On the poverty profile, it is found that poverty headcount in the MFI sample, which was highest in the initial year 2001, dropped faster compared to those in two other samples over 2001-2004 and 2001-2008. This could suggest that using loans from MFI have a positive effect on poverty reduction. Sources of loans are grouped as informal (family, relative, and private lender) and formal (NGO and MFI). The purpose of loans is regrouped into two main categories: productive and non-productive loans. The former refers to those loans that are used for the purchase of agricultural inputs, business input, and land as well as expenses used in job searching activities. The latter refers to those loans that are used to cover food shortage, medical cost, old debt repayment, and social ceremonies. There are no figures for 2001 because the questions regarding the use of loans were only introduced in 2004 survey. In general the percentage of loans used for productive purpose from both sources increased. Nevertheless, the proportion of productive loans versus non-productive loans, which were at 50:50 and 48:52 in 2004, changed to 70:30 and 62:38 in 2008 for the MFI and non-MFI groups, respectively. This suggests that more MFI households were able

to direct loans for productive purposes related to non-MFI households. This, in part, accounts for MFI policies to encourage borrowers to use loans towards this objective in addition to the relatively lower interest rate they provided.

Consistent with the selection criteria, households with larger agricultural land size and male-headed households were more likely to participate in microcredit schemes. The ratio of irrigated agricultural land overall is negative and significant, suggesting that households with larger irrigated land size seem to not participate in credit schemes. This seems counterintuitive, but it reflects the fact that households which have access to irrigation are either from a relatively non-poor area or are located in a remote village where MFI service is not widely available yet. Similarly, the coefficient of shock is negative and significant, suggesting that shock decreased probability of participation. This may reflect the fact the sudden death of a bread winner or the occurrence of a natural disaster decreases the capability of households to generate incomes, which makes them encounter difficulty in finding people to set up a group of four guarantors in order to obtain loans from an MFI or NGOs.

The result of regression analysis, based on the sample with the common support using the DID method, indicates that using MFI loans signficantly leads to better livelihood reflected in higher per capita consumption expenditure, food expenditure, education expenditure, and health care expenditure over 2001-2004. Over the longer term 2001-2008, the effect of using MFI loans is sometimes significant and positive but only the per capita consumption and per capita food consumption.

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ANNEX 1. Reduction of bias due to matching

Variable	Sample	Mean		% Reduction	
		Treated	Control	%bias	bias
married 2001	Unmatched	0.7826	0.8476	-16.7	
	Matched	0.7826	0.7994	-4.3	74.1
sex of head 2001	Unmatched	1.3043	1.1793	29.3	
	Matched	1.3043	1.2549	11.6	60.5
age of head 2001	Unmatched	42.2830	43.5060	-9.9	
	Matched	42.2830	42.8990	-5	49.6
edu of head 2001	Unmatched	3.1739	3.2586	-2.9	
	Matched	3.1739	3.2365	-2.1	26.1
dependency ratio 2001	Unmatched	1.7101	2.0238	-19.3	
	Matched	1.7101	1.8098	-6.1	68.2
onfarm job 2001	Unmatched	0.1304	0.0922	12.1	
	Matched	0.1304	0.1072	7.3	39.3
total agricultural land size 2001	Unmatched	1.9503	1.2039	39.6	
	Matched	1.9503	1.6012	18.5	53.2
log of per capita asset 2001	Unmatched	2.6291	2.5024	8.2	
	Matched	2.6291	2.6747	-3	64.0
ratio of irrigated land on total land 2001	Unmatched	0.0755	0.2137	-49.5	
	Matched	0.0755	0.0988	-8.4	83.1
access to CPR 2001	Unmatched	0.8478	0.9449	-32	
	Matched	0.8478	0.8827	-11.5	64.1
shock 2001	Unmatched	0.6087	0.8617	-59.4	
	Matched	0.6087	0.6074	0.3	99.5

ANNEX 2. Test of propensity score before and after matching

Summary of ps-test Before and After Matching				
BEFORE MATCHING				
	Percentiles	Smallest		
1%	2.869686	2.869686		
5%	2.869686	8.240543		
10%	8.240543	9.891338	Obs	11
25%	9.891338	12.10209	Sum of Wgt.	11
50%	19.3757		Mean	
		Largest	Std. Dev.	
75%	39.63693	32.02029		
90%	49.54116	39.63693	Variance	333.3048
95%	59.40742	48.54116	Skewness	0.5768721
99%	59.40742	59.40742	Kurtosis	2.143483

ANNEX 2. Test of propensity score before and after matching (continued)

	Percentiles	Smallest		
Summary of ps-test Before and After Matching				
BEFORE MATCHING				
AFTER MATCHING				
	Percentiles	Smallest		
1%	0.3163748	0.3163748		
5%	0.3163748	2.119589		
10%	2.119589	2.966697	Obs	11
25%	2.966697	4.320705	Sum of Wgt.	11
50%	6.147609		Mean	
		Largest	Std. Dev	
75%	11.48729	8.367522		
90%	11.59823	11.48729	Variance	27.30775
95%	18.54187	11.59823	Skewness	0.8308588
99%	18.54187	18.54187	Kurtosis	3.096073
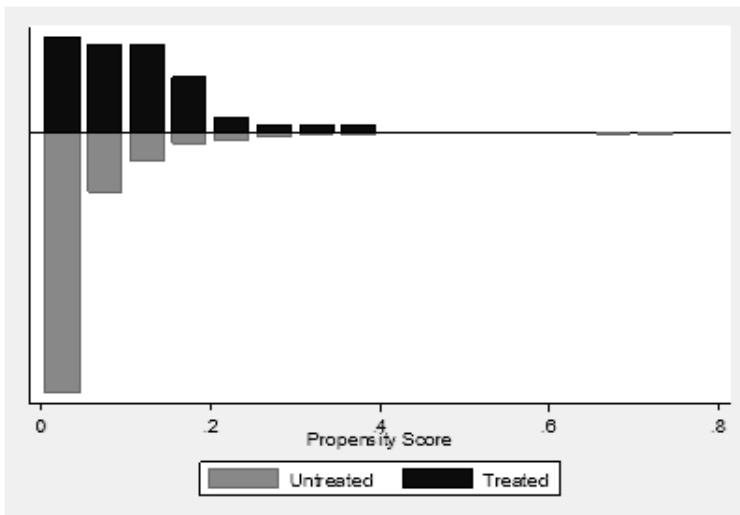
ANNEX 3. Propensity score of untreated and treated groups

Kernel density estimate
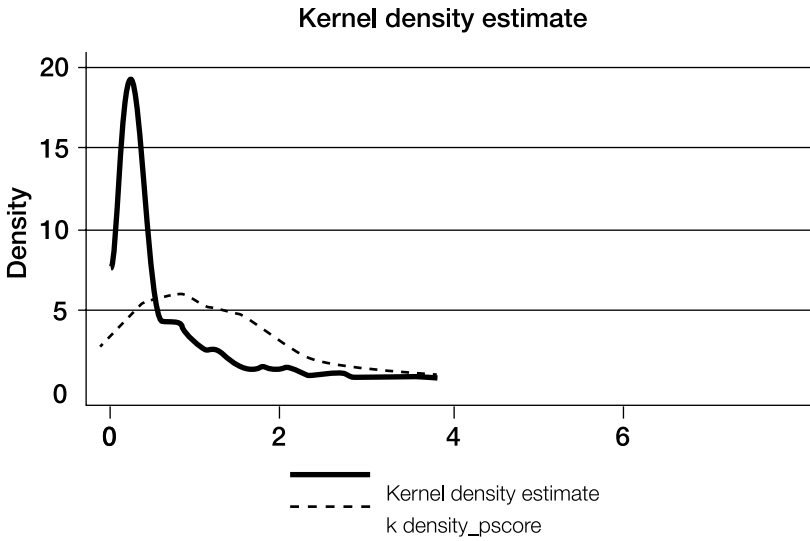
kernel - epanechnikov, bandwidth - 0.0329

ANNEX 4. Kernel density estimate before matching

Kernel density estimate
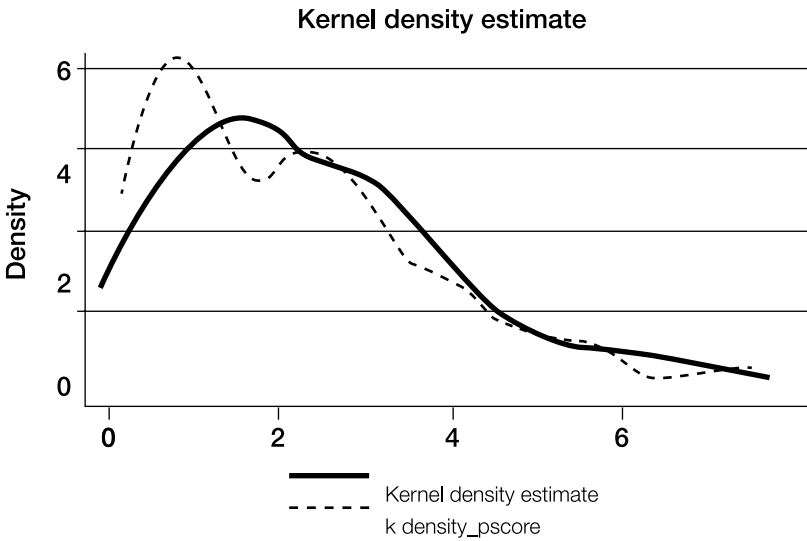
kernel - epanechnikov, bandwidth - 0.0329

ANNEX 5. Kernel density estimate after matching