How does competition among MFIs affect lenders and borrowers? An evaluation based on PKSF data in Bangladesh

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Abstract

Microcredit offered by microfinance institutions (MFIs) has emerged as one of the major source of credit for households living in rural areas in Bangladesh. However, competition among MFIs and its consequences on MFIs and their borrowers is a growing policy concern. In this paper we develop a theoretical model and examine the effect of MFI competition on MFI memberships, loan size and loan amount offered by MFIs, and loans received from informal sector and its interest rates, and borrowers debt burden. We use two rounds of survey data collected from both MFI members and non-members from villages characterized by both single and multiple MFIs. We find that in comparison to a monopoly market, competition among MFIs is associated lesser growth in the number of MFI loans, loan size and total amount borrowed from MFIs. In addition, we also find that while the role of informal sector credit and its interest rates increased for MFI borrowers, however, the rise in borrowing from the informal sector seems to be driven entirely by MFI members living in villages characterized by monopoly MFI.

Key words: Micro-finance, competition, informal lending, Bangladesh.
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1   Introduction

Micro-credit offered by micro-finance institutions (MFIs) has emerged as one of the most significant source of credit, especially for poor households living in rural areas in developing countries who otherwise would not have access to formal sector credit. According to the State of the Micro-credit Summit Campaign Report 2013 (http://stateofthecampaign.org/the-report/executive-summary/) by 2011, there were 195 million micro-credit borrowers. In Bangladesh, based on the nationally representative Household Income and Expenditure Survey (HIES) 2010 conducted by the of Bangladesh Bureau of Statistics, by 2010, MFI loan constituted more than 50% of total credit for rural households, and for households with smaller landholding, such as 0.5 acre or less, it constituted approximately 54% of total credit.[1] Furthermore, approximately 33% of all rural households took MFI loans, and the average number of loans in 2010 stood at 1.2 loans per household.

The increased reach of MFIs to rural unbanked borrowers has accompanied with competition among MFIs. The objective of our study is to understand the effects of competition among MFIs on borrowers' MFI memberships, loan size and loan amount offered by MFIs, and loans received from informal sector and its interest rates, and borrower's debt burden in rural areas of Bangladesh. In addition, our focus is to understand the interactions between informal lenders that traditionally dominated rural sector and MFIs that newly emerged as a major source of credit, and how their interactions affected loans received from informal sector and its interest rates for rural borrowers with limited access to formal sector credit.

Competition among MFIs in micro-credit market and its consequences on MFIs and borrowers is a growing concern for policy makers and development practitioners in Bangladesh and many other developing countries (PKSF 2006, Vogelsang 2003, McIntosh et al. 2005, de Quidt et al. 2013). In Bangladesh and elsewhere, MFIs have achieved phenomenal success in expanding credit and reaching the poor (Gonzalez 2010). Encouraged by the success, recent years have witnessed a large influx of competing MFIs in the rural sector. With borrowers having access to multiple MFIs, the restriction of 'one borrower from one household' is breaking down and in 2005, the overlapping/double-dipping rate (the proportion of borrowers with multiple lending sources) stood at around 40% (PKSF, 2006). Such a process has purportedly worsened MFI performance and has emerged as an important policy concern in Bangladesh and other matured micro-credit markets such as India (Srinivasan 2010), Bolivia (Vogelsang 2003) and elsewhere (McIntosh et al. 2005).

The rural credit market in Bangladesh has historically been served by a range of informal providers such as landlords, local money lenders, shopkeepers, friends and relatives. During the 1970s, the government expanded its state-owned banks' branches to rural areas and until 1982, acted as the major source of credit in the rural areas. However, the financial liberal-

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[1]The second most important source of credit for poor household was the informal sector interest bearing loans that constituted approximately 24% of total credit in 2010.

ization that had started in 1980s resulted in either the denationalization of state-owned banks or closure of their rural branches (Khalily and Meyer, 1993). However, the void created by the retreat of state-owned banks has not been fulfilled by private commercial banks. Instead, micro-finance institutions (MFIs) supported by national governments and donor agencies have rapidly expanded credit to a segment of (poor) rural households.

Understanding how MFI competition may affect lenders and borrowers is perhaps nowhere more important than in Bangladesh. Based on Credit and Development Forum (CDF) that collates annual data on MFIs and micro-finance(MF) NGOs, while the MFIs and MF-NGOs grew at an annual rate of 0.4%, the number of borrowers borrowing from them increased at a rate of 16.7%. Similarly, based on Mix Market Data[2], 82 MFIs listed there had a total of US$3.9 billion outstanding loans disbursed among more than 16.5 million micro-credit borrowers [3] (Taka 18,900 per borrower). The five largest MFIs that cover most districts had an outstanding loan of US$100 million or more, and each of the four largest MFIs had more than a million borrowers. While the high number of MFIs in aggregate suggests that micro-finance is very a competitive industry at national level, at local level the actual number of MFIs vary substantially. Moreover, at village level, that matters the most for borrowers access to MFI loans [4], even in 2012, there were villages that still remained outside the operation of MFIs (PKSF Annual Report 2013).

The literature on MFI competition is relatively nascent. However, the general presumption here is that competition among MFIs weakens repayment incentives since borrowers having access to multiple lenders reduces any given MFIs ability to discipline a borrower (Hoff and Stiglitz 1998). Competition also creates problem due to limited information sharing among MFIs, absence of borrowers credit history and costly verification. Indeed, focus group discussions with MFIs credit officers in Bangladesh suggest that misreporting and manipulation from borrowers have been on the rise and presumably increased competition among MFIs has led to lower repayment rate. This point has also been argued in McIntosh et al. (2005). However, the loan repayment rate of MFIs in Bangladesh at aggregate level does not show any apparent downward trend in recent years marked by increased competition. Based on two rounds of survey data conducted on MFI members and non-members collected from villages characterized by single and multiple MFIs, we find that as opposed to conventional wisdom, competition of MFIs is associated with fewer numbers of MFI memberships, smaller loan size and smaller amount of MFI loans. In addition, we also find that while the role of informal sector credit and its interest rate have reduced significantly between the survey periods, however, the difference in their roles between monopoly and competitive MFI market is not evident.

The rest of the paper is organized as follows: in Section 2, we review the theoretical and empirical literature, while we develop a theoretical model in Section 3. In Section 4, we describe

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[2]http://www.mixmarket.org/mfi/country/Bangladesh accessed in July 2014

[3]Borrower numbers for Grameen Bank the largest micro lender in the country, and few others were missing in the mix market data.

[4]MFIs do not offer credit to borrowers from outside villages

the data and empirical strategy while followed by empirical results in Section 5. We conclude the paper in Section 6.

2 Literature on MFI Competition

2.1 Theoretical Models and their Testable Implications

Theoretical papers that examined the mechanics of competition among MFIs on borrowers' outcomes are relatively new. Three such papers that make testable predictions are Hoff and Stiglitz (1998), Jain and Mansuri (2003), and McIntosh and Wydick (2005).

In Hoff and Stiglitz (1998), an increase in the number of lenders adversely affects borrowers' incentives to repay. If enforcement is done through collection effort and reputation effects of borrowers, the later (reputation effects) gets weakened with increased in (the number of) lenders. This in turn increases lenders enforcement costs, and may result in higher interest rates. Hoff and Stiglitz provide testable predictions; with increased competition among MFIs (uncollateralized lenders) the interest rates and default on loans will go up. However, the first outcome cannot be directly tested since interest rate is more of an administratively set and it is fairly constant across MFIs in Bangladesh (Salim 2013). In the case of the second outcome, the default rate of MFI loans is close to zero. In the specific case of our data, the total number of default loans among the sample households stood at 10 and 4 in year 1998 and 2010, respectively, which represented less than 1% of the total number of MFI loans. Hoff and Stiglitz (1998) predictions may be relevant if we think, given the regulatory constraints, MFIs adjust their loan size at the margin. In this case, competition may reduce loan size, which, as we will see, is supported by our empirical findings.

In McIntosh and Wydick (2005), while competition among MFIs may make the wealthier and impatient borrowers better off by offering them multiple loans, it makes the poorer and more patient borrowers worse off. The entry of a new MFI reduces the ability of the incumbent MFI to generate rents from the profitable borrowers and to cross-subsidize the poorest borrowers. Similar to Hoff and Stiglitz (1998), competition in McIntosh and Wydick (2005) reduces information sharing among lenders about borrowers which leads impatient borrowers to take multiple loans, which in turn, reduces repayment rate, and makes patient borrowers worse off. As said, repayment rates remain very high, almost perfect, in Bangladesh. However, in our empirical analysis, we will see if borrowers' heterogeneity matters or not. In particular, if a poor (land ownership less than 0.5 acre), female-headed, and older (household head is above 50 years old) borrowers are worse off in competition.

Jain and Mansuri (2003) is perhaps the first paper that gazed at the competition in rural credit market between incumbent informal lenders and an entrant MFI. However instead of competition, they focused on one specific but very important feature of micro-credit contracts, weekly/regular repayment schedule often imposed on clients, and showed how this particular

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feature may complement MFIs and informal lenders. In their model, the repayment schedule that the entrant MFI offers to its client requires the client to borrow from an informal lender, who (informal lender) ensures that the client does not engage in ex-post moral hazardous behavior. As such, Jain and Mansuri predict positive complementarities between informal lenders and MFIs, and the possibility of crowding-in of informal lenders and increased interest rate in the informal sector. Though Jain and Mansuri did not discuss competition among MFIs, one can conjecture that with competition, borrowers may not need to borrow from informal lenders, and it seems our data supports this conjecture. While borrowing from informal sector went up for MFI members in monopoly MFI market, MFI members in competitive MFI market borrowed less from the informal sector.

Competition among MFIs can lead borrowers to borrow from more than one MFIs, which is termed as double dipping in McIntosh and Wydick (2005). In PKSF data, information on the total number of loans taken from MFIs and the total number of MFI memberships are available, and we have used them to test this prediction. Related to double dipping is the debt burden on borrowers often portrayed as over-indebtedness due to MFI competition (Vogelgesang 2003). From PKSF data, we have constructed debt-ratio (total outstanding credit over total income) and an indicator if the client had to take a loan to repay another loan. The effect of competition on repayment of MFI loans is predicated to be negative. However, as is well known in the micro-finance literature, repayment rates have always been very high, and in the particular case of Bangladesh, the repayment rates remain as high as 99%, and hence this cannot be tested using the PKSF data. Similarly, in Bangladesh, interest rate is regulated and the variations in interest rate charged by MFIs are almost non-existent, and hence cannot be tested.

How competition reshapes the average loan size that MFIs offer is not discussed in any of the above three papers, and it seems that they all assume that MFIs do not adjust this important instrument. However, in PKSF data, it can be seen that the loan size varies over time and across space, and we will associate this change with a change in the market structure.

2.2 Empirical Literature

On multiple loan-taking/double-dipping: Multiple loan-taking has been associated with increased default rates in Vogelgesang (2003) and Marconi and Mosley (2005) in Bolivia during a period of economic crisis. However, Vogelgesang (2003) also found positive effect of credit market competition on repayment behavior of micro-finance clients. McIntosh et al. (2005) in Uganda found the evidence of double dipping through an increase in default rate at group level.

On over-indebtedness: Vogelgesang (2003) associated increased indebtedness of micro-finance clients in Bolivia with increased competition among MFIs.

Loan size offered by MFI: McIntosh et al. (2005) examined the effect of competition on loan size and found no effect. Again, the outcome is measured at group level, not at individual borrower level.

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On dropout from MFIs: McIntosh et al. (2005) found that increased competition among lenders in rural credit market significantly increases the likelihood of dropout of clients from the incumbent lenders. However, lenders considered in McIntosh et al. (2005) were heterogeneous and often offered differentiated products (e.g., repayment terms were different).

On interest rate: Fernando (2006) found that increased competition among MFIs led to a reduction in interest rates charged by MFIs over 2003-2006 in Cambodia. Porteus (2006) found a similar effect of competition on interest rates over the 1990s in Bolivia. However, Vogelgesang (2003) in the same context found the opposite effect with increased competition clients had to pay high interest rates in Bolivia.

On informal lending: Lending from MFI may work as a substitute to other lending sources and hence may reduce the borrowing from other sources including money lenders. In fact, this was the basis for expansion of state-owned banks in many developing countries in the 1960s and 1970s, and this has been the stated objective of many MFIs including Grameen Bank.[5]

Available empirical evidence relies heavily on observed associations. For example, Sinha and Matin (1998), Zeller et al. (2001), McKernan et al. (2005), and Barman et al. (2009) suggest that households in Bangladesh that borrow from MFIs often borrow from informal lenders as well. Furthermore, Mallick (2012) finds that moneylender interest rates are higher in the villages where higher percentage of households borrows from MFIs. This supports Jain and Mansuri (2003) that due to frequent, often weekly, repayment requirement, MFI lending generates demand for other lending, especially informal lending, hence works as a complement. Alternatively, MFI lending may make borrowers previously unqualified for informal lending credit-worthy and provide access to informal lending and fulfills their unmet credit demand. However, it is not clear how MFI competition may affect the demand for and supply of informal loans.

3 Theoretical Model

3.1 Before the MFI enters: informal money lender in isolation

There are many villagers in a village. Each villager has access to a risky production technology. With probability p the outcome of the project is $f(\cdot)$ and zero otherwise. The production technology $f(\cdot)$ satisfies the following usual assumptions

A 1. $f(\cdot) > 0$; $f'(\cdot) > 0$; $f''(\cdot) < 0$; $f'(0) = \infty$ and $f'(\infty) = 0$.

Definition 1. *Given A1, the efficient scale of investment (k^e), where $k^e = \underset{k}{argmax}[f(k) - k]$, is well defined.*

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[5]'Freeing' poor people from the clutches of 'evil moneylenders' is one of the important justifications put forward by MFIs (Meyer, 2002).

The villagers do not have any money or assets, so they have to borrow for investment. We will start with the case where MFIs are absent and there is one moneylender[6] in the village. We also assume due to thick interactions the money lender knows each borrower's project return and can enforce repayment perfectly. Let per unit cost of lending be c^L. In order to focus on the case of interest, we assume that the expected value of project return is higher than the cost for all scale of investment:

A 2. $pf(k) - c^L k > 0$.

The moneylender lends as much as the borrower wants. He chooses interest rate r_A^L to maximize his own profit subject to the limited liability constraint. So, the problem of the moneylender at any t is to

$$\underset{r_A^L}{\text{Maximize}} \quad p(1 + r_A^L)k_t - c^L k_t$$

Subject to:

$$\text{LL}_A: \quad f(k_t) \geqslant (1 + r_A^L)k_t \qquad \forall t \tag{1}$$

$$\text{PC}_A^L: \quad p(1 + r_A^L)k_t \geqslant c^L k_t \qquad \forall t. \tag{2}$$

We concentrate on the stationary problem. Hence, the problem of the moneylender becomes:

$$\underset{r_A^L}{\text{Maximize}} \quad p(1 + r_A^L)k - c^L k$$

Subject to:

$$\text{LL}_A^B: \quad f(k) \geqslant (1 + r_A^L)k \tag{3}$$

$$\text{PC}_A^M: \quad p(1 + r_A^L)k \geqslant c^L k. \tag{4}$$

Since, the moneylender is profit maximising so at optimum he charges interest rate r_A^L such that the limited liability constraint binds: $r_A^{L*} = \frac{f(k)-k}{k}$.[7] Hence, in absence of MFI, the borrower's utility is zero and, the moneylender's lifetime utility is $\frac{pf(k)-c^L k}{1-\delta}$.

3.2 One MFI and one moneylender

Now we will concentrate on the case where there is one MFI along with the moneylender. The differences between MFI and money lender are the following: Due to large scale of operation and subsidies received from the Government and donors, we assume, per unit lending cost of the MFI is less than that of the moneylender and it is normalised to zero. The interest rate (r) charged by the MFI is exogenously given[8] and the MFI chooses loan size in order to maximize borrower's welfare, given sustainability condition. We also assume that unlike the moneylender,

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[6]Like Mookherjee and Motta (2014) we assume: if there is more than one lender within a village, they collude

[7]Given A2 moneylender's participation constraint is satisfied.

[8]by Government regulation or by donors.

the MFI cannot observe borrowers' project returns, so a borrower can always report failure in order to avoid repayment. Hence, the MFI designs a contract $\langle \{k_t\}_{t=0}^{\infty} \rangle$ such that the borrower always repays, in case of success on her own and in case of failure by borrowing from the moneylender.

Each borrower decides whether to accept MFI's contract or not. She can either take loans from the moneylender and the MFI simultaneously or can borrow from the moneylender only to repay MFI's loan when her project fails or can borrow only from the moneylender. Due to close knitted community, the moneylender is aware of her decision and sets interest rate accordingly. Like the benchmark case, it can be shown that the profit maximizing moneylender extracts all the surplus from the borrower - the borrower's utility becomes zero whenever she takes loan from the moneylender. On the otherhand, the borrower gets all the surplus when she borrows from the benevolent MFI. So the borrower only takes loan from the moneylender, when her project fails, to repay MFI's loan.
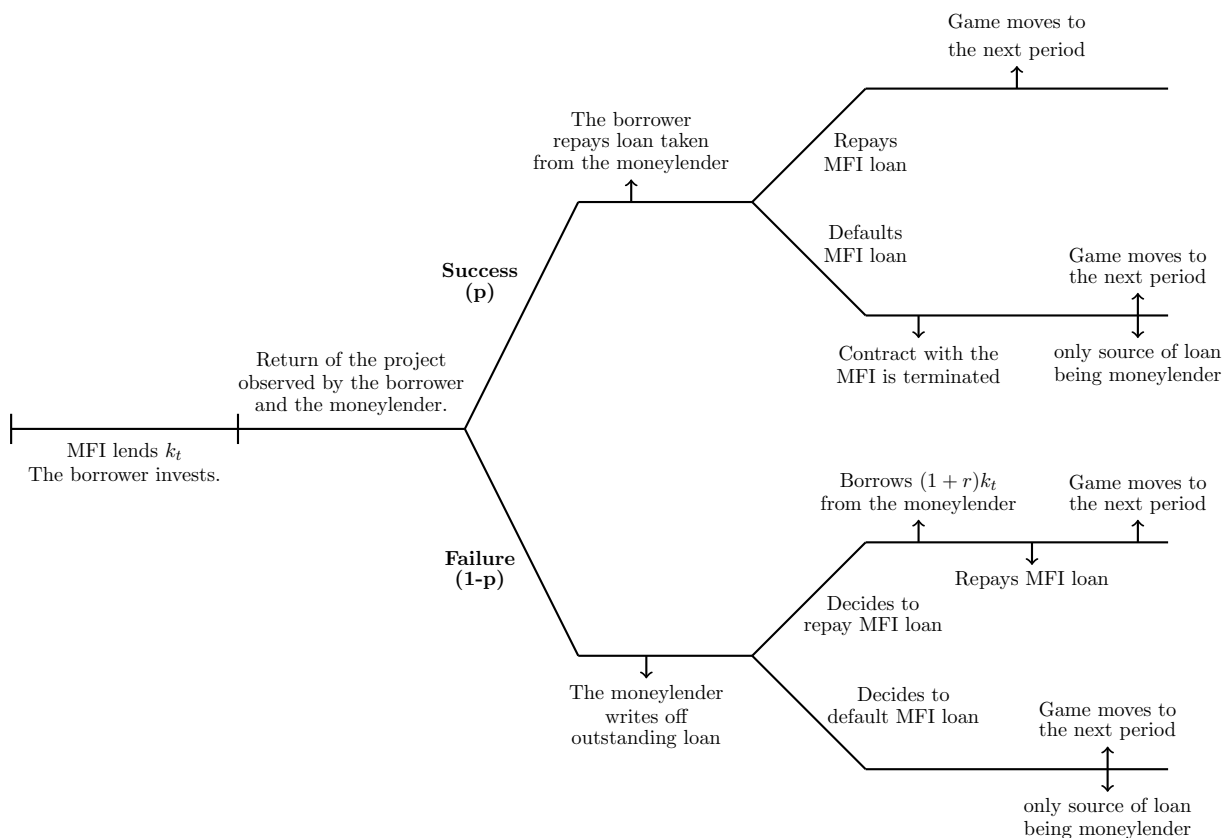
Figure 1: Borrowing and repayment options with one MFI and one moneylender

Given this observation and having been no default of MFI loan till date, at any t the following things happen: The MFI lends k_t and the borrower invests. With probability p the

project yields $f(k_t)$ and with probability 1-p it yields zero. The borrower and the moneylender observe it and in case of success she repays moneylender's outstanding loan, if any, immediately. Then she decides whether to repay MFI loan or not. In case she defaults, the MFI terminates the contract and her only source of loan, from next period onwards, becomes moneylender and in case of repayment the MFI contract remains valid. When her project fails, the moneylender writes off outstanding loans, if any. The borrower then decides whether to repay MFI loan or not. If she decides to repay, she borrows $(1+r)k_t$ from the moneylender and she remains eligible for MFI loan whereas when she defaults, the MFI terminates the contract.

Now let us concentrate on the incentive compatibility constraints:

1. Suppose the borrower becomes successful at t, then the borrower would choose to repay, if her lifetime utility from repayment is (weakly) greater than that from default:

In case her project was successful at $t-1$ her utility from repayment at t is

$f(k_t) - (1+r)k_t + \sum_{t'=t+1}^{\infty} \delta^{t'-t} \left[p[f(k_{t'}) - (1+r)k_{t'}] - \delta p(1-p)(1+r_M^L)(1+r)k_{t'} \right]$ while

her utility from default being $f(k_t)$. In case her project was a failure at $t-1$ her utility from

repayment is $f(k_t) - (1+r)k_t - (1+r_M^L)(1+r)k_{t-1} + \sum_{t'=t+1}^{\infty} \delta^{t'-t} \left[p[f(k_{t'}) - (1+r)k_{t'}] - \right.$

$\left. \delta p(1-p)(1+r_M^L)(1+r)k_{t'} \right]$ whereas that from default is $f(k_t) - (1+r_M^L)(1+r)k_{t-1}$[9]

So incentive compatibility constraint in case of success is:

$$f(k_t) - (1+r)k_t + \sum_{t'=t+1}^{\infty} \delta^{t'-t} \left[p[f(k_{t'}) - (1+r)k_{t'}] - \delta p(1-p)(1+r_M^L)(1+r)k_{t'} \right] \geqslant f(k_t)$$

2. Suppose the borrower's project fails then the borrower would choose to borrow from the moneylender and repay MFI loan so that her contract with the MFI is not terminated if:

$-\delta p(1+r_M^L)(1+r)k_t + \sum_{t'=t+1}^{\infty} \delta^{t'-t} \left[p[f(k_{t'}) - (1+r)k_{t'}] - \delta p(1-p)(1+r_M^L)(1+r)k_{t'} \right] \geqslant 0$

We concentrate on the stationary problem, so the problem of the MFI is:

$$\underset{k}{\text{Maximize}} \quad \frac{p[f(k) - (1+r)k] - \delta p(1-p)(1+r_M^L)(1+r)k}{1-\delta}$$

Subject to:

$$\text{IC}_M: \quad \frac{\delta}{1-\delta} p \left[f(k) - (1+r)k - \delta(1-p)(1+r_M^L)(1+r)k \right]$$

$$\geqslant \max\{(1+r)k, \delta p(1+r_M^L)(1+r)k\} \tag{5}$$

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[9]Observe she can default on MFI loan, but she has to repay moneylender loan, so her utility from default is $f(k_t) - (1+r_M^L)(1+r)k_{t-1}$.

Like before the moneylender wants to maximize his own profit, so whenever a borrower's project fails and she borrows from him in order to repay MFI loan, he sets r_M^L such that her entire surplus of next period, in case of success, goes to him. So, the moneylender's problem when there is one MFI in the economy is to

$$\underset{r_M^L}{\text{Maximize}} \quad \delta p(1 + r_M^L)(1 + r)k - c^L(1 + r)k$$

Subject to:

$$\text{LL}_M^B: \quad f(k) \geqslant (1 + r_M^L)(1 + r)k + (1 + r)k \tag{6}$$

$$\text{PC}_M^L: \quad \delta p(1 + r_M^L)(1 + r)k \geqslant c^{ML}(1 + r)k. \tag{7}$$

In case of success the project yields $f(k)$, after repaying MFI loan the borrower has $f(k) - (1 + r)k$ in her hand, given limited liability constraint the borrower can atmost repay this amount to moneylender. Being profit maximizer, the moneylender would set interest rate such that the borrower would pay exactly $f(k) - (1 + r)k$. So optimum interest rate would be $r_M^{L*} = \frac{f(k) - (1 + r)k}{(1 + r)k} - 1$

MFI knows this and sets k accordingly, such that the borrower's lifetime utility is maximized. So after taking moneylender's interest rate into account, MFI's problem becomes:

$$\underset{k}{\text{Maximize}} \quad \frac{p[1 - \delta(1 - p)][f(k) - (1 + r)k]}{1 - \delta}$$

Subject to:

$$\text{IC}_M: \frac{\delta}{1 - \delta}p[1 - \delta(1 - p)][f(k) - (1 + r)k] \geqslant \max\{(1 + r)k, \delta p[f(k) - (1 + r)k]\} \tag{8}$$

Observe, when $\max\{(1 + r)k, \delta p[f(k) - (1 + r)k]\} = \delta p[f(k) - (1 + r)k]$, IC_M is satisfied for any k, whereas when $\max\{(1 + r)k, \delta p[f(k) - (1 + r)k]\} = (1 + r)k$ from (8) we have: $\frac{\delta p[1 - \delta(1 - p)]}{1 - \delta + \delta p[1 - \delta(1 - p)]} \geqslant \frac{(1 + r)k}{f(k)}$.

Definition 2. *Given any δ, $k_M^I(\delta)$ is the amount such that a borrower with discount factor δ is indifferent between repaying $k_M^I(\delta)$ and not repaying. Hence,*

$$\frac{(1 + r)k_M^I}{f(k_M^I)} = \frac{\delta p[1 - \delta(1 - p)]}{1 - \delta + \delta p[1 - \delta(1 - p)]} = g(\delta)$$

Observe, for every δ, $\exists$ a unique $k_M^I(\delta)$ such that borrower repays any amount $k \leqslant k_M^I(\delta)$ and does not repay any amount higher that $k_M^I(\delta)$. The maximum amount which a borrower repays, increases with her patience level, which is our next claim. Proof of the claim can be found in the Appendix.

Claim 1. *As δ increases $k_M^I(\delta)$ increases.*

This is quite intuitive in that, more patient borrowers care for future more and are willing to repay higher amount of loan, whereas less patient borrowers would run away with higher amount of loan even if that leads to loss in future access to MFI loan.

Hence, there exists a minimum δ for which a borrower repays the efficient amount i.e. k^e which gives us our next definition.

Definition 3. *Let δ_M be the minimum δ such that a borrower with discount factor δ_M is indifferent between repaying k^e and not repaying, i.e.*

$$\delta_M : \frac{\delta p[1 - \delta(1-p)]}{1 - \delta + \delta p[1 - \delta(1-p)]} = \frac{(1+r)k^e}{f(k^e)}.$$

Hence, at optimum $k_M^* = k_M^I < k^e \; \forall \delta \in [0, \delta^M)$

and $k_M^* = k^e \; \forall \delta \in [\delta^M, 1]$

Welfare:

Here, borrower's expected utility $\dfrac{p[1 - \delta(1-p)][f(k_M^*) - (1+r)k_M^*]}{1 - \delta}$ which is positive whereas when there was no MFI her utility was zero, so she is gaining with entrance of MFI. Moneylender's lifetime expected profit $= \dfrac{\delta p f(k_M^*) - (\delta p + c^L)(1+r)k_M^*}{1 - \delta}$.[10] For any given k, lifetime utility of a moneylender in a village where there is no MFI is higher than a moneylender operating in a village where there is one MFI. Lastly, since we have assumed MFIs to be benevolent, MFI's profit is zero.

3.3 Competitive MFI

Suppose there are many MFIs along with one moneylender in a village. Now, though the MFIs do not share information among themselves, average number of MFIs from which a typical borrower takes loans is common knowledge. MFIs take that into account while designing the contracts. We will only consider symmetric equilibrium,[11] so a borrower who gets k_t amount of loan at any t^{th} period, gets $\frac{k_t}{n}$ amount from a particular MFI. Like before it can be argued that a borrower would not take loan from the moneylender when loan from at least one MFI is available. She will only take a loan from the moneylender when her project fails.

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[10]By participation constraint of moneylender this cannot be negative. Hence, we need $f(k)$ to be sufficiently high and c^L not very high.

[11]Our conjecture is that the qualitative results will go through even if we consider asymmetric equlibria.

So, the problem of an MFI at any t is to

$$\underset{\{\frac{k_t}{n}\}_{t=0}^{\infty}}{\text{Maximize}} \quad \sum_{t=0}^{\infty} \delta^t \left[p[f(k_t) - (1+r)k_t] - \delta(1-p)p(1+r_c^L(n))(1+r)k_t \right]$$

Subject to:

$$\text{IC}_c: \quad \delta(V_{t+1}(n) - V_{t+1}(n-1))$$
$$\geqslant \max\{(1+r)[k_t - \frac{n-1}{n}k_t], \delta p(1+r)[(1+r_c^L(n))k_t - (1+r_c^L(n-1))\frac{n-1}{n}k_t]\} \quad \forall t. \quad (9)$$

where $V_t(x)$ is the continuation payoff from getting loan from x MFI-s and $r_c^L(x)$ is moneylender's interest rate when the borrower takes loan to repay loans of x MFIs. IC_c is saying irrespective of the fact whether a borrower's project is successful or not, she chooses to repay loans of all n MFIs over repayment to only n-1 MFIs, in case of success on her own and in case of failure by borrowing from the moneylender.

Without loss of generality we will consider only stationary problem. So the problem of the MFI at any t is to

$$\underset{\frac{k}{n}}{\text{Maximize}} \quad \frac{pf(k) - (1+r)k - \delta(1-p)p(1+r_c^L(n))(1+r)k}{1-\delta}$$

Subject to:

$$\text{IC}_c: \frac{\delta}{1-\delta}\left[p[f(k) - (1+r)k] - \delta(1-p)p(1+r_c^L(n))(1+r)k \right]$$
$$- \frac{\delta}{1-\delta}\left[p[f(\frac{n-1}{n}k) - (1+r)\frac{n-1}{n}k] - \delta(1-p)p(1+r_c^L(n-1))(1+r)\frac{n-1}{n}k \right]$$
$$\geqslant \max\{(1+r)[k - \frac{n-1}{n}k], \delta p(1+r)[(1+r_c^L(n))k - (1+r_c^L(n-1))\frac{n-1}{n}k]\}. \quad (10)$$

Due to his informational advantage, the moneylender knows not only the return of a borrower's project but also the number of MFIs whose loans she would repay. So if that number is x, then the MFI would choose $r_c^L(x)$ to

$$\underset{r_c^L}{\text{Maximize}} \quad \delta p(1+r)(1+r_c^L(x))\frac{x}{n}k - c^L(1+r)\frac{x}{n}k$$

Subject to:

$$\text{LL}_c^B: \quad f(\frac{x}{n}k) \geqslant (1+r_c^L)(x))(1+r)\frac{x}{n}k + (1+r)\frac{x}{n}k \quad (11)$$

$$\text{PC}_c^L: \quad \delta p(1+r)(1+r_c^L(x))\frac{x}{n}k \geqslant c^L(1+r)\frac{x}{n}k. \quad (12)$$

From this we can get: $1 + r_c^{L^*}(x) = \dfrac{f(\frac{x}{n}k) - (1+r)\frac{x}{n}k}{(1+r)\frac{x}{n}k} \Rightarrow r_c^{L^*}(x) = \dfrac{f(\frac{x}{n}k) - 2(1+r)\frac{x}{n}k}{(1+r)\frac{x}{n}k}$

The benevolent MFIs know this and design contracts such that borrowers' welfare is max-

imised given sustainability condition. Hence, the problem of an MFI is to:

$$\text{Maximize}_{k} \quad \frac{p[1 - \delta(1 - p)][f(k) - (1 + r)k]}{1 - \delta}$$

Subject to:

$$\text{IC}_c : \frac{\delta}{1 - \delta}p[1 - \delta(1 - p)][f(k) - (1 + r)k] - \frac{\delta}{1 - \delta}p[1 - \delta(1 - p)][f(\frac{n - 1}{n}k) - (1 + r)\frac{n - 1}{n}k]$$

$$\geqslant \max\Big\{(1 + r)[k - \frac{n - 1}{n}k], \delta p\big[[f(k) - (1 + r)k] - [f(\frac{n - 1}{n}k) - (1 + r)\frac{n - 1}{n}k]\big]\Big\}. \tag{13}$$

Like before, solving the only constraint we need to consider we get:

$$\frac{\delta p[1 - \delta(1 - p)]}{1 - \delta + \delta p[1 - \delta(1 - p)]} \geqslant \frac{(1 + r)k}{n[f(k) - f(\frac{n-1}{n}k)]}$$

So we can now define the maximum amount which a borrower repays to all n MFIs, given her patience level.

Definition 4. *Given any δ, $k_c^I(\delta)$ is the amount such that a borrower with discount factor δ is indifferent between repaying $\frac{k_c^I}{n}(\delta)$ to all n MFI-s and repaying $\frac{k_c^I}{n}(\delta)$ to n-1 MFI-s. Hence,*

$$\frac{(1 + r)k_c^I}{n[f(k_c^I) - f(\frac{n-1}{n}k_c^I)]} = \frac{\delta p[1 - \delta(1 - p)]}{1 - \delta + \delta p[1 - \delta(1 - p)]}$$

Again this maximum value increases as the borrower becomes more and more patient which is our next claim.

Claim 2. *As δ increases $k_c^I(\delta)$ increases.*

Hence, $\exists$ a minimum δ for which a borrower repays the efficient amount i.e. k^e which gives us our next definition.

Definition 5. *Let δ_c be the minimum δ such that a borrower with discount factor δ_c is indifferent between repaying $\frac{k^e}{n}$ to all MFIs and repaying $\frac{k^e}{n}$ to n-1 MFIs, i.e.*

$$\delta_c : \frac{\delta p[1 - \delta(1 - p)]}{1 - \delta + \delta p[1 - \delta(1 - p)]} = \frac{(1 + r)k^e}{n[f(k^e) - f(\frac{n-1}{n}k^e)]}.$$

Hence, at optimum $k_c^* = k_c^I < k^e \ \forall \delta \in [0, \delta_c)$

and $k_c^* = k^e \ \forall \delta \in [\delta^c, 1]$

Welfare:

Borrower's expected utility $= \dfrac{p[1 - \delta(1 - p)][f(k_c^*) - (1 + r)k_c^*]}{1 - \delta} > 0$

Moneylender's lifetime expected profit $= \dfrac{\delta p f(k_c^*) - (\delta p + c^L)(1 + r)k_c^*}{1 - \delta}$. By participation constraint of moneylender this cannot be negative. Hence, we need $f(k)$ to be sufficiently high and c^L not very high.

MFI's profit is zero.

3.4 Comparison

In this section we compare the case where there is only one MFI in the Economy vis-a-vis where there are more than one MFIs. Our first claim establishes the fact that minimum patience level required to get efficient amount of loan is higher in the latter case. Intuitively, when there are more than one MFI, in case of default, the borrower does not lose access to MFI loans completely, she can still get loan from other MFIs whereas when there is only one MFI, she loses access to MFI loan completely. So, a moderately patient borrower, precisely whose discount factor $\delta \in [\delta_M, \delta_c)$ will not repay efficient amount when there are more than one MFIs, whereas she repays when there is only one MFI.

Claim 3. $\delta_c > \delta_M$

Proof. From Definition 4 and 5 we have,
$\delta_M = \frac{(1+r)k^e}{f(k^e)}$ and $\delta_c = \frac{(1+r)k^e}{n[f(k^e) - f(\frac{n-1}{n}k^e)]}$.

Now, $\delta_c - \delta_M$
$$= (1+r)k^e \left[\frac{f(k^e) - n[f(k^e) - f(\frac{n-1}{n}k^e)]}{nf(k^e)[f(k^e) - f(\frac{n-1}{n}k^e)]} \right]$$
$$= (1+r)k^e \left[\frac{f(\frac{n-1}{n}k^e) - \frac{n-1}{n}f(k^e)}{f(k^e)[f(k^e) - f(\frac{n-1}{n}k^e)]} \right]$$
> 0 where the last inequality is coming from $f(\frac{n-1}{n}k^e) > \frac{n-1}{n}f(k^e)$ $\qquad \square$

Next is our main result of this section. Empirically we find that total loan amount in competitive market is lower than that in monopoly market. Next theorem gives a theoretical explanation: When there are more than one MFIs in the Economy, in case of default, a borrower does not lose access to MFI loan completeley, so the maximum amount which a moderatley patient borrower chooses to repay in monopoly market is less than that of competitive market, the benevolent MFIs know this and design contracts accordingly. When the borrower is extremeny patient, precisely $\delta \in [\delta_c, 1]$, she repay efficient amount irrespective of number of MFIs in the Economy.

Proposition 1. *Total loan amount of competitive market is strictly less than that of monopoly market* $\forall \delta \in [0, \delta_c)$.

Proof: Case 1: Take any $\delta < \delta_M$
Hence, $k_M^* = k_M^I$ and $k_c^* = k_c^I$

Also, $\frac{(1+r)k_M^*}{f(k_M^*)} = \frac{\delta p[1 - \delta(1-p)]}{1 - \delta + \delta p[1 - \delta(1-p)]} = \frac{(1+r)k_c^*}{n[f(k_c^*) - f(\frac{n-1}{n}k_c^*)]}$

Let $k_M^* = k_C^* = k$

Then, $\dfrac{(1+r)k_M^*}{f(k_M^*)} - \dfrac{(1+r)k_c^*}{n[f(k_c^*) - f(\frac{n-1}{n}k_c^*)]} = (1+r)k\left[\dfrac{1}{f(k)} - \dfrac{1}{n[f(k) - f(\frac{n-1}{n}k)]}\right]$

$\Rightarrow 0 = (1+r)k\left[\dfrac{\frac{n-1}{n}f(k) - f(\frac{n-1}{n}k)}{f(k)[f(k) - f(\frac{n-1}{n}k)]}\right]$

But, we know R.H.S of the above equation is negative, hence there is a contradiction. Hence, $k_M^* = k_C^* = k$ is not possible.

Now, observe if we increase k_c keeping k_M constant then this difference will increase (since $h_c^{-1}(\cdot)$ is an increasing function). Hence, we need to decrease k_c.

Hence, $k_M^* > k_c^*$ $\delta \in [0, \delta_M]$

Case 2: For $\delta \geqslant \delta_M$ $k_M^* = k^e$, however for $\delta < \delta_c$ borrower will not pay k^e in competitive market. Hence the result. ■

Corollary: From the fact that $k_M^* > k_c^*$ for $\delta \in [0, \delta_c)$ and $k_M^* = k_c^* = k^e$ for $\delta \in [\delta_c, 1]$, we have:

 (i) Moneylender's loan amount $(= (1+r)k)$ is weakly higher in monopoly market.

 (ii) Welfare of the borrower in monopoly market is weakly higher than that of competitive market.

(iii) Welfare of the moneylender in monopoly market is weakly higher than that of competitive market.

Lastly we provide an explanation to an important observation that as competition among MFIs increases, interest rate charged by money lender increases. The intuition of this claim is simple, with increase in competition, surplus of a borrower decreases, the moneylender sets interest rate such that he can extract all the surplus, since production function is diminishing so money lender's interest rate decreases with loan size. Hence interest rate increases with increase in MFI competition.

Claim 4. *Money lender's interest rate decreases with increase in competition among MFIs.*

Proof. Observe money lender's interest rate in monopoly market $r_M^{L^*} = \frac{f(k_M^*) - (1+r)k_M^*}{(1+r)k_M^*} - 1$ and that in competitive market is $r_c^{L^*} = \frac{f(k_c^*) - (1+r)k_c^*}{(1+r)k_c^*} - 1$. Now by rooftop theorem it is trivial to show that $r_c^{L^*} > r_M^{L^*}$.

□

4 Data and Empirical Strategy

4.1 Data

We have used two rounds of household survey data collected first in December 1997-January 1998, and then in December 2010-January 2011. The first round of survey was commissioned by Palli Karma Sahayak Foundation (PKSF) and was administered by the Bangladesh Institute of Development Studies (BIDS) as a part of micro-finance evaluation study. The second round was commissioned by the University of Sydney and was administered by a local survey firm. The survey encompasses 91 villages in 23 sub-districts in 13 districts out of total 64 districts in Bangladesh.[12] While in 1998, 3,026 households were surveyed, in 2010-11, 1,981 of them are resurveyed.[13] Household splits between the two survey rounds and attritions due to migrations were taken care of.[14] The survey modules in both rounds remain identical except for few non-credit modules not relevant for the present paper.[15] Both rounds collected a range of information on credits and their sources, interest rates, and repayment status in addition to income, asset and demographic characteristics of the households. Appendix Table A1 gives the definition of all the variables used in this study.

Monopoly and Competitive markets: We start with market structure. Table 1 shows the baseline (1997) observed characteristics of villages, where we treat each village as a market and categorize them either into a monopoly or into a competitive market based on the number of MFIs that were operating there in 1997.[16] In 1997, during the first survey round, 14 villages out of 91 had only one MFI, and the rest 77 had two or more MFIs. The characteristics collected in the community survey in 1997-98 (and 2010-11) include average household income, average landholding size, daily male wages, average years of schooling, the extent of electrification, the length of paved road, distances to bus stand and market. With the exception of land

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[12]Two additional rounds of survey were conducted in 1999 and 2000 were administered by BIDS. We have not used the 1999 and 2000 rounds since the lags between them and the first round are not large enough to conduct a meaningful evaluation on the impact of MFI competition, and the rounds were somewhat partial in the sense that not all information collected in 1998 were recollected in those two rounds. In 2004 PKSF commissioned another round of survey; however, this time it was conducted by HB Consultants Limited. We intended to use the 2004 round data. However, after spending a significant amount of resources on data examination, discussions with the original survey coordinator, supervisors, enumerators and data analyst who were involved in data collection, and finally checking the original filled-out questionnaires conducted in the survey, we came to the conclusion that the data collected in 2004 are not credible and should not be used.

[13]A comparison between the partial sample survey in 2010-11 and the full sample of 1997-98 shows no difference between the two in their observed baseline characteristics collected in 1997-98. The comparison is available from authors on request.

[14]If a household migrated within a district, they were tracked and surveyed. However, most migrations were local due to household split and remain within the village.

[15]Additional modules in 2010-11 include information on marriage, marriage market transactions and fertility, and detailed food and non-food expenditure modules.

[16]To get loan, one needs to be a resident of a villages as MFIs do not offer credit across villages.

holding size, which is only marginally significant, the villages were very similar in terms of initial characteristic, and they remain similar in 2010-11 as well.

[Insert Table 1 about here]

Borrowers in Monopoly and Competitive Markets: Table 2 shows baseline (1997) observed characteristics of MFI members organized according to the market structure characterized by monopoly MFI or multiple MFIs in 1997: a) those who were members of MFIs in 1997 in a monopoly market and remained member in 2010; and b) those who were members in 1997 in a competitive market and remained member in 2010. We compare the baseline differences in their observed characteristics between group (a) and group (b). In addition, there were two other groups in 1997 data set: i) those who dropped out of MFIs - were members in 1997 but were not member in 2010 any longer, and ii) those who newly became MFI member by 2010-11 but were not members of any MFI in 1997-98. We do not consider these two groups in our analysis (with the exception of robustness check at the end). The working sample is restricted to the land ownership of 5 acres or less.[17] In our robustness check, we also present results restricting the working sample to 0.5 acre of landownership considered as functionally landless and often used by MFIs in Bangladesh as an eligibility criteria for borrowers selection (Pitt and Khandker, 1998; Islam, 2011).[18]

The mean differences in the baseline observed characteristics between group (a) and group (b) are presented in Table 2, column 3. It is obvious that MFI members were similar in their observed characteristics between monopoly and competitive markets. It is likely that in 1998 MFIs were offering credit to very similar kind of borrowers across markets. Hence, there is no obvious selection bias that can be related to observed characteristics. Note that in all cases, we do not see any significant differences between the two groups in case of their baseline community level characteristics displayed in Table 1.

[Insert Table 2 about here]

Table 3 shows the outcomes of MFI members collected in the baseline and end-line surveys organized under monopoly and competitive markets. These were the outcomes of households those who were MFI members in 1997-98 and remained so in 2010-11 (group (a) defined in Table 3). These are the outcomes that we are interested to evaluate, especially, how they systematically vary between monopoly and competitive markets. In 1997-98, the differences

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[17]The probability of MFI membership/receiving MFI loans significantly decreases after land ownership of 5 acres or more. See Appendix Figure A1. Restricting sample to 5 acre landownership drops only 2.6 percent of the sample. A similar land ownership restriction was applied in Pitt and Khandker (1998) as well.

[18]However, similar to Morduch (1998), and Rodman and Morduch (2013), we do not see any discontinuity in MFI membership around 0.5 acre of landownership also portrayed in Appendix Figure A1.

in outcomes between the two markets in 1997-98 were in the total number of MFI members, total outstanding amount of MFI loans, and MFI loan size. By 2010-11, the two markets diverged further and the differences in outcomes now included in the number of MFI loans as well. In both years, as opposed to conventional wisdom, monopoly MFI markets offered more membership and loans, and larger loan size and loan amount. In the informal lending market, the differences in the interest rate vanished by 2010-11.

[Insert Table 3 about here]

4.2 Empirical Strategy

We measure the impact of MFI competition on credit market outcomes using a difference-in-difference model with household-level panel data. The difference-in-difference specification compares the change overtime in outcomes in competitive markets with change in monopoly markets. Though the objective of PKSF survey and the study associated with was to evaluate the impact of micro-credit program on members, neither the assignment of villages to micro-credit program nor the membership of households to a micro-finance group was randomly assigned. Data that we use here comes from members and non-members of micro-finance program where both households and MFIs selected program participation and program placement decision, respectively. What follows is our attempt to overcome those selection biases.

We utilize the difference between members in two types of villages categorized by the number of MFI presence as described above. Descriptive statistics presented in Table 1 showed that in 1997-98, villages categorized into monopoly or competitive micro-finance markets were very similar in terms of their social and economic development proxied by daily male wage rate, length of paved road, distance to the nearest bus stand, average household income, population size, proportion of households with electricity connection, and the average years of schooling. The lone difference was in the average land holding size, which was only marginally significant.

Once these baseline differences are accounted for, our first-difference described above will show the difference in outcome due to the market structure of micro-finance market. However, it is likely that entry of an MFI into a village is not exogenous and hence competition measure is likely to be an endogenous variable. MFIs may enter into villages that have the highest poverty rate and hence easy to get a large number of eligible borrowers and fulfill their poverty reduction objectives or they may enter into villages that are relatively better off and hence can achieve high repayment rate of their loans.[19] To minimize biases associated with the endogenous entry

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[19]Salim (2013), using branch location data of two of the largest MFIs in Bangladesh, found that MFIs do take consideration of their poverty reduction objective and pure profit maximization alone cannot explain the branch placement pattern. However, the analysis is focused on two MFIs, Grameen Bank and BRAC, and may not be extended to the whole micro-finance sector.

of MFIs, we compare the difference in outcomes between 1997-98 and 2010-11 for households who lived in villages served either by a monopoly MFI or multiple MFIs in 1998.

The key identifying assumption underlying our (difference-in-difference) empirical strategy is that changes in outcomes for members over time in villages characterized by monopoly MFI constitutes a valid counter-factual for the changes in outcomes for members in villages characterized by competition among MFIs. However, if placement of additional MFI programs in a village leads to changes (e.g., business investment) that may not happen in monopoly MFI villages, our estimation will be biased. In order to account for trends that are different between two types of markets, we use an interaction term constituted of competition dummy and time.

The difference-in-difference model can be specified in regression form as

$$0_{ivt} = \alpha_0 + \beta_1 Com_{vt} + \beta_2 \delta_t + X_{ivt}\theta + \pi_1(Com_{ivt} * \delta_t) + \varepsilon_{ivt}$$

Here, O_{ivt} is the outcome of household i living in village v in year t; Com_{vt} is the competition measure; δ_t is the year fixed effect; and X_{ivt} are baseline household characteristics commonly considered in the micro-finance membership and credit applications. Com*δ is an interaction term between the indicator for a competition measure at baseline-level for village v, and the time indicator δ. ε_{ivt} is a mean-zero error term.

The above specification differences out any time invariant household and village characteristics, and incorporates time varying household specific unobservable factors by including a set of relevant baseline household characteristics.

π_1 is the parameter of interest, which measures the effects of MFI competition on credit market outcomes for MFI members. In the absence of other factors that might have influenced credit market outcomes during this period for MFI members in competitive market differently than MFI members in villages characterized by monopoly MFI, π_1 is an unbiased estimator.

Potential omitted variables that may threaten our identification are variables that both a) led to differential credit growth in markets characterized by competition, and b) differentially influenced MFI-members credit market outcomes compared to MFI-members in monopoly market. One such omitted variable could be differential growth in physical infrastructure between two different types of villages. However, it is hard to imagine such an infrastructure, and Table 1 showed that differences in social and economic indicators between two types of villages collected in the baseline and end-line survey were not statistically different.

4.3   Robustness checks

We check the robustness of our results in five ways:

First, we combine the difference-in-difference specification with propensity score matching due to Rosenbuam and Rubin (1983) where we match MFI members with non-members based on baseline characteristics. If household characteristics that influence MFI membership decision also influence outcomes of interests, matching on households initial characteristics combined

with DD can eliminate bias due to temporally invariant omitted variables (Heckman et al 1997, Ravallion and Chen 2005).

Second, we estimate a tripe-difference model where we combine the difference-in-difference model described above by taking the difference in outcomes between MFI members and non-members. That means, we compare the difference in credit market outcomes for MFI member households over time and compare those differences between monopoly and competitive markets after differencing out the corresponding change in never member households (or never member and dropped-out combined). The estimation equation appears as follows:

$$0_{ivt} = \alpha_0 + \beta_1 Com_{vt} + \beta_2 \delta_t + X_{ivt}\theta + \pi_1(Com_{ivt} * \delta_t) + \beta_2 Member_{ivt} +$$

$$\pi_2(Member_{ivt} * Com_{vt}) + \pi_3(Member_{ivt} * \delta_t) + \pi_4(Member_{ivt} * Com_{vt} * \delta_t) + \varepsilon_{ivt}$$

Here, O_{ivt} is the outcome of household i living in village v in year t; $Member_{ivt}$ is the micro-finance membership status of the household; Com_{vt} is the competition measure; δ_t is the year fixed effect; and X_{ivt} are baseline household characteristics commonly considered in the micro-finance membership and credit applications. Member*Com, Member*δ, Com*δ, Member*Com*δ are interaction terms among the indicator for a household's membership status, with the competition measure at baseline-level for village v, and the time indicator δ. ε_{ivt} is a mean-zero error term.

π_4 is the parameter of interest, which measures the effects of MFI competition on credit market outcomes for MFI members over time relative to non-members. In the absence of other factors that might have influenced credit market outcomes during this period for MFI members differently than non-members in villages characterized by MFI competition relative to monopoly MFI villages, π_4 is an unbiased estimator.

Third, in the triple-difference model described above, we compare MFI members with two separate comparison groups a) never members, and b) never members and program dropouts combined (Tedeschi and Karlan 2010). In 1997-98, there were two kinds of households in both types of villages: those who were members of MFIs in 1997-98 and those who were not members of MFIs. By 2010-11, those two groups became four groups: a) those who were members of MFIs in 1997-98 and remained member in 2010-11; b) those who never became member; c) those who dropped out - were members in 1997-98 but were not member in 2010-11 anymore; and d) those who newly joined an MFI, were not members of any MFI in 1997-98 but became member by 2010-11. We combine b) and c) together to form another comparison group for nonmembers.

Fourth, we redo the above analysis with different initial land ownership in the spirit of micro-finance eligibility criteria (Pitt and Khandkar 1998, Islam 2011).

Fifth, we restrict our data to the 1998 cross-section when a larger sample is available, and redo the above analysis (the double difference only since it is a cross-section).

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5 Results

5.1 The effects of MFI competition on outcomes related to micro-credit

Table 4 shows results from estimating equation (1) of the effect of competition among MFIs on the number of MFI membership, number of MFI loans, loan size, and total amount of MFI loan, using the triple difference strategy. Additional outcomes include total debt ratio and if the household had to borrow to repay MFI loans. Unless otherwise mentioned, all outcomes are at the household level.

[Insert Table 4 about here]

The coefficient of interest is on the variable *Competition*Yearend*, which shows the effect of MFI competition on members those live in a competitive market relative to members those who live in a monopoly market.

MFI memberships: Table 4 indicates that the number of MFI membership increased in both market over time. However, there was no significant difference in the membership growth between the two markets measured either as the total number of MFI memberships per household (column 1), or the unique number of MFI member per household (column 2) between the two survey periods.

Number of MFI loans: Between 1998 and 2010, the total number of MFI loans per household had increased by 3.6 loans which is more than double the number of MFI loans received per households in 1998 (2.5 loans in 1998). However, the growth was higher in the monopoly market compared to competitive market. In comparison to MFI members living in monopoly villages, MFI members living in villages characterized by MFI competition had about 1.1 fewer loans per household between the two survey rounds and the difference in their number of loans is statistically significant. While the size of the coefficient reduces to 0.79 when we restrict our working sample to households with landownership of 0.5 acre or less (Table A4 in Appendix), the difference between the two markets remains statistically significant.

MFI loan size: Between 1998 and 2010, for households that remain always members, their average loan size increased by 4,411 Taka which is almost double the loan size received in 1998. However, the growth in loan size was significantly higher in the monopoly market compared to competitive market. Compared to MFI members living in monopoly villages, MFI members living in villages characterized by competition had an average loan size which was 2,598 Taka smaller in 2010 and the difference is statistically significant (column 4 in Table 4). The difference between the two markets remains statistically significant if we include the dropouts in comparison group (Table A3 in Appendix) or restrict the sample to households with landownership of 0.5 acre or less (Table A4 in Appendix).

Total amount of MFI loan: While MFI members experienced a growth in the total

amount of MFI loans, it increased by 6,221 Taka more in monopoly market compared to competitive market, and difference between the two market is statistically significant (column 5 in Table 4). Given the two results on MFI loan size and loan numbers described above, it is thus not a surprise.

Total debt ratio: In the case of debt ratio which is defined as the total outstanding debt to total yearly household income, the MFI membership is not associated with higher debt ratio. This result persists when we restrict our sample to households with land ownership of 0.5 acre or less, or when we change the comparison from never members to never members and dropouts combined.

Household had to borrow to repay MFI loans: Between 1998 and 2010, borrowing to repay MFI loans for always member households increased by 36.4 percent. However, it seems the effect is entirely offset in villages marked by competition; households that had to borrow to repay MFI loans had decreased there by 33%. These findings remain qualitatively similar when we restricted our data to households that owned 0.5 acre of land or less, or include the other comparison group.

5.2   The effects of MFI competition on outcomes related to informal sector credit

[Insert Table 5 about here]

Interest rate of informal loans: Interest rates that we look at are specific to each loan taken from informal lenders as well as at the village level. While we do not find any difference between two types of market, interest rates charged by informal lenders have decreased by about 36% (columns 1 & 2 in Table 5). However, as we will see in the robustness section, compared to non-members, MFI members have experienced a rise in informal sector interest rate.

Total amount of informal loans: Between the two periods, 1997-98 and 2010-11, MFI members' borrowing from informal sector went up. However, as we will see in the next section, this rise in informal sector borrowing seems to be driven entirely by MFI borrowers living in villages characterized by monopoly MFI.

5.3   Heterogeneous effects

In terms of impact heterogeneity, we examined the effect of MFI competition on older borrowers and female borrowers by including two additional interaction terms: $Com_{vt} * \delta_t * Age_{ivt}$ and $Com_{vt} * \delta_t * Gender_{ivt}$, where Age_{ivt} and $Gender_{ivt}$ are age and gender of household head of household i living in village v in time t. Results are presented in Table 7. Here household head age equals 1 if the age is above 50 and gender equals 1 if household head is female.

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[Insert Tables 6 & 7 about here]

Two outcomes stand out: first, compared to monopoly, in MFI competition, female headed households are more likely to be offered MFI membership. Second, older households and female headed households are charged lower interest rate by the informal sector under MFI competition.

5.4 Robustness checks

We used propensity score (Rosenbuam and Rubin 1983)to match MFI members in monopoly market with MFI members under competition.

Second, triple difference. Results (A4 & A5) are already there, and they remain unchanged.

In other words, it shows the difference in credit market outcomes for MFI member households over time and compared those differences between monopoly and competitive markets after differencing out the corresponding change in never member households.

Our third robustness check was to redo all the above analysis by comparing always members with a separate comparison group that combine program dropouts and never members together (Tedeschi and Karlan 2010). The results are presented in Appendix Tables A6, and A7. As can be seen, they remain qualitatively very similar to our main findings.

Our fourth robustness check was to restrict the initial land ownership to 0.5 acre or less in the spirit of micro-finance eligibility criteria (Pitt and Khandkar 1998, Islam 2011). Results are reported in Appendix Tables A8 and A9. As found, they remain very similar to our main results.

Fifth, we restrict our data to the 1998 cross-section when a larger sample is available, and redo the above analysis (the double difference only since it is a cross-section). A10, and A11

6 Conclusion

In this paper we looked at competition among MFIs its consequences on lenders and borrowers. We developed a theoretical model to derive the implications of such competition and tested them empirically. Our findings largely support our theoretical predications.

We found that in comparison to a monopoly market, competition among MFIs is associated lesser growth in the number of MFI loans, loan size and total amount borrowed from MFIs. In addition, we also found that while the role of informal sector credit and its interest rates increased for MFI borrowers, however, the rise in borrowing from the informal sector seems to be driven entirely by MFI members living in villages characterized by monopoly MFI.

Reference

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Appendix 1

Proof of Claim 1.

Proof. Define, $k_M^I(\delta) = h_M(g(\delta))$. So, we are trying to prove that $h_M(g(\delta))$ is increasing with δ.

For that we will first prove $g(\delta)$ is increasing in δ and then we will prove $h_M^{-1}(\cdot)$ is increasing.

$$g(\delta) = \frac{\delta p[1 - \delta(1-p)]}{1 - \delta + \delta p[1 - \delta(1-p)]}$$

Differentiating $g(\delta)$ with respect to δ we have:

$$\frac{\partial g(\cdot)}{\partial \delta} = \frac{p\big[1 - \delta + \delta p[1 - \delta(1-p)]\big][1 - 2\delta(1-p)] - \delta p[1 - \delta(1-p)][-1 + p - 2\delta p(1-p)]}{\big[1 - \delta + \delta p[1 - \delta(1-p)]\big]^2}$$

$$> 0$$

Now, $h_M^{-1}(k_M^I(\delta)) = \frac{(1+r)k_M^I}{f(k_M^I)}$

Differentiating $h_M^{-1}(\cdot)$ with respect to k_M^I we have:

$$\frac{\partial h^{-1}(\cdot)}{\partial k_M^I} = \frac{1+r}{f(k)} - \frac{(1+r)kf'(k)}{[f(k)]^2}$$

$$= \frac{(1+r)}{[f(k)]^2}\big[f(k) - kf'(k)\big]$$

$$> 0$$

where the inequality comes from the assumption that $f(\cdot)$ is a concave function.

Hence, as δ increases the maximum amount the borrower is willing to repay increases. $\square$

Proof of Claim 2.

Proof. Define, $k_c^I(\delta) = h_c(g(\delta))$. So, we are trying to prove that $h_c(g(\delta))$ is increasing with δ. We have already proved that $g(\delta)$ is increasing in δ.

$$h_c^{-1}(k_c^I(\delta)) = \frac{(1+r)k_c^I}{n[f(k_c^I) - f(\frac{n-1}{n}k_c^I)]}$$

Differentiating $h_c^{-1}(\cdot)$ with respect to k_c^I we have:

$$\frac{1+r}{n[f(k_c^I) - f(\frac{n-1}{n}k_c^I)]} - \frac{(1+r)k_c^I[f'(k_c^I) - f'(\frac{n-1}{n}k_c^I)]}{n[f(k_c^I) - f(\frac{n-1}{n}k_c^I)]^2}$$

$$> 0$$

where the last inequality comes from the assumption that $f(\cdot)$ is increasing concave function.

Hence, as δ increases the maximum amount the borrower is willing to repay increases. $\square$

Appendix 2
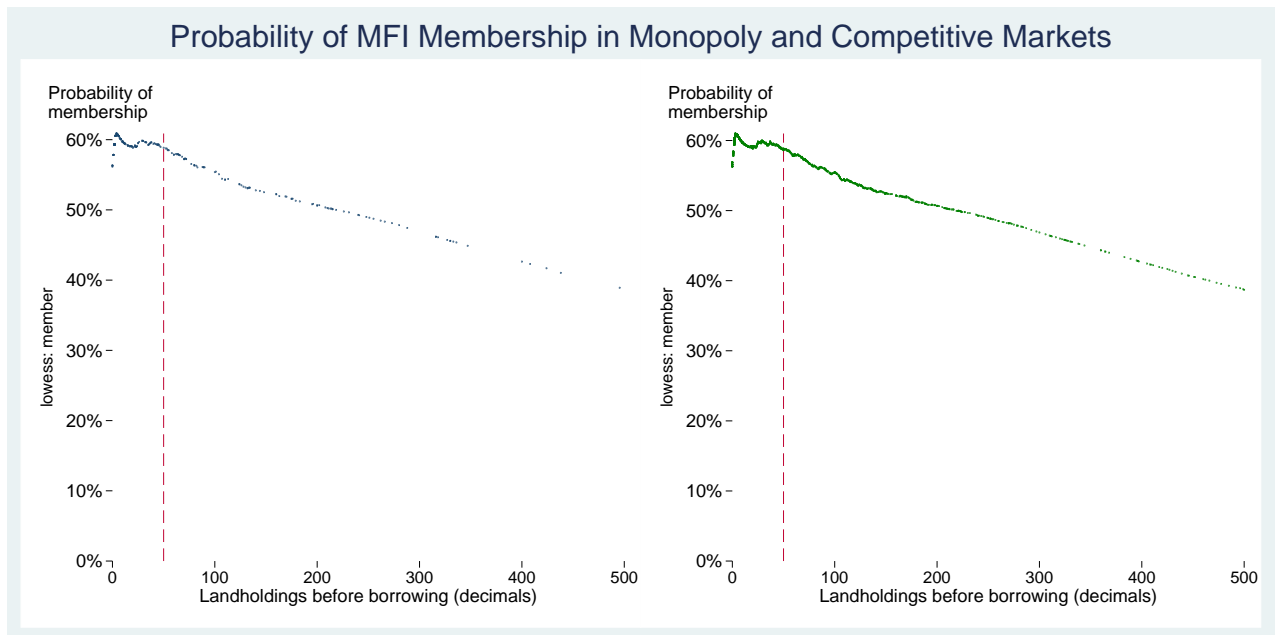
Landownership and MFI Membership

Table A1: Definition of variables

Variable	Definition
Per-capita income	Household's per-capita income in Taka adjusted for inflation
Per capita food exp.	Household's per-capita food expenditure in Taka adjusted for inflation
Per capita non-food exp. in Tk.	Household's per-capita non-food expenditure in Taka adjusted for inflation
Total land owned in decimals	Total amount of land in decimal currently owned by the household
Number of assets owned	The number of different types of business assets owned by the household
Gender of the household head	Gender of the household head (1= male)
Age of the household head in yrs	Age of the household head in years
Education of the household head in yrs	Education of the household head in years completed
Religion of the household head	Religion of the household head (1= muslim; 0 = others)
Total number of household members	Total number of household members who are current household members
Daily male wage in the village in Tk.	Normal daily wages in the village for adult male in Taka
Daily female wage in the village in Tk.	Normal daily wages in the village for adult female in Taka
Proportion of households having electricity at home in the vill. (in %)	Percentage of households in the village that have access to electricity
Distance to the nearest bus stand in KM	Distance of the nearest bus stand from the center of the village in KM

Table A4: Effect of Competition among MFIs on Loans, Loan Size, Loan Numbers, and MFI Membership (always members versus never members, landownership is 5 acre or less)

	Number of MFI loans	Number of MFI membership	Number of Unique MFIs	Total amt. of MFI loans	MFI loan size	Total debt ratio	Had to borrow to repay
Competition measure (0-1 monopoly)	-0.0445	0.00378	-0.00589	-50.68	-6.856	0.0350	-0.0011
	(0.811)	(0.746)	(-0.522)	(0.316)	(-0.101)	(0.162)	(0.157)
MFI membership status (1= yes)	2.608***	1.223***	1.006***	8,946***	6,036***	-0.136	0.252**
	(5.468)	(12.940)	(46.81)	(6.889)	(7.188)	(-0.725)	(2.043)
Yearend indicator	-0.491	0.00161	-0.112**	-1,372	29.04	-0.0860	-0.0918**
	(1.600)	(0.056)	(-2.090)	(1.181)	(0.0731)	(-0.723)	(-2.353)
Competition*MFI member	-0.187	-0.121	0.135***	-1,829	-1,106	0.00416	-0.0662
	(0.382)	(1.265)	(4.299)	(1.364)	(-1.302)	(0.0179)	(0.530)
Competition*yearend	0.299**	-0.00548	0.0383*	289.1	555.0**	0.0227	0.0315
	(2.141)	(0.863)	(1.725)	(0.900)	(2.524)	(0.133)	(1.478)
MFI member*yearend	3.564***	0.150*	0.0494	12,474***	4,438***	0.292**	0.364**
	(6.812)	(1.913)	(0.304)	(3.927)	(3.838)	(2.134)	(2.270)
Competition*MFI member*yearend	-1.239**	-0.084	-0.00635	-6,285*	-3,085***	-0.00585	-0.351**
	(2.225)	(1.048)	(-0.0381)	(1.956)	(-2.595)	(-0.0260)	(2.151)
Observations	2,248	2,248	2,248	2,239	2,248	1,572	2,248
Number of hhid	1,124	1,124	1,124	1,124	1,124	949	1,124
Adjusted R-square	0.5	0.76	0.5	0.34	0.5	0.02	0.12

Numbers in parentheses are t-statistics. Standard errors are clustered by village. ***$p<0.01$, **$p<0.05$, *<0.1. Additional controls included in each regression are gender, age, occupation, education and religion of household head; land owned by the household in 1997; and average land holding in the village.

Table A5: Effect of MFI Competition on Informal Sector Loans (always members versus never members, landownership is 5 acre or less)

	Annual interest rate (village)	Total amt. of inf. loans	Annual interest rate (individual)	Total amt. of loans
Competition measure (0-1 monopoly)	-13.02	-4,496	-11.19	-1,822
	(-0.825)	(-1.232)	(-0.372)	(-1.199)
MFI membership status (1= yes)	-22.77*	-5,896	-31.97	14,168***
	(-1.646)	(-1.634)	(-1.431)	(3.518)
Yearend indicator	-49.97***	-2,553	-75.97***	-4,854
	(-2.677)	(-0.852)	(-3.821)	(-1.155)
Competition*MFI member	27.77*	5,518	32.4	-899.6
	(1.826)	-1.522	-0.994	(-0.219)
Competition*yearend	19.94	5,701*	9.351	4,870**
	(1.260)	-1.89	-0.34	(2.073)
MFI member*yearend	28.68*	6,774**	31.56*	48,181***
	(1.653)	-2.237	-1.845	(8.095)
Competition*MFI member*yearend	-30.65	-6,722*	-20.41	-25,893***
	(-1.641)	(-1.941)	(-0.631)	(-4.148)
Observations	2,049	2,248	397	2,248
Number of hhid	1,111	1,124	345	1,124
Adjusted R-square	0.16	0.02	0.22	0.22

Numbers in parentheses are t-statistics. Standard errors are clustered by village. ***p<0.01, **p<0.05, *<0.1. Additional controls included in each regression are gender, age, occupation, education and religion of household head; land owned by the household in 1997; and average land holding in the village.

Table A6: Effect of Competition among MFIs on Loans, Loan Size, Loan Numbers, and MFI Membership (always members versus never members and dropouts combined, landownership is 5 acre or less)

	Number of MFI loans	Number of MFI membership	Total amt. of MFI loans	MFI loan size	Total debt ratio	Had to borrow to repay
Competition measure (0-1 monopoly)	-0.0162	-0.0001	-33.12	32.88	0.0115	0.0004
	(0.325)	(0.018)	(0.211)	(0.482)	(0.0529)	(0.052)
MFI membership status (1= yes)	2.437***	1.197***	8,171***	5,510***	-0.0735	0.224*
	(5.097)	(12.410)	(6.179)	(6.624)	(-0.343)	(1.839)
Yearend indicator	-0.336	-0.00571	-1,093	160.6	-0.0234	-0.0788**
	(1.210)	(0.227)	(1.143)	(0.494)	(-0.169)	(2.340)
Competition*MFI member	-0.126	-0.107	-1,376	-793.7	-0.0396	-0.0422
	(0.258)	(1.100)	(1.017)	(-0.944)	(-0.156)	(0.343)
Competition*yearend	0.451***	0.00142	423.4	871.4***	-0.0654	0.0359*
	(3.104)	(0.239)	(1.336)	(4.443)	(-0.368)	(1.816)
MFI member*yearend	3.676***	0.170**	13,017***	4,809***	0.118	0.384**
	(7.013)	(2.402)	(4.081)	(4.178)	(0.954)	(2.393)
Competition*MFI member*yearend	-1.499***	-0.0952	-6,832**	-3,689***	0.170	-0.381**
	(2.677)	(1.306)	(2.115)	(-3.127)	(0.855)	(2.340)
Observations	2,814	2,814	2,804	2,814	1,938	2,814
Number of hhid	1,407	1,407	1,407	1,407	1,206	1,407
Adjusted R-square	0.48	0.79	0.34	0.46	0.01	0.1

Numbers in parentheses are t-statistics. Standard errors are clustered by village. ***p<0.01, **p<0.05, *<0.1. Additional controls included in each regression are gender, age, occupation, education and religion of household head; land owned by the household in 1997; and average land holding in the village.

Table A7: Effect of MFI Competition on Informal Sector Loans (always members versus never members and dropouts combined, landownership is 5 acre or less)

	Annual interest rate (village)	Total amt. of loans	Annual interest rate (individual)
Competition measure (0-1 monopoly)	-10.85	-4,743	-10.44
	(-0.673)	(-1.294)	(-0.347)
MFI membership status (1= yes)	-21.57	-5,981*	-34.24
	(-1.567)	(-1.655)	(-1.512)
Yearend indicator	-42.85**	-2,534	-75.47***
	(-2.215)	(-0.886)	(-3.469)
Competition*MFI member	26.75*	5,596	33.80
	(1.803)	(1.542)	(1.069)
Competition*yearend	17.38	5,175*	12.72
	(1.053)	(1.859)	(0.466)
MFI member*yearend	29.01*	6,814**	35.38**
	(1.649)	(2.150)	(1.969)
Competition*MFI member*yearend	-31.61*	-5,836*	-26.77
	(-1.689)	(-1.706)	(-0.859)
Observations	2,571	2,814	468
Number of hhid	1,391	1,407	411
Adjusted R-square	0.15	0.02	0.2

Numbers in parentheses are t-statistics. Standard errors are clustered by village. ***$p<0.01$, **$p<0.05$, *<0.1. Additional controls included in each regression are gender, age, occupation, education and religion of household head; land owned by the household in 1997; and average land holding in the village.

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Table A8: Effect of Competition among MFIs on Loans, Loan Size, Loan Numbers, and MFI Membership (always members versus never members, landownership is 0.5 acre or less)

	Number of MFI loans	Number of MFI membership	Total amt. of MFI loans	MFI loan size	Total debt ratio	Had to borrow to repay
Competition measure (0-1 monopoly)	0.00263	-0.00403	-93.64	-5.450	-0.377*	-0.006
	(0.067)	(1.484)	(0.943)	(-0.0971)	(-1.916)	(1.001)
MFI membership status (1= yes)	2.711***	1.189***	8,499***	5,622***	-0.173	0.177*
	(4.666)	(11.490)	(4.831)	(5.964)	(-0.774)	(1.817)
Yearend indicator	-0.612	-0.0166	-2,473	-455.9	-0.247	-0.117**
	(1.579)	(0.508)	(1.644)	(-0.834)	(-1.180)	(2.297)
Competition*MFI member	-0.208	-0.118	-1,542	-870.3	0.448*	0.0302
	(0.353)	(1.132)	(0.856)	(-0.908)	(1.951)	(0.297)
Competition*yearend	0.401*	0.0213*	949.6*	1,268***	0.634***	0.0670*
	(1.779)	(1.685)	(1.713)	(3.563)	(2.734)	(1.916)
MFI member*yearend	2.979***	0.0749	10,099***	4,547***	0.336	0.448***
	(7.968)	(0.753)	(2.959)	(3.268)	(1.233)	(2.946)
Competition*MFI member*yearend	-0.794*	0.0136	-3,725	-3,453**	-0.382	-0.446***
	(1.778)	(0.134)	(1.074)	(-2.389)	(-1.157)	(2.824)
Observations	1,356	1,356	1,351	1,356	994	1,356
Number of hhid	678	678	678	678	592	678
Adjusted R-square	0.47	0.75	0.32	0.46	0.04	0.12

Numbers in parentheses are t-statistics. Standard errors are clustered by village. ***p<0.01, **p<0.05, *<0.1. Additional controls included in each regression are gender, age, occupation, education and religion of household head; land owned by the household in 1997; and average land holding in the village.

Table A9: Effect of MFI Competition on Informal Sector Loans (always members versus never members, landownership is 0.5 acre or less)

	Annual interest rate (village)	Total amt. of loans	Annual interest rate (individual)
Competition measure (0-1 monopoly)	-4.115	-6,157	26.99
	(0.248)	(1.636)	(0.575)
MFI membership status (1= yes)	-23.48	-7,226*	-49.37
	(1.606)	(1.894)	(1.594)
Yearend indicator	-38.00**	-7,693*	-97.03***
	(2.062)	(1.828)	(3.201)
Competition*MFI member	22.42	7,985**	-6.321
	(1.372)	(2.072)	(0.128)
Competition*yearend	6.905	10,221**	-30.71
	(0.411)	(2.345)	(0.638)
MFI member*yearend	18.71	10,287**	55.28*
	(1.040)	(2.213)	(1.925)
Competition*MFI member*yearend	-17.26	-11,783**	14.20
	(0.870)	(2.423)	(0.271)
Observations	1,236	1,356	240
Number of hhid	670	678	209
Adjusted R-square	0.15	0.03	0.28

Numbers in parentheses are t-statistics. Standard errors are clustered by village. ***p<0.01, **p<0.05, *<0.1. Additional controls included in each regression are gender, age, occupation, education and religion of household head; land owned by the household in 1997; and average land holding in the village.

Figures & Tables

Table 1: Observed Characteristics at Village Level

	1997-98		2010-11	
	Monopoly	Competitive	Monopoly	Competitive
Daily male wage in the village in Tk.	64.212	56.471	188.957	174.302
	(4.581)	(1.958)	(16.945)	(5.672)
Proportion of households with	0.198	0.254	51.786	58.519
electricity at home (in %)	(0.077)	(0.028)	(10.104)	(3.445)
Length of paved road in KM	0.214	0.34	1	1.623
	(0.098)	(0.088)	(0.593)	(0.278)
Distance to the nearest bus stand in KM	3.679	3.663	4.571	4.348
	(0.883)	(0.402)	(0.905)	(0.354)
Distance to the daily market in KM	1.571	1.59	1.821	2.036
	(0.339)	(0.196)	(0.295)	(0.204)
Average household income IN Tk.	45581.25	47789.3	64289.5	1.04E+05
	(6758.205)	(2889.195)	(9564.301)	(27761.820)
Population size	2342.714	2431.831	2897.071	3038.571
	(259.174)	(192.452)	(320.315)	(217.550)
Average land holding size in decimals	104.85	85.977*	70.25	75.164
	(13.549)	(3.521)	(8.553)	(3.655)
Average years of schooling	2.838	2.647	3.516	3.513
	(0.316)	(0.157)	(0.457)	(0.170)
Number of villages	14	77	14	77

Numbers in parentheses are standard errors. ***, **, * Differences are significant at 1 %, 5 %, and 10% level.

Table 1: Baseline (1998) observed characteristics of MFI members in monopoly and competition, and their differences

	Always member in monopoly (a)	Always member in competition (b)	Mean difference (a-b)
Per-capita income in Tk.	10145.398	8793.594	1351.804
	(1392.318)	(250.87)	(1066.643)
Per capita food exp. in Tk.	2646.408	2887.176	-240.768
	(196.075)	(68.403)	(280.294)
Total land owned in decimals	55.122	55.579	-0.457
	(13.643)	(2.921)	(12.230)
Number of assets owned	3.927	3.994	-0.067
	(0.375)	(0.09)	(0.368)
Gender of the household head	1	0.967	0.033
(Female=0, Male=1)	0	(0.007)	(0.028)
Age of the household head in yrs	39.439	40.758	-1.319
	(1.623)	(0.413)	(1.709)
Education of the household head in yrs	2.805	3.162	-0.357
	(0.546)	(0.152)	(0.624)
Religion of the household head	0.78	0.803	-0.023
(Muslim=1, 0 otherwise)	(0.065)	(0.015)	(0.064)
Total number of household members	5.525	5.074	0.451*
	(0.282)	(0.062)	(0.260)
Proportion of Households having	0.268	0.253	0.015
Electricity at home in the vill. (in %)	(0.037)	(0.009)	(0.038)
Distance to the nearest bus stand in KM	3.671	3.595	0.076
	(0.523)	(0.136)	(0.563)
Number of borrowers	41	664	705

***, **, * differences are significant at 1 %, 5 %, and 10% level.

Table 2: Mean values of outcome variables in 1998 and 2010 categorized by MFI competition

	1997-98		2010-11	
	Monopoly	Competitive	Monopoly	Competitive
Number of MFI loans	2.732	2.459	6.22	5.045**
	(0.266)	(0.067)	(0.563)	(0.126)
Total number of current MFI memberships	1.22	1.099**	1.366	1.166***
	(0.065)	(0.013)	(0.103)	(0.017)
Total outstanding amount of MFI loan	9096.418	7032.095**	19868.41	13146.702***
	(1155.702)	(238.048)	(3074.491)	(480.595)
MFI loan size	6069.197	4916.581***	10653.396	7072.656***
	(480.807)	(97.159)	(1123.773)	(156.957)
Total debt ratio	0.402	0.339	2.546	-0.534
	(0.067)	(0.069)	(1.671)	(1.275)
Had to borrow to repay MFI loans	0.268	0.193	0.61	0.224***
(yes=1, 0 otherwise)	(0.07)	(0.015)	(0.077)	(0.016)
Informal sector interest rate per year	97.556	114.835*	80.074	79.776
at village level	(0.832)	(2.196)	(5.777)	(1.421)
Total outstanding amount of	204.859	1156.622	5298.018	5346.98
informal sector loans	(128.969)	(337.749)	(1703.249)	(758.189)
Informal sector interest rate per year	117.619	142.916	71.933	78.956
at individual level	(7.168)	(9.708)	(18.522)	(4.349)
Number of villages	14	77	14	77

*** ** * Differences are significant at 1 %, 5 %, and 10% level.

Table 3: Effect of Competition among MFIs on Loans, Loan Size, Loan Numbers, and MFI Membership (members in monopoly versus members in competition, landownership is 5 acre or less)

	Number of MFI loans	Number of MFI membership	Number of Unique MFIs	Total amt. of MFI loans	MFI loan size	Total debt ratio	Had to borrow to repay
Competition measure (monopoly=0)	-0.175	-0.119	0.137***	-1,810	-1,107	0.0334	-0.0584
	(-0.381)	(-1.311)	(4.388)	(-1.374)	(-1.295)	(0.363)	(-0.462)
Yearend indicator	2.935***	0.155*	-0.105	10,665***	4,411***	0.155	0.234
	(4.447)	(1.852)	(-0.602)	(3.341)	(3.488)	(1.175)	(1.494)
Competition*yearend	-1.070*	-0.0950	0.0199	-6,221*	-2,598**	0.0270	-0.330**
	(-1.840)	(-1.140)	(0.123)	(-1.902)	(-2.171)	(0.198)	(-2.140)
Observations	1,410	1,410	1,410	1,402	1,410	1,243	1,410
Number of unique hhid	705	705	705	705	705	696	705
Adjusted R-square	0.22	0.02	0.01	0.11	0.13	0.03	0.04

Numbers in parentheses are t-statistics. Standard errors are clustered by village. ***$p<0.01$, **$p<0.05$, *<0.1. Additional controls included in each regression are gender, age, occupation, education and religion of household head; land owned by the household in 1997; and average land holding in the village.

Table 4: Effect of MFI Competition on Informal Sector Loans (members in monopoly versus members in competition, landownership is 5 acre or less)

	Annual interest rate (village)	Total amount of informal loans	Total amt. of loans	Annual interest rate (individual)
Competition measure (monopoly=0)	18.13**	1,203*	-2,174	31.97**
	(2.422)	(1.648)	(-0.572)	(2.140)
Yearend indicator	-11.38	3,181	42,118***	-35.60***
	(-0.641)	(1.345)	(6.517)	(-3.007)
Competition*yearend	-19.98	-857.7	-22,040***	-22.83
	(-1.157)	(-0.375)	(-3.505)	(-1.277)
Observations	1,283	1,410	1,410	262
Number of hhid	694	705	705	231
Adjusted R-square	0.14	0.02	0.25	0.17

Numbers in parentheses are t-statistics. Standard errors are clustered by village. ***p<0.01, **p<0.05, *<0.1. Additional controls included in each regression are gender, age, occupation, education and religion of household head; land owned by the household in 1997; and average land holding in the village.

Table 5: Effect of Competition among MFIs on Loans, Loan Size, Loan Numbers, and MFI Membership (heterogeneous effects, landownership is 5 acre or less)

	Number of MFI loans	Number of MFI mem.	Number of Unique MFIs	Total amt. of MFI loans	MFI loan size	Total debt ratio	Had to borrow
Competition measure (monopoly=0)	-0.174	-0.121	0.136***	-1,741	-1,106	0.0243	-0.0529
	(-0.384)	(-1.293)	(4.321)	(-1.320)	(-1.293)	(0.263)	(-0.418)
Yearend indicator	2.913***	0.160*	-0.112	10,591***	4,385***	0.153	0.233
	(4.398)	(1.903)	(-0.647)	(3.304)	(3.456)	(1.156)	(1.491)
Head age indicator	0.374*	-0.0761	0.0401	1,064	255.7	0.0255	0.00149
	(1.743)	(-1.160)	(0.711)	(1.267)	(0.682)	(0.368)	(0.0262)
Head sex indicator	-0.209	0.00641	-0.0765	1,239	-195.9	-0.327	0.161***
	(-0.817)	(0.101)	(-0.690)	(1.079)	(-0.480)	(-1.390)	(3.287)
Competition*yearend	-2.215**	0.0928	-0.440*	-7,978**	-4,072***	-0.497	-0.172
	(-2.007)	(0.560)	(-1.827)	(-2.032)	(-2.696)	(-1.260)	(-0.890)
Competition*yearend*hh head age	-0.120	-0.165	0.0313	-258.8	410.1	0.0948	0.0220
	(-0.256)	(-1.565)	(0.262)	(-0.164)	(0.817)	(0.686)	(0.328)
Competition*yearend*hh head gender	1.294	-0.0378	0.444***	2,037	1,134	0.451	-0.184
	(1.608)	(-0.420)	(2.734)	(1.106)	(1.263)	(1.334)	(-1.538)
Observations	1,410	1,410	1,410	1,402	1,410	1,243	1,410
Number of hhid	705	705	705	705	705	696	705
Adjusted R-square	0.22	0.04	0.02	0.11	0.13	0.03	0.04

Numbers in parentheses are t-statistics. Standard errors are clustered by village. ***p<0.01, **p<0.05, *<0.1. Additional controls included in each regression are gender, age, occupation, education and religion of household head; land owned by the household in 1997; and average land holding in the village.

Table 6: Effect of MFI Competition on Informal Sector Loans (Heterogeneous effects, landownership is 5 acre or less)

	Annual interest rate (village)	Total amount of inf. loans	Total amt. of loans	Annual interest rate (individual)
Competition measure (monopoly=0)	19.07**	1,217*	-2,144	37.74**
	(2.549)	(1.699)	(-0.570)	(2.449)
Yearend indicator	-10.78	3,224	41,956***	-32.29***
	(-0.611)	(1.365)	(6.448)	(-2.934)
Head age indicator	16.40**	513.5	2,839	71.59***
	(2.438)	(0.720)	(1.576)	(2.968)
Head sex indicator	4.564	394.0	-1,002	77.15***
	(0.388)	(0.571)	(-0.533)	(5.218)
Competition*yearend	-6.574	3,091	-29,692***	131.1***
	(-0.283)	(0.678)	(-2.911)	(4.606)
Competition*yearend*hh head age	-15.88**	-5,677	-1,923	-105.8***
	(-2.258)	(-1.611)	(-0.413)	(-4.117)
Competition*yearend*hh head gender	0.522	1,278	9,697	-55.52***
	(0.0379)	(0.370)	(1.390)	(-3.608)
Observations	1,283	1,410	1,410	262
Number of hhid	694	705	705	231
Adjusted R-square	0.14	0.03	0.25	0.2

Numbers in parentheses are t-statistics. Standard errors are clustered by village. ***p<0.01, **p<0.05, *<0.1. Additional controls included in each regression are gender, age, occupation, education and religion of household head; land owned by the household in 1997; and average land holding in the village.