Journal of Banking & Finance 50 (2015) 141–156

Contents lists available at ScienceDirect

Journal of Banking & Finance

journal homepage: www.elsevier.com/locate/jbf

Does microfinance change informal lending in village economies? Evidence from Bangladesh ☆

Asadul Islam *, Chau Nguyen, Russell Smyth

Department of Economics, Monash University, Australia

ARTICLE INFO

Article history:
Received 28 January 2014
Accepted 5 October 2014
Available online 17 October 2014

JEL classifications:
C21
C23
G21
O12
Q00

Keywords:
Microfinance
Bangladesh
Informal loan
Long-term effects

ABSTRACT

This paper examines how availability of microfinance influences households' borrowing from informal sources in village economies. It uses a unique household level panel data set, which spans more than two decades (1987–2008), from rural Bangladesh. We find that households' access to microfinance reduces the incidence of borrowing from informal sources, but not the amount of borrowing. We find that less poor households benefit more in terms of reducing their reliance on informal borrowing and that the benefit accrues over time. We also find that having access to microfinance increases women's informal borrowing for small consumption usage, without facilitating access to new business opportunities.

1. Introduction

Microfinance has come to be regarded as an important vehicle to reduce the incidence of rural poverty. An increasing proportion of the rural poor in many developing countries receive credit from microfinance institutions (MFIs). It is estimated that microfinance now serves more than 150 million borrowers (Hartarska et al., 2013). As noted by Servin et al. (2012, p. 2136): "Some observers [have] even called the development of microfinance... one of the main innovations in the past 25 years". No doubt, such claims reflect the increasing public recognition that microfinance has received over the last decade, stemming from the United Nations decision to declare 2005 as the Year of Microfinance and that Mohammad Yunus and the Grameen Bank were awarded the Nobel Peace Prize in 2006. The extremely rosy view of microfinance as a means to tackle rural poverty, however, has started to be questioned in recent studies of microfinance (Servin et al., 2012).

To this point existing studies of microfinance have focused primarily on the effect of microfinance on assets, consumption, income and profits (Banerjee et al., 2013; Crépon et al., 2014; Kaboski and Townsend, 2005, 2012; Khandker, 2005; Lensink and Pham, 2012; Morduch, 1998; Pitt and Khandker, 1998, 2002) as well as the role of microfinance in mitigating the effects of health and income shocks (Gertler et al., 2009; Islam and Maitra, 2012). Other studies have focused on the effect of relationships between borrower and lender on access to finance and loan conditions in microlending (Behr et al., 2011) or on corporate governance and the relationship between economies of scale, ownership and efficiency in MFIs (Galema et al., 2012; Hartarska, 2005; Hartarska and Mersland, 2012; Hartarska et al., 2013; Hermes et al., 2011; Mersland and Oystein Strom, 2009; Servin et al., 2012).

However, these studies do not consider how successful microfinance has been in terms of reducing the reliance of poor

☆ We thank Choon Wang, Gaurav Datt, Lata Gangadharan, Klaus Abbink, conference participants at the Australasian Development Economic Workshop at ANU, European Research Conference on Microfinance at University of Agder, Monash-Warwick Workshop on Development Economics and seminar participants at Monash University for very helpful comments and suggestions. We are also very grateful to Mahabub Hossain and Abdul Malek from BRAC for giving us access to the dataset used in this paper. The usual disclaimer applies.

* Corresponding author at: Department of Economics, Monash University, Caulfield Campus, VIC 3145, Australia. Tel.: +61 399032783; fax: +61 399031128.
E-mail address: Asadul.Islam@monash.edu (A. Islam).

http://dx.doi.org/10.1016/j.jbankfin.2014.10.001
0378-4266/

households on informal loans.[1] One of the key objectives of microfinance is to reduce the reliance of the poor on informal moneylenders. This objective, for example, is clearly enunciated in Grameen Bank documents (see eg. Yunus, 1994) and is accepted in the extant literature on microfinance (Jain and Mansuri, 2003). The extent to which microfinance has been successful in reducing the reliance of the poor on informal lenders is important given that informal moneylenders typically charge exorbitant interest rates on loans and eat into the savings of borrowers (Mallick, 2012). By contrast, microfinance programs are targeted at the poor and are designed to actively promote savings.

Evidence from the existing empirical literature on the effect of access to microfinance on informal lending among the poor, and near poor, is mixed. As noted by Besley et al. (2012), and also emphasised by Mookherjee and Motta (2013), the presence of the MFI can provide an outside option for poor borrowers that effectively reduces the level of 'exploitation' by informal lenders. Khandker (2000) finds that being a member of an MFI reduces the incidence of borrowing from an informal source. He also finds heterogeneous effects: male members reduce household borrowing from informal sources, but this is not the case for female members. On the other hand, Sinha and Matin (1998) find that microfinance member households do not reduce borrowing from informal credit sources.

Menkhoff and Rungruxsirivorn (2011) analyse the role of village funds in rural Thailand. Their findings suggest that loans from informal sources are more likely to be used for shock absorption than loans from village funds. They do not find any evidence that village funds act as a substitute for informal lenders. Similar studies, in the context of village funds in Thailand, also find that borrowers from village funds do not reduce their level of informal borrowing (Kaboski and Townsend, 2012; Kislat and Menkhoff, 2011). Karlan and Zinman (2010) show a positive impact of marginal loans on households having a credit score, but no impact on the score itself over a 15 to 27 month period. This seems contrary to the existence of a vicious circle of debt. However, given the existence of asymmetric information, the credit score that is assessed by the lender might not fully reflect the borrower's debt situation, due to debt underreporting and exclusion of informal borrowings from friends and/or family.

The purpose of this paper is to examine whether access to microfinance reduces the reliance of the poor, and near poor, on informal lending among rural households in Bangladesh. To do so, we use a unique panel data set, collected over three rounds spanning more than two decades (1987–2008). The availability of detailed borrowing data at the household level in 1987 enables us to compare the outcome before and after microfinance was available to these households. The long time span allows us to examine the effect of microfinance on informal lending in the very long run and over a much longer time period than previous studies. We also examine heterogeneous effects of microfinance across occupations and poverty status. We take advantage of having data at the individual level to identify heterogeneity in access to microfinance between male and female household members. The availability of household level panel data allows us to address the concerns of potential selection bias regarding the decision to be a member of an MFI and placement of an MFI at the village level.

In order to circumvent potential selection bias, the ideal approach is to randomly assign participants into treatment and control groups of microfinance programs. However, this also means that randomization would have to be in force over a long period, and not be contaminated, to estimate the long-run effects. In practice, it is extremely difficult, if not impossible, to implement randomized controlled trials (RCTs) over a long time horizon. We thus believe our approach of using a two-decade-long panel data set with pre-program level information addresses shortcomings in extant studies and allow us to examine the effect of microfinance on informal lending over a much longer time period than previous studies.

The paper closest to our own work is Berg et al. (2013). This paper uses the same dataset as us and addresses a similar question. However, our contribution differs from that of Berg et al. (2013) in several important respects. First, the dataset contains three rounds of surveys (1987, 2000, 2008). Berg et al. (2013) only use data from the 2000 and 2008 rounds, while we use all three rounds of surveys. This is an important difference because the 1987 survey predated the introduction of microfinance in the villages. Thus, employing the 1987 round provides us with pre-program level information on informal borrowing, which is crucial in addressing the selection bias when identifying the effect of microfinance on informal borrowing. Microfinance was virtually non-existent in our sample villages in 1987, but, by 2000, it had expanded to almost all parts of Bangladesh, including a majority of the villages in our sample. Without the pre-program data, it would be impossible to perform clean before-and-after comparisons in treatment versus control villages (Armendáriz and Morduch, 2010). This is an issue that has hampered most non-experimental evaluation studies of microfinance, due to the lack of clean baseline data.

Second, our study also differs from Berg et al. (2013) in that we examine both the intensive and extensive margin of the extent of informal borrowing while the latter focuses on the intensive margin. Third, unlike Berg et al. (2013) we examine the welfare implications of microfinance, and investigate the heterogeneous effects between husbands and wives (intra-household borrowing) and across different occupations and poverty status. This is an important point of difference because we do indeed find heterogeneous effects of access to microfinance on the incidence and amount of informal lending.

A fourth point of difference between our contribution and that of Berg et al. (2013) is in terms of the methods used to address selection bias. The availability of pre-program level survey data in 1987 and three rounds of panel data allow us to address the concerns of potential selection bias regarding the decision to be a member of an MFI and placement of an MFI at the village level. [2] We use a household level fixed effects regression method, and also use the propensity score matching (PSM) method, to address selection based on observed and unobserved determinants of participation in microfinance. Fifth, we also differ in terms of defining the long-run effects as our sample spans two decades of participation status, while Berg et al. (2013) define the long-run based on only eight years of survey data.

Our results show that access to microfinance reduced households' propensity to borrow from informal sources, but it did not reduce the amount of their informal loans. However, there are heterogeneous effects, in which relatively less poor MFI members are found to benefit more in terms of reducing their reliance on informal borrowing, both in the propensity to borrow and the amount of borrowing. The benefit also accrued over time, commensurate

[1] In this paper, we define informal loans as all loans that stem from sources other than either formal financial institutions or MFIs. Thus, informal loans include loans from moneylenders, landlords, friends and relatives. More details on this definition are provided in Section 3.

[2] Because of the absence of baseline data, Berg et al. (2013) used new MFI members who joined the program after 2000 as the treatment group. They also omitted 234 households from the analysis, considering these households were MFI members in both 2000 and 2008. They used drop-outs from the program as the comparison group. However, these people were participants in microfinance, and it is not clear how one can use these households as the comparison group given that they were already microfinance members. A major advantage of our study is that we do not need to rely on such sample selection as we have data that predates these households becoming microfinance members.

with receipt of larger microfinance loans. However, microfinance borrowers that were poorer did not reduce the amount of informal borrowing. Our results suggest that microfinance not only increased a household's supply of funds, but also changed its demand for credit or/and its accessibility to informal loans. We also find heterogeneous effects based on households' occupations before joining MFIs, which could be explained by differing trends in occupational transition between microfinance members and non-members. In terms of gender differences, while women are often the target clients for MFIs, we find that having access to microfinance increased women's informal borrowing for small consumption purposes, without facilitating access to new business opportunities.

2. Hypothesis development

In this section we review the existing theoretical and empirical literature on the effect of microfinance on informal borrowing and derive a series of testable hypotheses. We break this exercise into three parts. We first discuss whether provision of microfinance can be expected to increase, or decrease, overall informal borrowing. We then proceed to examine whether there are heterogeneous effects in the relationship between provision of microfinance and informal borrowing across the poor and less poor and how the household's propensity to enter into business in the baseline affects the relationship between microfinance provision and informal loans. Given that microfinance has been targeted at women, we conclude this section by focusing on the effect of microfinance on informal borrowing by women.

2.1. Effect of microfinance on informal borrowing

The theoretical predictions of the effect of microfinance on the informal credit market remain ambiguous. As a rationale for MFIs to intervene in rural credit markets, it has been argued that MFIs can efficiently substitute for informal lenders who are commonly viewed as being exploitative (Armendáriz and Morduch, 2010). Due to lack of collateral, the poor in developing countries are mostly unable to access credit from the formal financial sector. Instead, they borrow from informal lenders, who typically charge excessively high interest rates. Given the crucial role of access to affordable credit in promoting households' productive activities, credit rationing is a major obstacle preventing households in developing countries from escaping the poverty trap (Paulson and Townsend, 2004). The high interest rates charged by informal lenders have been explained by the existence of high default rates (Collins et al., 2009) and absence of returns to scale (Aleem, 1990). MFIs can be regarded as an efficient substitute for informal lenders given their innovative group lending approach and high returns to scale due to their large coverage of clients, which ensures the provision of more favourable interest rates (Armendáriz and Morduch, 2010; Meyer, 2002; Robinson, 2001). Due to this improved access to affordable credit, the poor may be expected to borrow more from MFIs and reduce their reliance on the provision of informal credit (Khandker, 2000).

On the other hand, there is widespread anecdotal evidence that households borrow concurrently from both MFIs and informal sources (Jain and Mansuri, 2003; Sinha and Matin, 1998). One possible reason for the coexistence of microfinance and informal lending is that microfinance members may need to borrow in the informal market in order to repay microfinance loans (Sinha and Matin, 1998). Alternatively, microfinance loans with a strict repayment schedule might be less favourable than informal loans which allow for much more flexibility (Collins et al., 2009). The coexistence of microfinance and informal lending has also been explained in a number of theoretical papers. Jain and Mansuri (2003) argue that an instalment repayment plan with a strict schedule allows MFIs to exploit the better monitoring capability of the informal lenders in constraining strategic behaviour by borrowers. Therefore, the entry of an MFI into a village might stimulate the activities of the informal lenders. Other theoretical studies also attribute the prevalence of an informal credit market to its informational advantage over formal institutions (Hoff and Stiglitz, 1990; Stiglitz and Weiss, 1981). Other reasons include high transaction costs involved during the loan application process to formal or microfinance institutions, making the cost of borrowing from the informal sector relatively cheaper (Barham et al., 1996; Guirkinger, 2008; Mushinski, 1999) and the lower risk involved in entering into a borrowing contract with informal lenders (Boucher and Guirkinger, 2007; Guirkinger, 2008). An alternative explanation for an increase in informal borrowing is provided in McIntosh and Wydick (2005), who show that MFI competition can increase asymmetric information among lenders, thus creating an incentive for the most impatient borrowers to take multiple loans and increase their debt levels.

Thus, we have the following competing hypotheses:

H1. Provision of microfinance reduces household reliance on informal borrowing.

H1a. Provision of microfinance increases household reliance on informal borrowing;

2.2. Heterogeneous effects of microfinance on informal borrowing

We expect heterogeneous effects of microfinance provision on informal borrowing depending on the poverty level of the household and the household's propensity to engage in business. In terms of poverty level, we distinguish between poorer, and less poor, households. Households who are less poor are better placed to replace informal borrowing with microfinance because they have the resources to meet microfinance repayment schedules without having to resort to informal borrowing. By contrast, households that are poorer are likely to be more impatient and less endowed with collateral and, as such, more exposed to the strict microfinance repayment schedule. Mookherjee and Motta (2013) present a model in which MFIs attract both safe households with more land holdings and risky households with less land. They show that poorer microfinance borrowers tend to be risk-taking and borrow more from informal sources to meet microfinance repayments. Data in Jain and Mansuri (2003) and Sinha and Matin (1998) also suggest that poorer households borrow more from informal sources in order to service debt repayment, compared with less poor households.

Microfinance creates an increased demand for credit from informal sources as business expands and microfinance alone cannot meet the borrower's credit needs (Khandker, 2000; Mallick, 2012). Crépon et al. (2014) find that access to microfinance assisted households to expand their self-employment activities, as seen by a significant increase in investment in assets used for animal husbandry and agriculture. Similarly, Mallick (2012) finds that moneylenders' interest rates increase in response to the provision of microfinance, particularly in villages in which loans are more likely to be invested in productive activities, rather than used for consumption purposes. If the demand for credit increases with new business opportunities, we should find that households who have higher propensity to start a new business following access to microfinance borrow more from informal sources.

Since we are interested in understanding the welfare effect of microfinance on a household's informal borrowing, it is also

important to disentangle the demand and supply effects. Our analysis of heterogeneity can help us identify the demand effect; namely, whether the demand for credit increases and, if so, whether the increase reflects loan repayments or new business investment. In order to examine the supply effect, we would need to analyse how informal lenders respond to the presence of MFIs.

In Mookherjee and Motta's (2013) model informal credit markets are characterized by adverse selection and segmentation. In their model, MFIs have an informational disadvantage vis-à-vis informal lenders, but have access to capital at lower cost. MFIs and informal lenders co-exist with MFIs, attracting certain categories of borrowers (high risk borrowers and safe borrowers with enough land to shoulder the burden of joint liability). The effect of MFIs on informal interest rates are ambiguous and depend on interest rates for safe borrowers with landholdings and the relative proportion of safe and risky borrowers in the population. Other theoretical papers suggest that average informal interest rates should increase in response to the presence of MFIs. For example, the 'cream skimming effect' may lead to MFIs attracting low risk borrowers, leaving high risk borrowers to be served by informal lenders (Bose, 1998; Demont, 2010). Demont (2010) shows that assortative matching at the group formation stage in microfinance group lending encourages the safer borrowers, who have already borrowed from moneylenders, to switch to MFIs, thus increasing the riskiness of the moneylenders' pool of borrowers. As a result, moneylenders have to raise interest rates to avoid making losses.

Our data do not allow a complete analysis on the supply effect as there is hardly any information on the supply side. The only information that we have which is useful is the interest rates that households reported were charged by their lenders. Thus, we cannot observe the informal interest rates faced by those who reported having no informal loans. Maitra et al. (2013) find that MFIs offering joint liability loans disproportionately attracted clients that pay higher interest rates in the informal market. The empirical findings in Mallick (2012) and Berg et al. (2013) show that informal interest rates at the village level increase with the coverage of MFIs. However, any common trend in the average informal interest rate is likely to affect both microfinance borrowers and non-borrowers in the same way. As we are focusing on whether microfinance borrowers reduce their reliance on informal lending more than non-borrowers, the question becomes whether there is any change in the informal interest rate faced by microfinance borrowers, relative to the rate faced by non-borrowers. If informal lenders reduced the interest rate to retain borrowers who are targeted by MFIs, microfinance borrowers might borrow more from informal sources. On the other hand, if MFIs tend to attract risky and poorer households together with safe and less poor households (Mookherjee and Motta, 2013), among the poorer households microfinance borrowers would be charged at a higher informal interest rate compared with their non-borrower counterparts (since the former are considered to be riskier) while the opposite applies for microfinance borrowers who are less poor. If this effect exists, we would expect to see microfinance borrowers who are poorer borrow less from informal lenders, while those who are less poor borrow more. While our data do not allow us to formally analyse these competing effects, we will discuss the implications of the effects on our findings. On the basis of the above discussion, we propose, and test, the following hypotheses: concerning heterogenous effects:

H2. Provision of microfinance increases informal borrowing for households with high propensity to start a new business.

H3. Provision of microfinance reduces informal borrowing for less poor households, but increases it for poorer households.

There are a few recent studies that suggest that long-term effects could differ from short-term effects. Islam (2011) finds larger benefits from longer-term participation. He explained this result on the basis that microfinance borrowers can obtain larger loans by participating in a program over a long period and can generate higher returns from their business over time. Kaboski and Townsend (2012) employed an eleven-year (1997–2007) panel data set from rural Thailand. Their findings show that, with microfinance access, expansion of household credit is persistent, while increases in consumption and income are short-lived. Khandker and Samad (2013) show that in the long term access to microfinance has helped increase income, consumption and assets for MFI members. At the same time, while their debt has also increased, debt-asset ratios have declined. Thus, on the basis of existing findings, we expect that the effects outlined in *H1–H3* will be accentuated over time. Specifically, we test the following hypothesis concerning long run versus short run effects:

H4. The effects identified in H1–H3 will be larger in the long run than in the short run.

2.3. Effect of microfinance on informal borrowing by females

We now turn to whether there are gender differences in the effects of microfinance provision on informal borrowing. In rural Bangladesh, the decision to borrow, and how the loan is used, is mainly made by male members of the household without much input from their wives. In the household, the wife is mostly involved in making decisions about daily consumption expenses or small agricultural purchases like poultry. According to Kabeer (2001), restricted by purdah norms, women in rural Bangladesh remain confined to female occupations like livestock rearing and paddy husking, even after having access to microfinance.

While most microfinance members are female, their microfinance loans are most likely to fall under the control of their husbands (Goetz and Gupta, 1996; Rahman, 1999). The decision to borrow from informal sources, and the purpose for which the loan is employed, also tends to be made by the husbands. In the dataset employed in this study, in the baseline only 3 percent of borrowers from informal sources were women.

Sinha and Matin (1998) suggests that women without microfinance access could not borrow from informal sources, since they are not seen as a good credit risk and are not in the habit of borrowing. Females are disadvantaged vis-à-vis males in terms of collateral requirements and credit availability (Bellucci et al., 2010) – on the relevance of collateral in emerging markets see Menkhoff et al. (2012). If microfinance loans are under the control of men, and if microfinance access does not have any empowerment effects on women, we would not expect to see an effect on informal borrowing by women. However, becoming an MFI member may increase both a women's need, and ability, to borrow from informal sources. While it is possible that women cede control of their informal loans to their husbands, any increase in women's informal borrowing suggests a reduction in their credit constraint as well as an increase in their involvement in the household's financial decision-making.

In interviews with Grameen Bank borrowers reported in Sinha and Matin (1998), female borrowers reported that they could borrow more from moneylenders due to their almost assured credit from Grameen, that money-lenders would keep track of their Grameen loan disbursements and "even follow the borrower to the Bank on the day of the disbursement". Alternatively, women with microfinance membership might have to take responsibility for repaying microfinance loans and thus need to borrow more for repayment purposes. Grameen Bank female borrowers were

not in the habit of borrowing before joining MFIs, but the need to borrow from informal sources became more common when they started borrowing from MFIs and when their microfinance loan amounts increased (Sinha and Matin, 1998). On the basis of the above discussion, we test the following hypothesis:

H5. Provision of microfinance increases women's informal borrowing.

3. Data and descriptive statistics

3.1. Data

Our data set is nationally representative panel data from rural Bangladesh, which was collected by the Bangladesh Institute of Development Studies (BIDS) in three waves in 1987–1988, 1999–2000, and 2007–2008. The baseline survey was administered in 1987–88 to 1240 rural households from 62 villages in 57 out of 64 districts in Bangladesh. BIDS researchers used a multistage random sampling method. First, 64 unions were randomly selected from all unions in Bangladesh; then one village was selected from each union that best represented the union in terms of the size of land holding and literacy rate. All the households in the selected villages were stratified by the size of land ownership and land tenure, then a random sample of 20 households was drawn from each village such that the structure of landownership and land tenure of all households was represented (Nargis and Hossain, 2006).

MFIs barely existed in these villages in Bangladesh at the time of the baseline survey in 1987. Hence, an important and distinguishing feature of this dataset is that we have information on households that were not a member of an MFI at the time of the baseline survey, but subsequently became a member of an MFI when microfinance became available in their community. In most villages, no villager reported being a member of an MFI in 1987. We drop two villages (from two districts) from the dataset as more than five (six and eight) villagers in these villages reported being MFI members. This is to ensure that we have a clean baseline data set that does not include any village in which MFIs might be present. For 15 other villages in which less than five (mostly one to two) villagers reported being MFI members, we keep the villages but drop those MFI members. We keep these villages in the sample because there were no MFIs in these villages at the time. It is likely that a few households did not understand the difference between a microfinance loan and other similar loans (e.g., cooperative society loans) that existed at that time. The pre-program dataset also contains extensive information about participation of both the household and each individual member within a household in formal and informal borrowing.

The first follow-up survey was administered in 1999–2000 with the assistance of the International Rice Research Institute (IRRI). The households in this survey include those covered in the baseline survey in 1987–88 plus new households formed when household members left to set up their own household (Nargis and Hossain, 2006). The third, and final, wave, 2007–2008, followed the same households as the first two waves plus newly established households since the second wave, resulting in a total of 2,010 households. This final survey was carried out by BRAC.[3]

3.2. Attrition and split households

We first examine whether there is any attrition bias. There are 153 households who were surveyed in the first round, but not in the second round, representing 12 percent of the original sample. Another 77 households dropped out from the survey after the second round. The attrition rate is very low considering the two-decade-long period of the survey. Following Fitzgerald et al. (1998), we test for attrition bias that is due to observables. We estimate a probit model of attrition using lagged demographic variables and outcome variables to explain the attrition probability in the subsequent round and find no significant correlation between attrition probability and the lagged variables (see appendix, table A1 for the results from a probit regression for attrition in the second round). To account for selection on unobservables, we also run a weighted least squares (WLS) regression. In particular, we use the inverse of the probability of remaining in the sample between rounds, computed from the probit, for attrition. The weight assigned to estimation is described in detail in the next section. We find that the results are similar with, or without, weighting[4]. It is to be noted that a number of studies on attrition bias suggest that attrition is mostly random and even if it is not, the effect of attrition on outcome estimates are insignificant (Alderman et al., 2001; Falaris, 2003; Fitzgerald et al., 1998; Thomas et al., 2001).

Due to the long time period between the baseline round and the second round, the percentage of newly formed households is large. About 40 percent of original households in the baseline survey had split into more than one household by the second survey round. The percentage of split households in the third round, compared with the second round, is relatively small; only 8 percent of the households surveyed in 2000 had split by 2007–08.[5] We consider split households as separate households, due to their considerable number and the nature of borrowing in the second round. Thus, each split household is treated as an independent unit for the purpose of constructing outcome and control variables, but we use the baseline household identification when using household fixed effects. We also run a robustness check, in which we exclude all split households and the main results are similar to what we find when these split households are included. We discuss this further below.

3.3. Descriptive statistics

Table 1 shows descriptive statistics on households' borrowing according to MFI membership across the three waves of the survey. We consider unbalanced panel households surveyed in each round. In the first round of the survey, none of the households were participants in a microfinance program.

We define informal loans as all loans that stem from sources other than either formal financial institutions or MFIs. Thus, informal loans include loans from moneylenders, landlords, friends and relatives. We include loans from friends and relatives in our definition of informal loan since in rural Bangladesh people in a village usually know each other well and might think of 'everyone' as friends and relatives. Therefore, loans that were reported to be borrowed from friends and relatives are not necessarily at either a zero or low interest rate and, thus, are not necessarily more favorable than loans from moneylenders. Our data shows that the mean interest rate of loans from friends and relatives was considerably higher (48 percent) than the mean interest rate on microfinance loans (15 percent) in 2000. However, we also tried running regressions using the narrower definition of informal loans that exclude loans from friends and relatives. The findings are similar to our reported results.[6]

[3] For all the three waves of survey data used in the paper, Mahabub Hossain (now in BRAC, previously in BIDS) led the survey data collection.

[4] The full set of WLS results is available from the authors upon request.

[5] This could be due to the fact that in the second round the survey includes a large number of young households (the mean age of household heads in these households is 33) that split from the original households in the first round. These households were likely to not have split again by the third round, which was eight years later.

[6] The results are available from the authors upon request.

Table 1
Descriptive statistics for household borrowings from microfinance and non-microfinance sources.

	Round 1		Round 2				Round 3					
	All		MF non borrower in R2		MF borrower in R2	Difference (MF borrower-non borrower)	MF non borrower in R2		MF borrower in R2		Difference (MF borrower-non borrower)	
No. of observations	1010		1101		259	1360	914		454		1368	
	Mean	Std	Mean	Std	Mean	Mean	Std	Mean	Std	Mean	Mean	Std
Years of microfinance membership	0	–	0.15	0.91	3.13	2.97***	0.12	0.28	1.48	4.61	4.33***	0.14
% Households with loan	0.34	0.47	0.22	0.41	1.00	0.78***	0.03	0.18	0.38	1.00	0.83***	0.02
% Households with bank loan	0.09	0.29	0.08	0.27	0.03	−0.05***	0.02	0.07	0.26	0.02	−0.05***	0.01
% Households with microfinance loan	0	–	0	–	1.00	1.00	–	0	–	1.00	1.00	–
% Households with informal loan	0.29	0.45	0.14	0.35	0.09	0.29	−0.05**	0.02	0.11	0.31	0.05	0.21	−0.06***	0.02
Total loan amount (taka)	2619	9331	2706	15,187	6389	8534	3691***	971	5142	28,634	8941	14,435	3837***	1419
Bank loan amount (taka)	563	3067	1313	12,393	567	4285	−733	775	1315	9911	339	3317	−966**	475
Microfinance loan amount (taka)	0	–	0	–	5425	6135	5408***	184	0	–	7312	7744	7309***	255
Informal loan amount (taka)	2056	8686	1393	8837	397	1934	−982.8*	548	3827	26,869	1290	11,160	−2507*	1307
For borrowers only:														
Total loan amount (taka)	7689	14,731	12,412	30,668	6389	8534	−6045***	1980	29,375	63,181	8941	14,435	−20,441***	3170
Bank loan amount (taka)	6463	8396	16,423	41,122	18,366	17,414	1944	14,714	18,491	32,845	17,089	17,351	−1403	11,204
Microfinance loan amount (taka)	–	–	–	–	5,425	6,135	–	–	–	–	7,312	7,744	–	–
Informal loan amount (taka)	7235	15,118	9707	21,584	4282	4959	−5425	4433	34,981	74,547	26,625	44,498	−8356	16,537

This table presents descriptive statistics for households' borrowing for round 1 (1987), round 2 (2000) and round 3 (2008) of the survey. The table presents the mean and standard deviation for each of the percentage of households with a loan, bank loan, informal loan and microfinance loan. The table also presents the mean and standard deviation of the total loan amount, bank loan amount, microfinance loan amount and informal loan amount for each of the full sample and for borrowers. The difference in the mean and standard deviation between borrowers and non-borrowers in each of round 2 and round 3 is given. * significant at 10%; ** significant at 5%; *** significant at 1%.

Overall, 29 percent of surveyed households borrowed from informal sources and the average amount of informal loans were 2056 taka ($US70.4). [7] The average amount of informal borrowing is 7235 taka ($US 247.7) among those who borrowed (only those with a positive informal loan) in the first round. Without microfinance presence, the households mostly borrowed from informal sources while their formal loans are relatively small. Only 9 percent of households in the first round had borrowed from the formal banking sector. In both second and third rounds, MFI members were less likely to borrow and also borrowed less in amount from informal sources, compared with non-members. MFI members' propensity to borrow was 5 percentage-points less than non-member households in 2000 and 6 percentage-points less in 2008. The informal loan amount by MFI members was about 70 percent smaller than that by non-member households in both rounds. There was a drastic increase in the amount of informal loans among those who borrowed (both MFI members and non-members) from the second round to the third round. While this could be explained by the real changes in the economy and/or household's tendency to borrow, we cannot ignore the possibility of measurement errors where the loan amounts were recorded wrongly. To reduce the effect of measurement errors, we exclude from our analysis a number of outliers. Specifically, we exclude individuals with informal loan amounts in the top 1 percent, which is equivalent to 180,000 taka ($US 6162.3) or more.

In addition to participation in microfinance programs, differences in informal borrowing between member and non-member households may be due to their demographic differences and original conditions in the baseline. Member households are those who are poorer and have restricted access to both formal and informal non-microfinance loans. Member households also tend to borrow more due to their higher credit needs. In Table 2, we report descriptive statistics at the baseline and the mean difference between microfinance member and non-member households in the second and third rounds for households' demographic characteristics. The number of observations across survey rounds differs due to splitting households. There are some significant differences between member and non-member groups. Major differences are household head's education, land and non-land assets, and households' main earning activities. Treatment households have less land and non-land assets than control households in all three rounds. Therefore, treatment households are also less likely to work on home agriculture. Household heads in the treatment households also have lower education than their counterparts in the control households.

The difference between participating households and non-participating households in a number of observable characteristics reflected above raises a potential concern regarding selection bias into the program. Both the household's decision to participate in microcredit and its borrowing from informal sources could be driven by differences between observed and unobserved characteristics between participants and non-participants. We control for these variables in our regression modelling. We also use methods that can account for unobservables that are time invariant. In addition, we use the PSM method, which was initially proposed by Rosenbaum and Rubin (1983). With PSM, participants are compared with matched non-participants (based on propensity scores), while controlling for the characteristics that are potential determinants of participation in microfinance. We explain this method in the next section and robustness check section.

[7] The exchange rate between the Bangladesh taka (BDT) and $US as of June 30 of the year in each of the survey years is as follows: 1 USD = 29.2 BDT (1987), 50.5 BDT (2000), 68.5 BDT (2008). US$ figures given in the text are based on the exchange rate in 2000.

Table 2
Descriptive statistics for household characteristics.

No. of observations	Round 1 1010		Round 2 difference (MF borrower-non borrower) 1360		Round 3 difference (MF borrower-non borrower) 1368	
	Mean	Std	Mean	Std	Mean	Std
Head age	41.74	14.14	−3.09***	0.94	−3.72***	0.82
Female head	0.06	0.24	−0.04**	0.02	−0.11***	0.02
Head education	3.13	3.93	−1.08***	0.30	−0.80***	0.25
Household size	5.95	2.79	−0.19	0.17	0.10	0.13
No of disabled/unwell members	0.20	0.48	−0.10	0.07	−0.10***	0.04
No of children	2.26	1.60	0.04	0.09	−0.01	0.07
Cultivable land (ha)	0.38	0.87	−0.14***	0.04	−0.10***	0.02
Agricultural assets (taka)	7,124	13,935	−1,684**	707	−1,133	894
Max female education	2.45	3.16	−0.62**	0.26	−0.17	0.22
No of female members	2.91	1.63	−0.11	0.10	0.01	0.08

This table reports the mean and standard deviation for household characteristics for round 1 (1987) of the survey and the difference between microfinance borrowers and non-borrowers for each of round 2 (2000) and round 3 (2008) of the survey. * significant at 10%; ** significant at 5%; *** significant at 1%.

4. Empirical strategy

4.1. Method

We need to address a number of concerns regarding the decision to be a member of an MFI and placement of an MFI at the village level. For example, it could be the case that villages with more informal lenders get priority for microfinance as that would encourage many people to participate considering the demand for loans. That is, the decision to locate an MFI might come about because of strong demand from a local community. Moreover, households within the program villages self-select into the program. Participating households are also different in terms of a number of observable characteristics as shown in the previous section. The decision to participate in a program could be driven by the perceived benefit from such credit (for example, availability of lower interest rates compared to what local money lenders offer). Below we address this concern based on selection on observables. We also address the potential concern that the decision to participate in a microfinance program is likely to be based on unobserved characteristics.

First, we consider balancing the observed characteristics between participating and non-participating households. In order to do so we use the PSM method and select samples based on their propensity to participate in the microfinance program. PSM can directly compare the outcomes for participant and non-participant households with the same (or similar) values of those variables thought to influence both participation in microfinance and outcomes in the absence of the program. We therefore match households based on their socio-economic status. We include a number of pre-program level household characteristics and restrict our analysis to the matched sample. This approach controls for heterogeneity in initial socioeconomic conditions that may be correlated with the subsequent decision to participate in microfinance. We describe the matching protocol in Section 6.

However, it is likely that there are unobservables at both household and village level and that these determine participation in the program or placement of a program in a village. As a result, participation in the microfinance program may not be orthogonal to unobservable factors that also affect the outcome of interest. Thus to control for the unobserved characteristics that influence households' decision to participate in a microcredit program and borrowing from informal sources, we employ a household fixed-effect regression in estimating the effect of microfinance on informal loans as follows:

$$Infloan_{ijvt} = \alpha + \beta_1 Treat_{ivt} + \beta_2 X_{ivt} + \mu_j + \sigma_v + \lambda_v t + \gamma t + \varepsilon_{ivt} \quad (1)$$

Where $Infloan_{ijvt}$ is the informal loan borrowed by a household with identification number i in the current round (t) and identification number j in the first round (identification differs between the first and subsequent rounds for split households), who live in village v in survey round t. We use both incidence and amount of borrowing[8] from informal sources.

For the incidence of borrowing, *Infloan* = 1 if a household borrowed money from informal sources. It is equal to the total amount (in taka) borrowed from informal sources when we examine the amount of loans. For the latter, we use the full sample, including those who did not borrow any money from informal sources. There are only 13 percent of original households who borrowed in the second round from informal sources[9]. 'Treat' is the treatment status variable, which is equal to 1 if, in the second round, if the household had any microfinance loan from an MFI during the previous year and zero otherwise. We also use alternative treatment variables, including the number of years of membership in a microfinance program. Although we do not have data on the total accumulative amount of microfinance borrowing, the membership duration variable can be used as a proxy. The vector X includes household characteristics that affect households' demand for loans: household head's age, gender and education, household size, number of unwell members, total value of household agricultural assets, total owned cultivable land,[10] maximum education level of female members and number of female members. The time dummy equals 1 if the observations come from the second round. $\lambda_v t$ is the village trend, which captures any village time-varying factors. The time dummies control for prices, such as interest rates, and the interaction of the time dummies with the village fixed effects allows us to control for price changes that are village-specific over time. They also enable us to control for village level shocks that might affect informal borrowing across villages differently or the decision of an MFI to locate to a particular village. μ_j and σ_v are household and village fixed effects. The village fixed effects are in effect accounted for when we control for household fixed effects in our regressions.

[8] All loan amounts are deflated by the respective year's GDP deflator.

[9] Although our sample includes a large number of zero observations for informal borrowing, we prefer using OLS to Tobit due to complications with using Tobit with panel data. Greene (2004a, 2004b) found that most fixed effect Tobit estimates are biased, with the only exception being semi-parametric estimates by Honoré (1992). Honoré's main assumption is that the latent variable is independent and identically distributed after controlling for covariates and household unobservables for each individual over time (Baltagi, 2005). Therefore, the estimates are very sensitive to functional form and likely to be biased in the presence of time-varying unobservables. There are also computational difficulties due to its semi-parametric nature, especially when we include a village time trend.

[10] The variables of asset value and owned cultivable land could be endogenous, so we also run a robustness check in which these two variables are excluded and find similar results.

Due to the problem of having a large number of split households between the first and the second round, we treat households which have split as separate household units, but control for the original household fixed effect. Therefore, the subscript for the household fixed effect μ is j, which is the household identification in the first round, not i, which is the household identification in the second round. For example, if household A in the first round split into households B and C in the second round, all household level variables are computed as household A in the first round and households B and C separately in the second round. However, we control for the fixed effect of the original household A for all these households. The same method applies for the split households in the third round. This is also appropriate when dealing with borrowings, for which the decision is more likely to be made within each split household rather than in the combined household. By doing this we can also solve the difficulty of how to treat informal borrowings from relatives or family members, who can be in the same household in the first round, but in different households in the second round.

We run our regressions using both the full sample and a subsample selected based on the propensity score of participating in the program. However, results based on the full and matched samples are similar. We report results based on the full sample while the results based on a sub-sample of matched observations are provided as a robust check.

4.2. Heterogeneous effects

Given that MFIs prioritize supporting household businesses, it is possible that access to microfinance could create new business opportunities, or expand existing ones, thus affecting household demand for credit besides offering them an additional source of credit. While microfinance loans are ostensibly restricted to business purposes, the restriction is not always imposed strictly with monitoring. Therefore, the use of loans remains at the discretion of the borrowers. MFI members are observed to use microfinance loans for various purposes outside business. Our data shows that in the second round, only 27 percent of all treatment households have a business, so the majority of households having access to microfinance seem to use their microfinance loans for purposes other than business. Therefore, we expect heterogeneous effects of microfinance access among member households, possibly differing across their income-earning activities and poverty level. To examine this heterogeneity, we include interaction terms between treatment status and households' main earning activities. Based on the primary occupation of household heads at the baseline, we categorized these activities into business, home agriculture, and wage labour (including services and paid labour). Moreover, motivated by the evidence on differences between target households and non-target households in terms of their use of microfinance loans, we also interact the treatment variable with the household's poverty level: the poor or the less poor. We categorize the poor and the less poor based on MFIs' target criteria on household's owned land. Specifically, we use household's total owned cultivable land at the baseline. A household is defined as poor if it owns less than 0.5 acres of cultivable land area.[11]

4.3. Medium and long-run effects

In order to estimate the long-run effects, we look at how informal borrowing changed between the baseline (1987/88) and the final survey round (2008) for households who were microfinance members since 2000. We then compare with changes in informal borrowing of these households between the baseline and 2000 survey round. Thus, we estimate Eq. (1) using data from the first and third rounds, but define the treatment variable as household's participation status in the second round instead of in the third round (we call this the 'long-run effect'). We then compare the new results with the results we get from Eq. (1) using data from the first two rounds (we call this the 'medium-run effect').

The modified equation is defined as follows:

$$Infloan_{ijvt} = \alpha + \beta_1 Treat_{ivt} + \beta_2 NewTreat_{ivt} + \beta_3 X_{ivt} + \mu_j + \sigma_v + \lambda_v t + \gamma t + _{ivt} \quad (2)$$

In Eq. (2), we add a variable '*NewTreat*', which is equal to 1 if the household borrowed from microfinance in the third round, but not in the second round, and equal to zero otherwise. If we only use 'Treat' as household's treatment status in the second round, our estimate of the effect of microfinance on informal borrowing might be underestimated due to the inclusion of 278 households who were new microfinance borrowers in the third round. Among households who borrowed from microfinance in the second round, 101 households dropped out from microfinance in the third round. As we expect the long-run effect of microfinance to vary between those households who drop out and those who continue to borrow from microfinance by the third round, we estimate Eq. (2) again, but this time excluding the households that dropped out.

4.4. Gender, bargaining power and informal lending

To examine the relevance of gender difference, we use data on informal borrowing at the individual level to examine potential heterogeneity. We use the following equation, where k is the individual identification.

$$Infloan_{ijkvt} = \alpha + \beta_1 Treat_{ivt} * Male_{ijkv} + \beta_1 Treat_{ivt} * Fem_{ijkv} + \beta_2 X_{ivt} + \beta_3 X_{kvt} + \mu_j + \sigma_v + \lambda_v t + \gamma t + _{ivt} \quad (3)$$

The dependent variable is the informal loan amount for individual k (male or female) in household i (in the current round), which is part of household j in the first round. The treatment variable is still the same as in Eq. (1), which is the treatment status of the household, not the individual. Therefore, the coefficient β_1 measures the effect of the household's access to microfinance on informal borrowings by household members. We also control for individual variables, such as age and education. Since most of the MFI members are female (88 percent) and we are more interested in whether women's microfinance loans fall under control of their spouses, we exclude all households where male members get microfinance loans. To examine the difference in informal borrowing between males and females, we interact treatment status with binary variables for gender. Understanding there could be strategic considerations involved in the household's decision as to who should borrow from informal sources, we focus on any change in women's informal borrowing as an implication for their active participation in the credit market.

5. Results

5.1. Main results

5.1.1. Average effect of microfinance on informal borrowing

Table 3 reports the estimation results from Eq. (1), examining the effect of microfinance access, measured alternatively by a dummy variable for microfinance borrowing in the previous year or the number of years for which a household has been a member,

[11] This criteria is also generally used by MFIs as the eligibility criteria to participate in a microfinance program. However, the criterion was not followed strictly and the eligibility rule has been relaxed recently due to competition among microfinance institutions. We use eligibility criteria with the baseline dataset in 1987.

on the household's borrowing from informal sources. Column (1) of Table 3A shows that having loans from MFIs reduces the incidence of informal borrowing during that year. An increase in the number of years for which a household is a member of MFIs also reduces the propensity to borrow from informal sources (column (1), Table 3B). However, in column (3) we find no significant effect of microfinance access on households' total amount of informal loans. While households with microfinance access are less likely to borrow from informal sources, those that continue to borrow do not borrow less than their non-member counterparts. Thus, we find partial support for *H1,* at least with respect to the incidence of informal loans.

The findings possibly reflect the fact that before having microfinance access, households could not afford to invest in new productive activities including opening new home businesses or adopting new farming technologies. Thus, their only demand was for consumption borrowing alone. That microfinance loans provide MFI members with opportunities to invest in these activities means that microfinance members may need to supplement microfinance borrowing with informal loans for productive activities. In addition, having microfinance loans could also increase household's need for extra funds for loan repayments, given the tight repayment schedule by MFIs and that new productive activities require time for profit realization. This also suggests that heterogeneous effects of microfinance access among member households differ across their baseline income-earning activities and poverty level. Depending on their conditions before borrowing from microfinance, access to microfinance might also change households' credit demand in addition to changing their supply of credit. We explore these possibilities below.

5.1.2. Heterogeneous effects of microfinance on informal borrowing by occupation

To examine whether the effect of microfinance access is heterogeneous across member households in terms of their occupation, we report results that include controls for households' main occupation at the baseline and an interaction term between these controls and microfinance access (columns (2) & (4), Table 3).[12] Column (2) shows that having microfinance access can reduce the propensity to borrow from informal sources for households engaged in business or agriculture, but not for those who worked as wage labour. In particular, having microfinance access reduced the propensity by 16 percentage-points for households engaged in business and by 7 percentage-points for those engaged in agriculture. An additional year of membership of an MFI also reduced the propensity by 2.1 percentage-points for households engaged in business and 1 percentage-point for households engaged in agriculture.

We find similar effects for the informal loan amount (column (4), Table 3). While we did not find any effect of microfinance access on the amount of the informal loan when looking at all households, we find microfinance has a negative effect on the informal loan amount for households engaged in business or agriculture. Borrowing from microfinance reduced informal borrowing by about 1700 taka ($US 58.2) for business households and 810 taka ($US 27.7) for agricultural households. Meanwhile, the effect is in the opposite direction for households working in wage labour jobs. While the effect of microfinance access is positive, but not significant, the longer the households borrowed from microfinance, the more they have to borrow from informal sources (column (4), Table 3B). In particular, households with wage labour jobs increased their informal borrowing by 277 taka ($US 9.50) with each additional year of microfinance membership.

The notable heterogeneity among households with different occupations suggests that microfinance not only increased households' supply of funds, but also changed households' demand for credit and/or their access to informal loans.[13] If access to microfinance only affected the supply of funds, we expect all microfinance borrowers to either reduce, or not change, their informal borrowing. However, the increase in informal loans for microfinance member households doing wage labour jobs implies that access to microfinance increased their demand for credit and/or improved their credit trustworthiness, so that they could borrow more from informal lenders. First, households with a better track record of microfinance borrowing (observable through longer membership duration) are more likely to have access to other lending sources, especially informal lenders, from whom they could not borrow before. Second, the increase in credit demand could reflect there being insufficient funds from microfinance and/or the strict repayment requirements by MFIs that means borrowers often do not have enough time to make profits before loan repayments are due.

Even if microfinance borrowers used microfinance loans for consumption purposes, rather than productive investments, they also need to borrow more from informal sources to service microfinance debt, and the deteriorating effect of cumulative debt in the long run might even be worse since they earn no profit from microfinance loans. While microfinance aims to offer new business opportunities to households, households without a business or home agricultural production before joining MFIs are more likely to need supplementary credit than those who already have a business or production due to the high set-up cost. To test for this, we run a regression testing the relationship between a household's informal borrowing and its main occupation, controlling for household fixed effects, other time-varying household characteristics and a village time trend. The results, which are reported in the appendix Table A2, show that households moving into business indeed borrowed more, both in terms of their propensity to borrow as well as the total amount that was borrowed.

To examine this result more closely, we look at the trend of occupational transition of microfinance borrowers and non-borrowers over the period between 1987 and 2008. The results are reported in Table 4. In all periods, microfinance borrowers were more likely to move into business than non-borrowers by 2000 and 2008, irrespective of their starting occupation in 1987. However, the difference is most prominent among households who did wage labour jobs in 1987. In particular, 29 percent of microfinance borrowers who did wage labour jobs in 1987 moved into business by 2000, while the corresponding number for non-borrowers was only 17 percent. The trend is similar for the periods 1987–2008 and 2000–2008. Thus, credit demand increased for borrowers compared with the non-borrowers, who were less likely to move into business and invest in new productive activities. Microfinance borrowers who were engaged in business in 1987 or 2000 were also more likely to remain in business by 2008 (50 percent versus 23 percent for non-borrowers between 1987–2008 and 48 percent versus 32 percent between 2000–2008) while non-borrowers were more likely to move to wage labour jobs. This may explain why access to microfinance reduced informal loans for households engaged in business, but the duration of microfinance membership

[12] Throughout this paper we will only make statements that there exist heterogeneous effects (by occupation, poverty level, and gender) when we find the difference is statistically significant.

[13] The heterogeneous effects among households with different occupations are not statistically significant when we run the robustness check that excludes split households (as discussed in section 3.2). This can be partly explained by the smaller sample size available for our robustness check. Another reason could be that after excluding the split households, the household heads in the original households were mostly very old (with a mean age of 54, compared with the mean age of 37 for split households) by the third round and might no longer directly participate, or be involved full-time, in income-earning activities. Therefore, any heterogeneous effect due to the difference in occupations (that is defined by occupations at the baseline) should be minimal for these original households.

Table 3
Effect of microfinance on the incidence and amount of informal loans.

Variables	(1)	(2)	(3)	(4)
	Loan incidence		Loan amount	
(*A*) *Effect of microfinance borrowing*				
Microfinance borrower	−0.074***		−155.7	
	(0.018)		(587.8)	
Microfinance borrower*business		−0.16***		−1734.3*
		(0.046)		(966.1)
Microfinance borrower*agriculture		−0.070***		−809.7**
		(0.023)		(409.7)
Microfinance borrower*wage labour		−0.045		1429.4
		(0.030)		(1160.1)
Observations	3705	3703	3705	3703
Adjusted R-squared	0.221	0.222	0.060	0.062
(*B*) *Effect of membership years*				
Membership years	−0.0086***		52.4	
	(0.0029)		(82.7)	
Membership years*business		−0.021***		−38.0
		(0.0054)		(128.4)
Membership years*agriculture		−0.010**		−127.4
		(0.0041)		(96.0)
Membership years*wage labour		−0.0010		276.5*
		(0.0048)		(161.5)
Observations	3705	3703	3705	3703
Adjusted R-squared	0.219	0.220	0.060	0.062

This table shows regression results with the probability of having an informal loan (columns 1 & 2) or the amount of informal loan (columns 3 & 4) as the dependent variable. The main independent variables are microfinance membership (panel A) or number of membership years (panel B). Interaction terms between these independent variables and household's occupation are added in columns 3 & 4. All specifications include other covariates: household head's age, gender and education, household size, number of children, number of unwell members, total household assets, total household owned land, number of female members, maximum education of female members. All specifications control for household fixed effects and village trends and correct standard errors for household clusters. The corrected standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4
Occupational transition of borrowers and non-borrowers of microfinance.

		2000					
		Non borrower			Microfinance borrower		
		Business	Agriculture	Labour	Business	Agriculture	Labour
1987	Business	42.62	25.41	31.97	43.59	25.64	30.77
	Agriculture	12.9	64.3	22.8	19.87	56.29	23.84
	Labour	16.49	32.26	51.25	29.27	26.02	44.72
		2008					
		Non borrower			Microfinance borrower		
		Business	Agriculture	Labour	Business	Agriculture	Labour
2000	Business	31.78	24.3	43.93	48.31	24.58	27.12
	Agriculture	6.82	63.52	29.66	7.85	68.59	23.56
	Labour	7.17	24.22	68.61	13.41	21.95	64.63
		2008					
		Non borrower			Microfinance borrower		
		Business	Agriculture	Labour	Business	Agriculture	Labour
1987	Business	22.55	17.65	59.8	50	21.95	28.05
	Agriculture	10.06	50.7	39.24	14.94	51.04	34.02
	Labour	9.62	28.08	62.31	15.98	31.96	52.06

This table presents the percentage of microfinance borrowers and non-borrowers employed in each of agriculture, business and wage labour in rounds 1(1987) and 2 (2000); rounds 1 and 3 (2008) and rounds 2 and 3 of the survey. In each case, the results show the percentage of microfinance borrowers and non-borrowers who were engaged in agriculture, business and wage labour in both of the relevant rounds.

did not have any significant effect. While microfinance borrowers were more likely to remain in business and need funds for investment in the long run, non-borrowers were more likely to become wage labourers and reduce their credit demand for investment in productive activities.

Our findings show that households moving into business in general need to borrow more, and microfinance borrowers who were wage earners in the baseline were more likely to open their own business by the second and third rounds. These results suggest that the increase in informal borrowing of households doing wage jobs at the baseline is most likely due to their increase in credit demand in order to realize new business opportunities. This finding supports *H2*; namely, that the provision of microfinance increases informal borrowing for households, who, in the baseline, had a high propensity to start a new business.

5.1.3. Heterogeneous effects of microfinance on informal borrowing by poverty levels

Table 5 reports the effects of access to microfinance on household informal loans, separately for the poor and the less poor households. We find both poor and less poor microfinance borrowers reduced their propensity to borrow from informal sources.

Table 5
Effect of microfinance on the incidence and amount of informal loans: The poorer vs. the less poor.

Variables	(1)	(2)	(3)
	Loan incidence	Loan amount	
(*A*) *Effect of microfinance borrowing*			
Microfinance borrower*poorer	−0.088***	40.4	
	(0.024)	(836.6)	
Microfinance borrower*less poor	−0.052**	−450.3	
	(0.025)	(406.7)	
Observations	3703	3703	
Adjusted R-squared	0.221	0.060	
(*B*) *Effect of membership years*			
Membership years*poorer	−0.0075**	179.0	270.0*
	(0.0035)	(114.3)	(139.6)
Membership years*less poor	−0.011**	−191.9**	−171.5**
	(0.0046)	(77.4)	(83.7)
Membership years*poorer*multi-membership			−357.2**
			(142.6)
Membership years*less poor*multi-membership			−104.7
			(145.7)
Observations	3703	3703	3703
Adjusted R-squared	0.218	0.062	0.062

This table presents regression results in which the dependant variable is the same as Table 3. The independent variables are microfinance membership interacted with poverty status (panel A) or number of membership years interacted with poverty status or poverty status and if one is a member of more than one MFI (panel B). All specifications include other covariates: household head's age, gender and education, household size, number of children, number of unwell members, total household assets, total household owned land, number of female members, maximum education of female members. All specifications control for household fixed effects and village trends and correct standard errors for household clusters. The corrected standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

However, access to microfinance only had a negative effect on the amount of informal loans for the less poor households. Column (2) of Table 5B shows that each additional year of microfinance membership reduced the amount of informal loans by 192 taka ($US 6.6) for the less poor households, while the corresponding effect for the poorer households is not statistically significant. While the less poor households could efficiently substitute microfinance loans for the higher-interest rate informal loans, the results are consistent with poorer households being more vulnerable to the strict repayment schedule of MFIs. The poorer households were also restricted from borrowing from informal sources in the first place. We find the poorer households borrowed from informal sources significantly less than the less poor households at baseline due to their lack of collateral. Thus, having access to microfinance might fill the gap between their actual credit demand and the limited supply of credit from informal lenders, rather than substituting for informal lending.

We also take into account the possibility of cross-financing across different MFIs. Due to the fast-growth in MFIs, there was more than one MFI present in most surveyed villages by 2008. With the possibility of having multi-membership with different MFIs, microfinance borrowers can cross finance to serve debt repayment and might not need extra funds from informal sources. While this might be beneficial in the short-run where borrowers could exploit the cheaper interest rate on offer for microfinance loans to invest in productive activities, the long-run impact on household welfare might be negative. We control for this effect by interacting the treatment variable with a variable indicating whether households have more than one microfinance membership. This variable implies that either one household member borrows from more than one MFI or more than one member in the household borrows from microfinance. We find that poor households borrowed more from informal sources the longer the period for which they remained microfinance members (each additional membership year increased informal borrowing by 270 taka ($US 9.2)), but they reduced informal borrowing (by 357 taka ($US 12.2)) if they cross financed across MFIs (column (3), Table 5). We, however, do not find a similar effect for less poor households. Less poor members borrowed less from informal sources without the need for cross financing. Hence, overall, our findings support *H3*; namely, that provision of microfinance reduces informal borrowing for less poor households, but increases it for poorer households.

5.2. Long-run versus medium-run effects

Table 6 reports results for Eq. (2), in which we use data from the first and third rounds to consider the long-term effects of access to microfinance on informal borrowing and results for Eq. (1) using the first two rounds of data. The effect of microfinance on the amount of the informal loan is negative, but not statistically significant, for all types of households in the short run (column (1), Table 6). In column (2), we consider the long-run effect of borrowing from microfinance in 2000 on the household's informal lending in 2008, including both those who continued to borrow in 2008 and those which dropped out by 2008. Although the magnitude of the effect in the long run is much larger than the effect in the short run for households who worked on home agriculture and the less poor households (based on baseline characteristics), the coefficients are still statistically insignificant. When we exclude the drop-outs from the regression, the long-run effect is larger and statistically significant (column (3), Table 6). This result implies that the effect of microfinance on reducing informal borrowing is larger in the long run than in the short run for less poor households and agricultural households who continue borrowing from microfinance. We do not find a similar effect for poorer households and households with occupations other than home agriculture. This is consistent with our previous findings that suggest access to microfinance could allow households to either open, or expand existing, businesses, thus increasing their credit demand. Our findings are consistent with *H4* that the effects identified in *H1–H3* are stronger in the long-run than the short-run, suggesting that the benefits of microfinance accrue over time.

5.3. Effect of microfinance on informal borrowing for women

The availability of data on borrowing activities of individual household members permits us to examine whether heterogeneity in informal borrowing exists between male and female household members (Eq. (3)). The results are reported in Table 7. Female

Table 6
Effect of microfinance on the incidence and amount of informal loans: the medium run vs. the long run.

Variables	(1)	(2)	(3)
	Informal loan amount		
	Short run (1987–2000)	Long run (1987–2008)	Long run (1987–2008) *drop-outs excluded*
(*A*) *By poverty*			
Microfinance borrower in 2000*poorer	−439.1	2131.2	1676.6
	(580.6)	(1431.5)	(1912.3)
Microfinance borrower in 2000*less poor	−323.9	−1176.4	−1972.3*
	(354.5)	(1067.2)	(1105.0)
New microfinance borrower in 2008*poorer		957.8	803.8
		(1476.0)	(1525.2)
New microfinance borrower in 2008*less poor		−479.9	−598.8
		(912.9)	(958.6)
Observations	2350	2360	2154
Adjusted R-squared	0.082	0.081	0.080
(*B*) *By occupational status*			
Microfinance borrower in 2000*business	−614.3	1559.4	−1232.7
	(963.3)	(1796.3)	(1327.8)
Microfinance borrower in 2000*agriculture	−396.0	−1115.1	−2153.8*
	(370.8)	(1054.1)	(1102.8)
Microfinance borrower in 2000*wage labour	−298.3	3052.3	3749.7
	(679.1)	(1956.1)	(2672.5)
New microfinance borrower in 2008*business		170.4	−270.9
		(1362.0)	(1442.8)
New microfinance borrower in 2008*agriculture		−574.5	−738.9
		(850.7)	(895.3)
New microfinance borrower in 2008*wage labour		2020.3	1962.2
		(2399.0)	(2441.5)
Observations	2350	2360	2154
Adjusted R-squared	0.082	0.082	0.083

This table presents regression results in which the dependant variable is the informal loan amount. The independent variables are if one was a microfinance borrower interacted with poverty status (panel A) or occupational status (panel B). The first column presents the short-run effects, based on borrowing, poverty and occupational status in 2000. The second and third columns present the long-run effects, based on borrowing, poverty and occupational status in 2008. All specifications include a full set of controls, household fixed effects and village trends and correct standard errors for household clusters. The corrected standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7
Gender of the borrower and the effects of microfinance on informal loans.

Variables	(1)	(2)	(3)	(4)
	Loan incidence		Loan amount	
	Total loan		Production loan	Consumption loan
Microfinance borrower*male	−0.061***	−269.6	−97.6	−158.7*
	(0.012)	(437.9)	(185.5)	(96.0)
Microfinance borrower *female	0.018**	366.4*	205.6	386.3*
	(0.0082)	(199.1)	(150.8)	(211.7)
Female	−0.12***	−1075.2***	−298.5***	−341.8***
	(0.0071)	(160.3)	(62.1)	(70.9)
Observations	7602	7602	7602	7602
Adjusted R-squared	0.138	0.020	0.018	0.019

This table presents regression results in which the dependant variable is the same as Table 3. Loan amount is divided into total loans (column 3), production loans (column 4) and consumption loans (column 5). The independent variables are if one was a microfinance borrower interacted with gender. All specifications include other covariates: household head's age, gender and education, household size, number of children, number of unwell members, total household assets, total household owned land, number of female members, maximum education of female members. All specifications control for household fixed effects and village trends and correct standard errors for household clusters. The corrected standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

household members always borrow less from informal sources than male members, both in terms of propensity to borrow and amount of borrowing (columns (1) & (2), Table 7). On average, a female member borrows about 1000 taka ($US 34.2) less than her male counterpart. When female members borrow from microfinance, there is a reduction in propensity to borrow from informal sources, but no significant effect on the amount of informal borrowing by male members in the same household, while female microfinance borrowers increased borrowing from informal sources, both in terms of propensity to borrow and amount of borrowing. The access to microfinance increased female borrowers' propensity to have an informal loan by 1.8 percentage-points and increased their amount of informal lending by 366 taka ($US 12.5). While these increases seem small in absolute terms, they are not negligible if one takes into consideration that women hardly borrowed at all at the baseline.

We next look at the different uses of informal loans, separating the amount of informal loan into loans for productive purposes and loans for non-productive purposes (including consumption and loan repayment). While the loan could end up being used for a different purpose from that for which it was intended, looking at loans for different purposes offers us an insight into the kinds of household financial decisions in which women are likely to be involved. We find that access to microfinance increased women's informal borrowing for non-productive purposes, but not productive purposes (columns (3) & (4), Table 7). These results

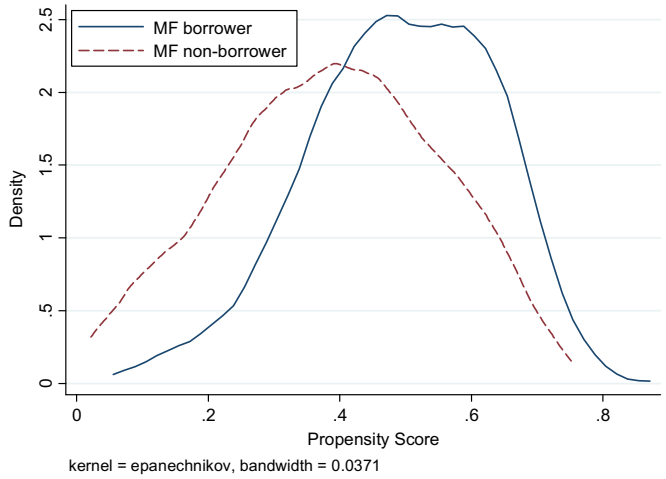

Fig. 1. Distribution of propensity score for microfinance borrowers and non-borrowers.

are consistent with the observation that women are more likely to be involved in making small purchase decisions rather than big decisions, such as business investments. In this case, women without microfinance access may not have any access to other informal loans, so microfinance membership provides them with more credit history to obtain loans from other sources for their small expenses, thus leading to an increase in informal borrowing. Our findings support *H5;* namely, that provision of microfinance increases informal borrowing by women, which is mainly used for small consumption usage.

6. Robustness checks: matching households based on propensity score matching

Our descriptive statistics have shown that the treatment and control groups were statistically different in terms of a number of observable characteristics in the baseline. This raises the question of comparability between the two groups, leading to imprecise estimates of the average treatment effect. We control for these observables in our regression to net out the influence of such factors on the outcomes of interest. We also use household level fixed effect estimation which relies on the assumption of the same cross-section bias existing before, and after, treatment, such that the average change in outcome is assumed to be the same for both treatment and control groups if they had not been treated. In addition, we also control for a time trend at the village level – allowing us to tackle factors such as shocks or other time varying unobservables at the village level that might attract the presence of a microfinance organization in a village following shocks or trends.

However, such fixed effects and inclusion of a linear time trend at the village level may ignore possible heterogeneity between the treatment and control groups in the initial conditions. To address this problem, we employed the PSM method, together with fixed effect estimation, as a robustness check. We used PSM to select a comparable control group, using the baseline survey in 1987. We then run the same fixed effects regression as in Eqs. (1)–(3) using a trimmed sample, in which treatment and comparison groups are matched along a number of observable dimensions. The identifying assumption for cross-sectional matching is that outcomes in the untreated state are independent of the treatment, conditional on a set of observable characteristics. In other words, this method relies on the assumption that there is no selection bias from the unobservables. The availability of panel data helps us address the selection based on unobservables. We therefore combine household fixed effect models and PSM approaches, thus, control for both initial heterogeneity and unobserved determinants of program participation.

We follow the matching approach of Heckman et al. (1998a) that allows for temporally invariant differences in outcomes between treatment and control households and also for selection into the treatment group to be based on anticipated gains from the program. To estimate the propensity score, we use a standard

Table 8
Effect of microfinance on informal loan – Results for the matched sample based on propensity score matching.

Variables	(1)	(2)	(3)	(4)
	Loan incidence		Loan amount	
(*A*) *Effect of microfinance borrowing*				
Microfinance borrower	−0.076***		−215.7	
	(0.018)		(611.1)	
Microfinance borrower*business		−0.16***		−1823.2**
		(0.049)		(792.6)
Microfinance borrower*agriculture		−0.070***		−874.4**
		(0.022)		(418.7)
Microfinance borrower*wage labour		−0.054*		1397.8
		(0.032)		(1240.3)
Observations	3594	3592		3592
Adjusted R-squared	0.226	0.228		0.096
(*B*) *Effect of membership years*				
Membership years	−0.0086***		23.4	
	(0.0031)		(82.6)	
Membership years*business		−0.021***		−72.9
		(0.0055)		(75.3)
Membership years*agriculture		−0.010**		−198.6***
		(0.0041)		(72.9)
Membership years*wage labour		−0.00093		299.8*
		(0.0053)		(179.1)
Observations	3594	3592	3594	3592
Adjusted R-squared	0.093	0.226	0.223	0.097

This table presents the results for propensity score matching in which the dependent variable is defined as in Table 3. The independent variables are if one is a microfinance borrower and if one is a microfinance borrower interacted with occupation (panel A) and the length of time one has been a microfinance member and membership years interacted with occupation (panel B). All specifications include other covariates: household head's age, gender and education, household size, number of children, number of unwell members, total household assets, total household owned land, number of female members, maximum education of female members. All specifications control for household fixed effects and village trends and correct standard errors for household clusters. The corrected standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

logit model in which the dependent variable takes a value of 1 if a household is a microfinance borrower and zero otherwise. The set of control variables include household and village variables that may affect both a household's microfinance membership and potential outcomes.[14] The results, which are not reported here for brevity, show that compared to microfinance non-borrowers, borrowers are less educated, own less cultivable land, have less working female members in the household, and reside in villages which have larger populations, are less flood-prone and are located closer to bus stops and railways.

We then apply the kernel matching method following Smith and Todd (2005), Heckman et al. (1997) and Heckman et al. (1998b). This method constructs a match for each treatment observation using a kernel-weighted average over multiple observations in the control group. The weights depend on the distance between each observation in the control group and the treatment observation for which the counterfactual is constructed. This method has the major advantage over other matching methods that it reduces the asymptotic mean squared error (Smith and Todd, 2005). It is preferable to the stratification method, in which a number of treatment observations are discarded due to the lack of controls available in their block and the nearest-neighbour method, which results in some poor matches.[15]

An important first step with matching is to check the overlap and the region of common support between participant and comparison groups. Fig. 1 shows the distribution of the estimated propensity score of microcredit borrowers and non-borrowers. It shows that there are very few regions of non-overlapping support. We only select the subset of the comparison group that is comparable to the treatment group. We discard observations that do not have any common support. We also delete observations so that households with very high, or very low, probability of participating in the program do not contaminate our results. We then run the fixed-effect regressions as before, but using the kernel weight. Table 8 reports the main PSM results. The results are similar to the previous results for the whole sample without matching, although the magnitude of the effect is slightly larger in general.

7. Conclusion

Focusing on the role of microfinance in reducing household's reliance on informal borrowing in the medium run and long run, this paper contributes to an under-researched area in the microfinance literature. We first summarize our findings with respect to the five hypotheses. We find that, in general, access to microfinance reduced household's propensity to borrow from informal sources, but not the amount of informal loans. Therefore, there is partial support for *H1*. Our findings suggest that the effect of access to microfinance on the incidence and amount of informal lending is heterogeneous across poverty levels, consistent with *H2*, and that households with a propensity to engage in business borrow more, consistent with *H3*. In terms of long run versus short-run effects, the effects identified in *H1–H3* are accentuated over time for the less poor households when they continued borrowing from microfinance and possibly received larger loans, consistent with *H4*. Finally, we find that the provision of microfinance increases informal borrowing by women for small consumption usage, consistent with *H5*, but without facilitating access to new business opportunities.

Being less dependent on informal lenders, we might expect that less poor households who continued to borrow from microfinance in the long-run may be able to benefit from income growth through increased saving and investment, which are promoted by the reduced cost of financing. As evidenced in the literature, microfinance interest rates are significantly lower than the rates charged by informal lenders (Khandker et al., 2013; Khandker and Samad, 2014; Mallick, 2012). Our data also show that the mean informal interest rate was 72 percent as opposed to the 15 percent charged by MFIs in 2000. As a result, we might expect that households who continued to borrow from microfinance may be able to invest more efficiently in inputs, labour and technologies (Sinha and Matin, 1998; Zeller et al., 1997). According to Zeller et al. (1997), access to more affordable credit can also reduce a household's cost of insurance against adverse shocks, enabling them to invest in riskier, but also more profitable, projects. Khandker et al. (2013) find that microenterprise profit is 115 percent higher for households that borrowed from MFIs, compared to those that borrowed from informal lenders. However, given the scope of this paper and our data availability we cannot directly examine whether these potential benefits are indeed present. This is an area that could be fruitfully examined in future research.

Meanwhile households that were poorer and households whose main occupation was wage labour did not reduce informal borrowing when they received microfinance loans. The longer the households remained with the MFI, the more they borrowed from informal sources; the exception was when households were able to cross-finance across MFIs. The heterogeneity among households with different occupations and poverty levels suggests microfinance not only increased a household's supply of funds, but also changed its demand for credit. Trends in occupational transition between microfinance borrowers and non-borrowers support these arguments. Poorer households and households without a business or sufficient landholding before joining microfinance mostly borrowed for consumption purposes. However, microfinance borrowers engaged in wage labour before borrowing from MFIs were more likely to move into business after borrowing, suggesting that they are more likely to need supplementary funds for the new investments not funded by MFIs.

On one hand, these households benefit from access to new business opportunities. On the other, cross-financing and a continuing increase in informal borrowing in the long run might keep them in a vicious circle of debt or over-indebtedness, in which business profits are compromised by debt repayment. Anecdotally, studies have pointed to microcredit's high interest rates and inadequate benefits relative to the borrowing cost as the cause of rising indebtedness and thus argued that microfinance cannot end poverty (Khandker and Samad, 2013). As defined by Schicks (2013), a microfinance borrower is over-indebted if "he/she is continuously struggling to meet repayment deadlines and structurally has to make unduly high sacrifices related to his/her loan obligations". It is thus important to look at heterogeneity in impact, which suggests a positive effect for the less poor, but not poorer, households. This heterogeneity could help explain findings in the literature that show microcredit has a heterogeneous impact on a household's profits from self-employment (Banerjee et al., 2013; Crépon et al., 2014), and thus have important policy implications. While microcredit could offer new business opportunities to poorer households, since the poor are more prone to the strict repayment schedule and in higher need for credit (for eg. to start a new business). Our findings therefore contribute to the literature on microfinance over-indebtedness, suggesting MFIs could be designed to better target households that are exposed to the vicious debt circle. In this respect, Pytkowska and Spannuth (2012) and Schicks (2014)

[14] The covariates are: household head's age, gender and education, household size, number of children, number of unwell members, total household assets, total household owned land, number of female members, maximum education of female members, number of migrating members, number of working male members, number of working female members, main earning activity, village's flood experience, village's average prices of main commodities, village's electricity status, village's population and village distance to the nearest bus stop, railway, and market.

[15] We also used other matching estimators including nearest-neighbour, stratification and caliper, and the results are similar.

argue for the need to improve the financial literacy of borrowers. Schicks (2014) also finds that the risk of over-indebtedness is higher for male borrowers, borrowers who experience adverse economic shocks, who use loans for non-productive purposes and who receive low returns to microenterprises investments. She calls for constructive policy measures such as flexible instalment schedules or emergency loans, instead of destructive measures including overly reducing the number of loans and loan amount.

While we cannot formally examine the supply effect of microfinance on informal lending, since we only observe an increase in informal borrowing for microfinance borrowers who were poorer or who earned wage income at the baseline, we can almost rule out the effect from informal lenders reducing interest rates to retain borrowers who are targeted by MFIs. If the effect exists, we should expect all microfinance borrowers, including the less poor, to borrow more from informal sources. On the other hand, if due to the selection effect of MFIs, the poorer microfinance borrowers were charged a higher informal interest rate and the less poor microfinance borrowers were charged a lower rate compared with their non-borrower counterparts, we would find a negative effect of microfinance on poorer households and a positive effect on less poor households. We did not find this result either.

In terms of the gender differential in borrowing, our findings are in line with common observations on the role of women in household's financial decision-making in the context of developing countries, especially in poor households. Without microfinance access, women are mostly not involved in the household's financial decisions, particularly in borrowing and using loan proceeds. They are also more credit-constrained than men when seeking to borrow from informal sources. Hence, most household informal borrowing is made by men. Even when women are targeted by microfinance, microfinance loans by women are mostly under the control of their husbands, who invest in business. We find evidence that having access to microfinance only affects women's informal borrowing for small consumption use by improving the extent to which they are considered a good credit risk by lenders.

Table A1
Probit estimation of attrition probability.

Variables in round 1	(1)	(2)	(3)
Head age	−0.0046	−0.0043	−0.0042
	(0.0036)	(0.0035)	(0.0035)
Female head	0.18	0.19	0.20
	(0.19)	(0.19)	(0.19)
Head education	0.026	0.023	0.023
	(0.017)	(0.016)	(0.016)
Household size	−0.035	−0.037	−0.037
	(0.037)	(0.038)	(0.038)
No of disabled/unwell members	−0.11	−0.13	−0.14
	(0.10)	(0.11)	(0.11)
No of children	−0.0011	−0.0037	−0.0050
	(0.050)	(0.051)	(0.051)
Cultivable land (ha)	−0.036	−0.033	−0.033
	(0.077)	(0.076)	(0.077)
Agricultural assets (,000 taka)	−0.0025	−0.0023	−0.0026
	(0.0046)	(0.0045)	(0.0045)
Max female education	−0.021	−0.017	−0.018
	(0.026)	(0.026)	(0.026)
Informal loan incidence		0.015	
		(0.10)	
Informal loan amount (,000 taka)			0.0045
			(0.0043)
Observations	1108	1108	1108

This table shows regression results with the probability of dropping out in the second round as the dependent variable. The independent variables are household's baseline characteristics in the first round. All specifications control for village fixed effects and correct standard errors for village clusters. The corrected standard errors are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table A2
Effect of occupation on informal borrowing.

Variables	(1)	(2)
	Loan incidence	Loan amount
Business	0.051**	2190.0***
	(0.021)	(823.3)
Agriculture	0.027*	541.7
	(0.016)	(497.5)
Observations	3705	3705
Adjusted R-squared	0.218	0.064

This table shows regression results with the probability of having an informal loan (column 1) or the amount of the informal loan (column 2) as the dependent variable. The main independent variables are dummy variables indicating household's main earning activities. The base occupation is wage labour. All specifications include other covariates: household head's age, gender and education, household size, number of children, number of unwell members, total household assets, total household owned land, number of female members, maximum education of female members. All specifications control for household fixed effects and village trends and correct standard errors for household clusters. The corrected standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Appendix A

See Tables A1 and A2.

References

Alderman, H., Behrman, J., Kohler, H.-P., Maluccio, J., Watkins, S., 2001. Attrition in longitudinal household survey data some tests for three developing-country samples. Demographic Research 5, 80–123.

Aleem, I., 1990. Imperfect information, screening, and the costs of informal lending: a study of a rural credit market in Pakistan. The World Bank Economic Review 4 (3), 329–349.

Armendáriz, B., Morduch, J., 2010. The Economics of Microfinance. MIT Press.

Baltagi, B.H., 2005. Econometric Analysis of Panel Data, vol. 13. Wiley.

Banerjee, A., Duflo, E., Glennerster, R., & Kinnan, C., 2013. The Miracle of Microfinance?: Evidence from a Randomized Evaluation. CEPR Discussion Paper.

Barham, B.L., Boucher, S., Carter, M.R., 1996. Credit constraints, credit unions, and small-scale producers in Guatemala. World Development 24 (5), 793–806.

Behr, P., Entzian, A., Guttler, A., 2011. How do lending relationships affect access to credit and loan conditions in microlending? Journal of Banking and Finance 35, 2169–2178.

Bellucci, A., Borisov, A., Zazzaro, A., 2010. Does gender matter in bank-firm relationships? Evidence from small business lending. Journal of Banking and Finance 34, 2968–2984.

Berg, C., Emran, M. S., & Shilpi, F., 2013. Microfinance and Moneylenders: Long-run Effects of MFIs on Informal Credit Market in Bangladesh. World Bank Policy Research Working Paper, September.

Besley, T., Burchardi, K., Ghatak, M., 2012. Incentives and the De Soto effect. Quarterly Journal of Economics 127, 237–282.

Bose, P., 1998. Formal-informal sector interaction in rural credit markets. Journal of Development Economics 56, 265–280.

Boucher, S., Guirkinger, C., 2007. Risk, wealth, and sectoral choice in rural credit markets. American Journal of Agricultural Economics 89 (4), 991–1004.

Collins, D., Morduch, J., Rutherford, S., Ruthven, O., 2009. Portfolios of the Poor: How the World's Poor Live on $2 a Day. Princeton University Press.

Crépon, B., Devoto, F., Duflo, E., & Pariente, W., 2014. Estimating the Impact of Microfinance on Those Who Take it up: Evidence from a Randomized Experiment in Morocco, Working Paper.

Demont, T. (2010). The Impact of Microfinance on the Informal Credit Market: An Adverse Selection Model, CRED Working Paper.

Falaris, E.M., 2003. The effect of survey attrition in longitudinal surveys: evidence from Peru, Côte d'Ivoire and Vietnam. Journal of Development Economics 70 (1), 133–157.

Fitzgerald, J., Gottschalk, P., Moffitt, R., 1998. An analysis of sample attrition in panel data: the Michigan panel study of income dynamics. The Journal of Human Resources 33 (2), 251–299.

Galema, R., Lensink, R., Mersland, R., 2012. Do powerful CEOs determine microfinance performance? Journal of Management Studies 49 (4), 718–742.

Gertler, P., Levine, D.I., Moretti, E., 2009. Do microfinance programs help families insure against illness? Health Economics 18, 257–273.

Goetz, A.M., Gupta, R.S., 1996. Who takes the credit? Gender, power, and control over loan use in rural credit programs in Bangladesh. World Development 24 (1), 45–63.

Greene, W., 2004a. The behaviour of the maximum likelihood estimator of limited dependent variable models in the presence of fixed effects. The Econometrics Journal 7 (1), 98–119.

Greene, W., 2004b. Fixed effects and bias due to the incidental parameters problem in the Tobit model. Econometric Reviews 23 (2), 125–147.
Guirkinger, C., 2008. Understanding the coexistence of formal and informal credit markets in Piura, Peru. World Development 36 (8), 1436–1452.
Hartarska, V., 2005. Governance and performance of microfinance institutions in Central and Eastern Europe and the newly independent states. World Development 33 (10), 1627–1643.
Hartarska, V., Mersland, R., 2012. Which governance mechanisms promote efficiency in reaching poor clients? Evidence from rated microfinance institutions. European Financial Management 18 (2), 218–239.
Hartarska, V., Shen, X., Mersland, R., 2013. Scale economies and input price elasticities in microfinance institutions. Journal of Banking and Finance 37, 118–131.
Heckman, J.J., Ichimura, H., Todd, P.E., 1997. Matching as an econometric evaluation estimator: evidence from evaluating a job training programme. The Review of Economic Studies 64 (4), 605–654.
Heckman, J.J., Ichimura, H., Todd, P., 1998a. Matching as an econometric evaluation estimator. The Review of Economic Studies 65 (2), 261–294.
Heckman, J., Ichimura, H., Smith, J., Todd, P., 1998b. Characterizing selection bias using experimental data. Econometrica 66 (5), 1017–1098.
Hermes, N., Lensink, R., Meesters, A., 2011. Outreach and efficiency of microfinance institutions. World Development 39 (6), 938–948.
Hoff, K., Stiglitz, J.E., 1990. Introduction: imperfect information and rural credit markets: puzzles and policy perspectives. The World Bank Economic Review, 235–250.
Honoré, B.E., 1992. Trimmed LAD and least squares estimation of truncated and censored regression models with fixed effects. Econometrica: Journal of the Econometric Society, 533–565.
Islam, A., 2011. Medium-and long-term participation in microfinance. An evaluation using a new panel dataset from Bangladesh. American Journal of Agricultural Economics 93 (3), 847–866.
Islam, A., Maitra, P., 2012. Health shocks and consumption smoothing in rural households: does microfinance have a role to play? Journal of Development Economics 97 (2), 232–243.
Jain, S., Mansuri, G., 2003. A little at a time: the use of regularly scheduled repayments in microfinance programs. Journal of Development Economics 72 (1), 253–279.
Kabeer, N., 2001. Conflicts over credit: re-evaluating the empowerment potential of loans to women in rural Bangladesh. World Development 29 (1), 63–84.
Kaboski, J.P., Townsend, R.M., 2005. Policies and impact: an analysis of village-level microfinance institutions. Journal of the European Economics Association 3 (1), 1–50.
Kaboski, J.P., Townsend, R.M., 2012. The impact of credit on village economies. American Economic Journal: Applied Economics 4 (2), 98–133.
Karlan, D., Zinman, J., 2010. Expanding credit access: using randomized supply decisions to estimate the impacts. Review of Financial Studies 23 (1), 433–464.
Khandker, S.R., 2000. Savings, informal borrowing, and microfinance. The Bangladesh Development Studies, 49–78.
Khandker, S.R., 2005. Microfinance and poverty: evidence using panel data from Bangladesh. The World Bank Economic Review 19 (2), 263–286.
Khandker, S., & Samad, H.A., 2013. Are microfinance participants in Bangladesh trapped in poverty and debt? World Bank Policy Research Working Paper 6404.
Khandker, Shahidur R., Samad, & Hussain A., 2014. Dynamic effects of microfinance in Bangladesh. World Bank Policy Research Working Paper Series 6821.
Khandker, Shahidur R., Samad, Hussain A., & Ali, Rubaba, 2013. Does access to finance matter in microenterprise growth? evidence from Bangladesh. World Bank Policy Research Working Paper Series 6333.
Kislat, C., Menkhoff, L., 2011. The Village Fund Loan: Who Gets it, Keeps it and Loses it? Manuscript. University of Hannover, Germany.
Lensink, R., Pham, T.T.T., 2012. The impact of microfinance on self-employment profits in Vietnam. Economics of Transition 20 (1), 73–111.
Maitra, P., Mitra, S., Mookherjee, D., Motta, M., & Visaria, S., 2013. Agent Intermediated Lending: A New Approach to Microfinance. Working Paper, Monash University.
Mallick, D., 2012. Microfinance and moneylender interest rate: evidence from Bangladesh. World Development 40 (6), 1181–1189.
McIntosh, C., Wydick, B., 2005. Competition and microfinance. Journal of Development Economics 78 (2), 271–298.
Menkhoff, L., Rungruxsirivorn, O., 2011. Do village funds improve access to finance? Evidence from Thailand. World Development 39 (1), 110–122.
Menkhoff, L., Neuberger, D., Rungruxsirivorn, O., 2012. Collateral and its substitutes in emerging markets' lending. Journal of Banking and Finance 36, 817–834.
Mersland, R., Oystein Strom, R., 2009. Performance and governance in microfinance institutions. Journal of Banking and Finance 33, 662–669.
Meyer, R.L., 2002. The demand for flexible microfinance products: lessons from Bangladesh. Journal of International Development 14 (3), 351–368.
Mookherjee, D., & Motta, A., 2013. A Theory of Interactions Between MFIs and Informal Lenders, Working Paper.
Morduch, J., 1998. Does Microfinance Really Help the Poor? New Evidence from Flagship Programs in Bangladesh. Technical Report, New York University, New York.
Mushinski, D.W., 1999. An analysis of offer functions of banks and credit unions in Guatemala. The Journal of Development Studies 36 (2), 88–112.
Nargis, N., Hossain, M., 2006. Income Dynamics and Pathways out of Rural Poverty in Bangladesh, 1988–2004. Agricultural Economics 35 (s3), 425–435.
Paulson, A.L., Townsend, R., 2004. Entrepreneurship and financial constraints in Thailand. Journal of Corporate Finance 10 (2), 229–262.
Pitt, M.M., Khandker, S.R., 1998. The impact of group-based credit programs on poor households in Bangladesh: does the gender of participants matter? Journal of Political Economy 106 (5), 958–996.
Pitt, M.M., Khandker, S.R., 2002. Credit programmes for the poor and seasonality in rural Bangladesh. Journal of Development Studies 39 (2), 1–24.
Pytkowska, J., Spannuth, S., 2012. Indebtedness of microcredit clients in Kosovo: results from a comprehensive field study. Microfinance Centre, Finance in Motion.
Rahman, A., 1999. Micro-credit initiatives for equitable and sustainable development: who pays? World Development 27 (1), 67–82.
Robinson, M.S., 2001. The Microfinance Revolution: Sustainable Finance for the Poor, vol. 1. World Bank Publications.
Rosenbaum, P.R., Rubin, D.B., 1983. The central role of the propensity score in observational studies for causal effects. Biometrika 70 (1), 41–55.
Schicks, J., 2013. The definition and causes of microfinance over-indebtedness: a customer protection point of view. Oxford Development Studies 41 (sup1), S95–S116.
Schicks, J., 2014. Over-indebtedness in microfinance – an empirical analysis of related factors on the borrower level. World Development 54, 301–324.
Servin, R., Lensink, R., van den Berg, M., 2012. Ownership and technical efficiency of microfinance institutions: empirical evidence from Latin America. Journal of Banking and Finance 36, 2136–2144.
Sinha, S., Matin, I., 1998. Informal credit transactions of micro-credit borrowers in rural Bangladesh. IDS Bulletin 29 (4), 66–80.
Smith, J.A., Todd, P.E., 2005. Does matching overcome LaLonde's critique of nonexperimental estimators? Journal of Econometrics 125 (1), 305–353.
Stiglitz, J.E., Weiss, A., 1981. Credit rationing in markets with imperfect information. The American Economic Review, 393–410.
Thomas, D., Frankenberg, E., Smith, J.P., 2001. Lost but not forgotten: attrition and follow-up in the Indonesia Family Life Survey. Journal of Human resources, 556–592.
Yunus, M., 1994. Credit as a Human Right. Grameen Bank, Dhaka.
Zeller, M., Schrieder, G., Von Braun, J., Heidhues, F., 1997. Rural finance for food security for the poor: implications for research and policy (No. 4). International Food Policy Research Institute.