



## Invited Article

# Heterogeneous effects of microcredit: Evidence from large-scale programs in Bangladesh



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## ABSTRACT

This paper evaluates the effects of microcredit on household consumption using a large dataset from Bangladesh. Village fixed effects and instrumental variable strategies are used to estimate the causal effects of microcredit program participation. Overall, the results indicate that the effects of microcredit on consumption vary across different groups of poor household borrowers. The groups that benefit the most include the poorest of the poor participants. The benefits are low for households that are marginal to the participation decision. The effects of participation are generally stronger for female borrowers than for male borrowers.

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## 1. Introduction

Microcredit has become a prominent element of development strategies. Over the last two decades, microcredit programs have expanded rapidly, first in Bangladesh and then across the developing world. Bangladesh's microcredit sector is remarkable for the speed at which it grew to its present size and prominence. This study estimates the effect of microcredit participation on household consumption using a large and nationally representative dataset from Bangladesh. The evaluation of large-scale microcredit programs can help us to gain a better understanding of the benefits of participation. Microcredit programs are of great significance, given the renewed pledges from policy-makers and practitioners to expand such programs and to increase their coverage to reach a wider community. The United Nations declared 2005 as the International Year of Microcredit and urged multilateral donor agencies and developed countries to support the microcredit movement to achieve its Millennium Development Goal of halving poverty by 2015. Moreover, the 2006 Nobel Peace Prize winner was Prof. Yunus and the Grameen Bank, which Yunus founded more than three decades ago.

The main goal of this paper is to estimate the heterogeneous effects of microcredit. Particularly, it attempts to understand which borrowers can benefit from the program the most. We examine (1) whether or not the program has a

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greater effect on the poorest households in program villages than on less poor households from the same village, and (2) whether women borrowers receive greater benefits from participating than men in the same program. We estimate the treatment effects on subgroups, which is the most common way to investigate the distributional effects of a program (Djebbari & Smith, 2008).

A number of studies have examined the effect of microcredit on households' socio-economic well-being. In general, these studies find microcredit to have a positive effect on the expansion of existing business enterprises (Banerjee, Duflo, Glennerster, & Kinnan, 2012), self-employment activities and business profits (Crepon, Devoto, Duflo, & Pariente, 2014; de Mel, McKenzie, & Woodruff, 2008; McKernan, 2002), income and poverty (Khandker, 2005; Pitt & Khandker, 1998), and informal loan (Islam, Nguyen, & Smyth, 2015). Several studies have also examined the way in which microcredit helps to mitigate the effects of health and income shocks (Gertler, Levine, & Moretti, 2009; Islam & Maitra, 2012) and children's schooling (e.g., Islam & Choe, 2013). In this paper, we focus on the effect of food consumption, because (1) in the rural areas of Bangladesh, expenditure on food consumption accounts for more than 70% of the total household spending among the poor, and (2) microcredit programs aim to improve households' economic well-being, with consumption playing the most important role in this.

Another contribution of this study is our use of data from a unique, nationally representative survey of microcredit program households. The survey encompasses a wide range of information at the household, village, and organizational levels. It includes 3026 households in the program and control groups, covering 91 villages spread over 23 thanas (sub-districts). This survey of microcredit households was the largest ever conducted in Bangladesh. The survey was conducted by the Bangladesh Institute of Development Studies (BIDS) for the Palli Karma-Sahayak Foundation (PKSF, Rural Employment Support Foundation) for the purpose of evaluating microcredit programs in Bangladesh.<sup>1</sup>

We estimate both the effect of participating in microcredit programs (treatment on the treated effect) and the effect of being offered a chance to participate in a microcredit program (intention-to-treat effect). The intention-to-treat (ITT) effect, or difference-in-difference estimate, suggests a smaller positive effect of assignment (eligibility). A substantial number of eligible households in the treatment villages did not participate in the program, whereas some ineligible (non-encouraged) households did participate. In our case, assignment (an eligibility criterion) is merely an encouragement to take treatment, and we observe some non-compliance among those so encouraged. Therefore, we aim to address the selection bias and to link ITT effects to treatment effects. In particular, we use village fixed effects to address the non-random program placement and an instrumental variable (IV) approach to control for the self-selection into the microcredit program of households within the village. Our instruments are generated by an eligibility rule for receiving microcredit and its interaction with pre-determined characteristics at the household level.

We find evidence against the "common effect" assumption using the analysis of subgroups. Overall, our results suggest that the effects of microcredit loans on food consumption expenditure vary across different groups of poor household borrowers. Our results overwhelmingly support the idea that the poorest of the poor benefit the most from participation in microcredit. The effects are low for households that are marginal to the participation decision, and the effects of participation are generally stronger for female borrowers than for male borrowers. These empirical findings hold across a range of different specifications and methods and also when they are corrected for various sources of selection bias, including possible spillover effects.

The remainder of the paper is organized as follows. Section 2 describes the related studies in the context of the paper. Section 3 presents the microcredit programs evaluated in this paper, describes the data and sampling strategy, and reports the descriptive statistics. Section 4 discusses the empirical strategy. The results are reported in Section 5. The summary and conclusion are presented in Section 6.

## 2. Related studies

The results from existing studies on the effects of the microcredit program in Bangladesh are ambiguous. Pitt and Khandker (1998) (PK hereafter) find that access to microcredit significantly increases consumption and reduces poverty. PK claim that program credit has positive effects on household consumption and female labor supply but has negative effects on the male labor supply. They also discover that the effect is greater for female than for male participants, indicating a lack of fungibility of capital and income within households. By contrast, Morduch (1998), using the same dataset as PK but a different estimation methodology, finds that the effect on consumption of access to microcredit is insignificant or even negative.<sup>2</sup> Chemin (2008), using a propensity score matching methodology, finds a lower effect than Pitt and Khandker (1998) but obtains estimates that are still positive and higher than those of Morduch (1998). Using panel data, Khandker (2005) discovers that access to microcredit reduces poverty. His results suggest that microcredit also benefits the local economy by reducing the overall poverty at the village level. He observes that lending women 100 taka leads to an increase in household

<sup>1</sup> The data collection and the preliminary analysis were supported by the World Bank. PKSF, established in May 1990, works as an organization for MCIs. The micro-lending community regards it as a regulatory agency, and it exercises authority over the MCIs.

<sup>2</sup> PK use an instrumental variable (IV) approach. Conversely, Morduch (1998) uses a simple difference-in-difference approach. Pitt (1999, 2011) defend PK's results in response to the studies by Morduch (1998) and Roodman and Morduch (2009), respectively. Pitt (2011) shows that the results of PK's study stand up very well to being estimated using Roodman and Morduch's *cmp* program after correcting for the Roodman and Morduch's errors, and are indeed strengthened.

consumption of up to 8 taka annually, a figure that is considerably lower than the 18 taka increase in PK's study. The results also cast doubt on the very optimistic 5% drop in poverty found by PK.

Using the IV method in a fixed-effects framework, [Lensink and Pham \(2012\)](#) evaluate the effect of microcredit on household self-employment profits in Vietnam and find a significant positive effect on profits. In Thailand, [Boonperm, Haughton, and Khandker \(2013\)](#) claim that the Village and Urban Community Fund is associated with increased spending levels, higher income, and the acquisition of more durable goods. [Imai and Azam \(2012\)](#) assert that microcredit has positive effects on both income and consumption growth in Bangladesh. [Islam \(2011\)](#) finds that, in Bangladesh, microcredit benefits the long-term borrowers the most, with the benefits not being significant for short-term borrowers. According to [Islam and Maitra \(2012\)](#), microcredit can act as a form of insurance against shocks. In particular, they find that microcredit helps its clients to insure against health shocks. Using data from a quasi-experiment in Thailand, [Coleman \(1999\)](#) finds that the average effect of the program on physical assets, savings, labor time, expenditure on education, and health care for a microcredit borrower is insignificant. However, Coleman's results need to be put into context and understood with caution, given that Thailand is relatively wealthier than Bangladesh. Therefore, small loans to households may not make much difference.

According to [Augsburg, De Haas, Harmgart, and Meghir \(2014\)](#), microcredit has no effects on durable purchases but leads to a cutback in consumption among the less-educated/poorer group. However, they also find microcredit to have led to the creation of more businesses and to an increase in self-employment. [Kaboski and Townsend \(2005\)](#) estimate the effect of a village fund in Thailand and find that the results vary depending on the type of institution. Institutions with good policies can promote asset growth and consumption smoothing, and decrease the reliance on moneylenders. However, they find no measurable effects on joint liability or repayment frequency. [Karlan and Zinman \(2010\)](#) examine the effect on consumer credit using an individual randomization of marginal clients in South Africa and find significant and positive effects for food consumption. [Banerjee et al. \(2012\)](#) find that access to microcredit has no effect on average consumption in the slums in India but that borrowers are more likely to start a new business. [de Mel et al. \(2008\)](#), [de Mel, McKenzie, and Woodruff \(2009\)](#) find significant effects of credit on business profits borrowed by male entrepreneurs in Sri Lanka and an insignificant or no effect on female borrowers, similar to the findings obtained by [Karlan and Zinman \(2009\)](#) in the context of Manila. [Attanasio, Augsburg, de Haas, Fitzsimons, and Harmgart \(2011\)](#) discover that microcredit borrowers in Mongolia are able to increase their food consumption and their ownership of various consumer durables and business assets.

[Crepon et al. \(2013\)](#) find access to microcredit to expand households' self-employment activities, with borrowers being able to significantly increase their investment in animal husbandry and agriculture. The authors claim that no average effect exists on consumption but do find some evidence of a small cutback in consumption, particularly among those who were already in agriculture or livestock rearing. However, they discover that borrowing households end up with high levels of assets, mainly in the form of livestock. [Karlan and Zinman's \(2009\)](#) results also suggest some evidence of a decline in well-being for some groups of borrowers. In their study, [de Mel et al. \(2008\)](#) find that heterogeneous returns vary with entrepreneurial ability and household wealth.<sup>3</sup> [Kaboski and Townsend \(2012\)](#) present evidence of positive effects on consumption and income growth in the short run. They find that both consumption and income increase when the program is started, but asset growth initially slows down and then returns to trend.

Therefore, the results from both experimental and non-experimental studies on microcredit are inconclusive. The results from these studies indicate that the effects of microcredit are likely to vary from place to place and are largely dependent on the particular settings and design of the program. This study is expected to shed light on the effect of microcredit on consumption, as it uses a very large and nationally representative dataset of microcredit program households from Bangladesh. It also contributes to the literature in terms of the heterogeneous effects of microcredit, which are an aspect that has largely been ignored in previous studies on the effect of microcredit.

### 3. Program, data, and descriptive statistics

#### 3.1. Program and context

One of the most visible changes in Bangladesh in recent times is the emergence of many microcredit institutions (MCIs) that have developed large-scale operations. The MCI sector experienced a phenomenal growth in the 1990s in terms of the number of MCIs and the total membership. This growth continues until now. The PKSF was established with a view to monitor the activities of these large numbers of MCIs and to lend donor and other funds to its partner organizations for microcredit. In 2004, PKSF funds made up about 17% of the total microcredit industry in Bangladesh, down from 24% in 1998.<sup>4</sup>

The organizations investigated here follow the lending procedure similar to that of Grameen bank, and they typically give eligible households access to microcredit. Credit is mainly given to groups of people that are jointly liable for the repayment of the loan and collateral is not required. Loans are advanced primarily for profitable and socially acceptable income-generating activities. The amount of a loan is usually in the range of US\$40–\$150, although members may take larger loans after they have repaid their first loan.

<sup>3</sup> For a comprehensive overview of the impact of microfinance, see [Armendáriz de Aghion and Morduch \(2005\)](#) and [Banerjee \(2013\)](#).

<sup>4</sup> See [www.bwtp.org](http://www.bwtp.org).

### 3.2. Data and survey design

The survey was conducted to obtain a nationally representative dataset for the evaluation of microcredit programs in Bangladesh. First, the data were collected to aid in monitoring and assessing the effect of microcredit programs undertaken by MCIs of the PKSF. The BIDS was responsible for the collection of data on behalf of the PKSF. The MCIs were chosen based on a stratified random sample of all MCIs of the PKSF, and thus these MCIs have similar types of program activities. The survey was administered in 1998, following a census of all households in the 91 villages in October 1997. It collected detailed information at the household, village, and institutional levels. The geographic coverage of the survey was spread evenly over Bangladesh. The thana (sub-district)-level comparisons revealed that the selected MCIs were not different from the average (Mahmud, 2003).

Of the 13 MCIs selected, two were deliberately chosen to be from the large category (i.e., Proshika and ASA). Second, thanas were selected when more than one thana was covered by the MCIs. The selection of villages involved visiting the local MCI offices and interviewing key informants to prepare a list of all villages in the area and to compile village-specific information on the following: type of MCI activities, number of MCI groups, number of borrowers, condition of the infrastructure, and existence of other MCIs in the area. After obtaining this information, a sample of villages was drawn through stratified random sampling. This stratification was based on the presence or absence of microcredit activity. The control villages were selected from among neighboring villages where an MCI was available. We intended to have two control villages and six program villages from each of the MCI areas. However, control villages could not be found in some areas. Therefore, we had 11 control villages in the final survey. The selection of the MCI within a village was not difficult at the time of the census in 1997, as hardly any village had two or more MCIs operating. However, the issue remains a concern because multiple MCIs operating in a given village is now common.

In selecting the survey households, the universe of households in the program villages, drawn from the census, was grouped according to the eligibility status of each household. A household is considered eligible if it owns 50 decimals (half an acre) or less of cultivable land. Using the village census list, 34 households were drawn from each of the program and control villages. Participation was defined in terms of current membership, as reported in the census in 1997. The sample sizes of eligible and ineligible groups within the program and control villages were determined according to the census. The ratio of eligible to ineligible households in the survey was about 12:5.<sup>5</sup> A total of 3026 households were drawn from the program and control villages, including 1740 participants. Of the 1286 non-participants, 277 were from the control villages and 1009 were from the program villages. Later, because of the inadequate number of comparison samples, we also interviewed non-participants from the treatment villages who had expressed their willingness to participate in the program.<sup>6</sup> The samples from the control villages included households whose heads had expressed (in the census) their willingness to participate in MCI programs, if available. Of the 3026 households surveyed, 2051 were eligible, representing 68% of the total. Although the programs mainly targeted the women, some villages offered microcredit only to men. In our survey, we found 207 male borrowers out of the 1740 borrowers.<sup>7</sup>

### 3.3. Descriptive statistics

Table 1 presents the descriptive statistics of the different village-level characteristics. No major differences can be found between the treatment and control villages. Table 2 shows the key descriptive statistics of a range of household-level variables. The average landholding for non-treated households is significantly higher than that for treated households. The treatment and comparison groups also differ in some household characteristics, but these differences are minimal when we consider only the eligible households (households owning less than half an acre of land).

Table 3 presents the summary statistics of the food consumption and credit variables. The consumption expenditure data include expenditures on food consumed in the reference period. We have information on 200 commodities consumed over a given period. For each food item, households were asked about the amounts they had consumed from their purchases, their own production, and other sources during the reference period. The reference periods for the food items differ depending on the type of food consumed. Some foods (e.g., beef or chicken) are consumed occasionally, whereas others (e.g., rice and lentils) are consumed more frequently. We use the prices quoted by households, as many items differ within a village in terms of quality (e.g., coarse rice vs. fine rice). We aggregate all food consumption amounts and convert them into monthly food consumption expenditures. In doing so, we also verify the value using the prices of the food items collected from local shopkeepers and groceries. Table 3 indicates no significant differences between treated and non-treated groups of households in terms of food consumption, although the non-treated group has slightly higher household and per capita consumption levels than the treated group. Household monthly food consumption expenditures do not differ between treated and non-treated households in the program villages. However, on a per capita basis, non-treated households have

<sup>5</sup> The sample size and its ratio of participating to non-participating households are different in several villages.

<sup>6</sup> Khandker (2005) also highlights the problem of finding suitable control villages. The villages that served as controls in his survey in 1991–1992 had all become program villages by 1997–1998.

<sup>7</sup> In our sample, a treated household consists of either male or female members, but not both. The groups are never mixed by gender. An MCI selects the gender of the treatment group, and households do not have any choice as to whether males or females will participate.

**Table 1**  
Village-level descriptive statistics.

Variable	Control village (I)	Program village (II)	Difference III = (II–I)	t-stat
Primary school	90.91	86.25	–4.66	0.42
Secondary school	27.27	31.25	3.98	0.26
Maktab/Madrasa (religious school)	81.82	90.00	8.18	0.80
Union health center	10	17.5	7.5	–0.59
Presence of grocery market	18.2	22.5	4.3	0.33
Presence of bus stand	9.1	15	5.9	0.59
Presence of post office	18.2	20	1.8	0.14
Presence of Union Parishad (local Government) office	18.2	13.8	–4.4	–0.35
Percentage of crop received by land owner in sharecropping	49.55	47.53	–2.02	0.96
Number of people who provide advances against crops	2.73	3.85	1.12	0.79
Number of small credit/savings groups	0.91	0.76	–0.15	–0.39

Source: Author's calculations.

Note: The first column presents the mean of each variable for the control villages, the second presents the same for the treatment villages, the third column presents the difference between the two, and the fourth provides the *t*-statistics for the mean difference between participating and non-participating households.

slightly higher consumption levels than treated households in the program villages. Table 3 also shows that male borrowers borrow more than their female counterparts. Households with male participants also have higher numbers of members in microcredit on average and have more exposure (length of membership in microcredit) to the program. They also have higher consumption levels, both per household and per capita.

#### 4. Empirical strategy

A number of different potential sources of bias need to be accounted for when examining the effect of participation in microcredit. Programs may be placed in a non-random sample of villages, and households may self-select into the program (and subsequently decide how much to borrow). For example, the treatment villages may be poorer than the control villages, given that microcredit programs target the poor households. Households also decide whether or not to participate in the microcredit program, and potential participants have to be approved by officials of the MCI. Therefore, observable and unobservable differences in characteristics may exist between participants and non-participants.

We address the potential problem of non-random program placement using village fixed effects. However, identification also requires us to control for the endogeneity that arises from household self-selection into the program. Therefore, even

**Table 2**  
Selected descriptive statistics of households.

Variable	Full sample					Samples of eligible households				
	Non-participant (I)	Participant (II)	Difference III = (II–I)	<i>p</i> -value (IV)	K–S	Non-participant (I)	Participant (II)	Difference III = (II–I)	<i>p</i> -value (IV)	K–S
Age of household head	45.14	43.91	–1.224	0.013	0.000	41.18	41.66	0.481	0.393	0.001
Sex of household head	0.93	0.95	0.026	0.003	0.701	0.91	0.94	0.034	0.004	0.609
Highest education achieved by any male member	5.17	4.59	–0.583	0.000	0.000	3.72	3.78	0.065	0.719	0.052
Highest education achieved by any female member	3.52	3.19	–0.323	0.013	0.001	2.57	2.69	0.125	0.388	0.004
Total arable land owned by household	80.51	58.37	–22.1	0.000	0.000	7.12	7.46	0.340	0.583	1.000
Number of children below 6 years of age	0.87	0.91	0.035	0.295	0.617	0.93	0.95	0.022	0.590	0.562
Number of old people above 60 years of age	0.29	0.21	–0.077	0.000	0.004	0.22	0.17	–0.051	0.009	0.276
Number of male members 15–60 years old	1.59	1.59	–0.004	0.906	0.672	1.37	1.46	0.088	0.028	0.232
Number of female members 15–60 years old	1.41	1.43	0.029	0.288	0.794	1.30	1.36	0.064	0.031	0.120
Lives in a nuclear family (=1) or joint family (=0)	0.67	0.69	0.020	0.236	0.921	0.69	0.72	0.026	0.208	0.896

Source: Author's calculations.

Note: This table gives the summary statistics of the participant and non-participant households. The left-hand side presents the results for the full sample, and the right-hand side shows the same results for the eligible households only. The reported *p*-values are the two-tailed tests of the null hypothesis that the program and control group means are equal. The K–S test column is based on the Kolmogorov–Smirnov test of equality of distribution.

**Table 3**  
Summary statistics of consumption and credit variables.

Variable	Men (I)	Women (II)	Difference (I–II)	p-value	K–S
Total amount of credit (Taka)	4650.9 (3961.7)	3799.4 (2115.2)	851.6 (176.1)	0.000	0.015
Total length of membership (in years)	4.1 (3.4)	3.3 (2.7)	0.8 (0.2)	0.000	0.001
Number of borrowers per household	1.4 (0.6)	1.1 (0.3)	0.3 (0.0)	0.000	0
Household total monthly consumption	2783.6 (2192.3)	2365.0 (1723.2)	418.5 (130.4)	0.001	0.003
Household per-capita consumption	497.6 (394.0)	436.5 (325.4)	61.1 (24.3)	0.013	0.002
Number of observations	213	1565			

  

Variable	Participant (I)	Non-participant (II)	Difference (II–I)	p-value	K–S
Household monthly food consumption (Tk)	2415.1 (1801.1)	2456.6 (1890.9)	41.5 (67.7)	0.730	0
Household monthly per-capita food consumption (Tk)	443.3 (336.1)	467.7 (337.4)	24.4 (12.4)	0.049	0.022
Household monthly food consumption in program village (Tk)	2417.8 (1806.9)	2461.8 (1942.7)	44.1 (73.6)	0.550	0.112
Per-capita monthly food consumption in program village (Tk)	444.3 (337.0)	477.8 (358.3)	33.5 (13.7)	0.014	0.028

Source: Author's computations.

Note: The top panel represents the descriptive statistics of the selected variables for male and female participants in microcredit. The bottom panel gives the descriptive statistics of the treatment and comparison households. The reported p-values are the two-tailed tests of the null hypothesis that columns II and I are equal. K–S values are based on the Kolmogorov–Smirnov test of equality of distribution. Standard errors are in parentheses.

conditional on a set of observed covariates,  $X$ , unobservable factors may influence a household's decision to join a microcredit program. These factors may include entrepreneurial ability, information advantage, attitudes, traditions, customs, and family culture, among others. To understand the difficulties inherent in the estimation of the treatment effect of participation or credit, we assume that the consumption of household  $i$  in village  $j$  can be described as follows:

$$Y_{ij} = \pi_1 D_{ij} + \varphi X_{ij} + F_j + \varepsilon_{ij}, \quad (1)$$

where  $X_{ij}$  is a vector of household-specific variables, and  $F_j$  is the village fixed effects. We define  $D_{ij}$  as the amount of microcredit borrowed by household  $i$  in village  $j$  in the previous year. We use the amount of credit as the treatment variable rather than the binary participation variable; the results obtained when the binary treatment variable is used are available upon request. One weakness of the binary treatment approach is that it classifies all treated beneficiaries in the same way, despite the fact that some households receive significantly larger amounts of credit than others. As the extent of the treatment varies greatly among treated households, we report the results from using the amount of credit borrowed as the treatment variable.<sup>8</sup>

The selection of households into microcredit programs based on the unobserved characteristics,  $\varepsilon_{ij}$ , may generate a non-zero correlation between  $\varepsilon_{ij}$  and  $D_{ij}$ . Therefore, the treatment effect estimated using ordinary least squares (OLS) may not reflect the program's causal effect on household consumption. To solve the problem of endogeneity, we consider the IV estimation techniques. We need a variable that is correlated with  $D_{ij}$ , satisfies the exclusion restriction, and is not correlated with  $\varepsilon_{ij}$  through unobservable characteristics, conditional on observable household- and village-level attributes and fixed effects. We follow Pitt and Khandker (1998) and use the interactions of eligibility with household-level exogenous characteristics such as the age, sex, and education of the household head.

We use the program eligibility criterion set by the MCIs. Formally, we define  $V_j$  as the presence of a program in village  $j$ , and  $E_i$  as a variable that takes the value of 1 if the household is eligible and zero otherwise. We define  $Z_{ij} = V_j \times E_i$ , where  $Z_{ij} = 1$  if the household lives in the treatment village and is eligible. We use the interactions of  $Z$  and  $X$  as excluded instruments. That is, our instruments for the treatment variable, namely, the amount of microcredit, are a series of household characteristics interacting with an indicator variable for whether or not a household is eligible and is in a program village. In this case, identification comes from the differences in the way in which education, occupation, and age, among others, affect consumption expenditure for the entire sample vs. their effects on the eligible households in the treatment villages. Therefore, any differences are assigned to the treatment effect on the treated. Our identifying assumption is that household  $i$ 's participation in microcredit, or the amount of credit borrowed,  $D_{ij}$ , is governed by

$$D_{ij} = \alpha(Z_{ij} \times X_i) + F_j + \omega_{ij}, \quad (2)$$

where  $X$  and  $F$  are the same as those in Eq. (1), and  $\omega_{ij}$  is the household-specific error term embodying the unobserved influences on  $D_{ij}$ . We assume that  $Z$  and  $X$  are exogenous with respect to  $\varepsilon_{ij}$  and  $\omega_{ij}$ . To include the direct effect of landholding status on households' consumption levels, we also use the amount of land as an explanatory variable.<sup>9</sup>

<sup>8</sup> We also tried using years of membership in an MCI, and the results are similar. This result is not surprising, considering the fact that members only receive more loans if they stay in the program for longer. Therefore, credit and length of membership are highly correlated.

<sup>9</sup> We also include a smooth function of land ownership as a control. The higher-order terms of land ownership are not statistically significant, and including these terms does not affect our impact estimates reported in the paper. We assume that any effect of eligibility on consumption is controlled adequately by the household land ownership included in Eq. (1) and partialled out of  $Z$  by the inclusion of land ownership in  $X$  in Eq. (2).

## 5. Estimation results

### 5.1. Validity of the instrument

We focus on the validity of the land-based eligibility criterion as an instrument for treatment. We test whether the eligibility is correlated with participation in microcredit and orthogonal to the error process. We test the first condition by examining a participation equation. The coefficient estimates for the first-stage estimate are positive and economically significant, implying that eligibility is significantly related to participation or the demand for credit. On the basis of the specification tests reported in the lower panel of Table 5, we conclude that the instruments satisfy the relevance and exogeneity conditions and are thus valid instruments.

### 5.2. Difference-in-difference estimates

In what follows, we evaluate the effect of microcredit on the household total monthly food consumption expenditure and per capita monthly food consumption expenditure. We also examine whether a differential effect of credit borrowed by males and females exists. The dependent variable in the regression is the log of each expenditure measure. On the basis of household eligibility for the microcredit program, we specify the following functional form:

$$Y_{ij} = \theta_0 + \delta_1 V_j + \delta_2 E_i + \delta_3 Z_{ij} + \varphi_7 X_{ij} + \zeta_{ij}, \quad (3)$$

where  $Y_{ij}$  is the log of the consumption expenditure of household  $i$  in village  $j$ . With this specification,  $\delta_3$  is the difference-in-difference of the mean log consumption expenditure. It captures the difference in conditional consumption expenditures between eligible and ineligible households in the program villages that is over and above the difference in the control villages.

Table 4 reports the results of the reduced-form estimates of Eq. (3) using OLS. The top panel shows the coefficient estimates of the effect on the log of household total consumption expenditure by male and female households and by land ownership. The estimated coefficient  $\delta_3$  is always positive, indicating that the program leaves the eligible households in the program village better off. The results are similar to the coefficient estimates of the effect on per capita consumption expenditures, as shown in the bottom panel of Table 4. The coefficient  $\delta_3$  is also known as the ITT effect, which is defined as the difference in mean consumption expenditure between those who are assigned by the program (whether they take it up or not) and those who are not assigned. The estimates in Table 4 indicate that the average ITT effect is approximately 4–8%. These results imply that the program has a positive effect on eligible households in the program villages. They also show that simple difference estimates using only the eligible households in the program and control villages would have understated the effect of eligibility by neglecting ineligible groups in both villages.

### 5.3. Estimates

The IV estimates of the effect of microcredit on household and per capita consumption expenditure levels are reported in Tables 5 and 6. We report the results for the groups of men and women both together and individually. The estimates are positive and are statistically and economically significant in most cases. The estimate in the top panel of Table 5 implies an increase in household total monthly consumption expenditure of about 27–38% when we consider both gender groups together. When the samples are restricted to households with less than one acre of land, participating households enjoy an increase of about 38% of their total consumption expenditures. The estimated effects are higher for female borrowers than for

**Table 4**  
Difference-in-difference estimates: effects of eligibility.

Estimated coefficient	Household land ownership					
	All sample	Land ≤ 500	Land ≤ 200	Land ≤ 100	Land ≤ 50	Landless
Dependent variable: household log of total monthly food consumption expenditure						
$\delta_1$	–0.015 (0.046)	–0.021 (0.047)	–0.051 (0.054)	–0.027 (0.077)	0.038 (0.034)	0.051 (0.040)
$\delta_2$	–0.104 (0.0520) <sup>b</sup>	–0.0983 (0.0549) <sup>a</sup>	–0.0788 (0.0644)	–0.0361 (0.0866)		
$\delta_3$	0.0471 (0.0523)	0.0532 (0.0531)	0.0826 (0.0588)	0.0628 (0.0799)		
Dependent variable: log of per capita monthly food consumption expenditure						
$\delta_1$	–0.023 (0.046)	–0.026 (0.047)	–0.048 (0.054)	–0.025 (0.077)	0.039 (0.035)	0.048 (0.041)
$\delta_2$	–0.104 (0.0522) <sup>b</sup>	–0.092 (0.0550) <sup>a</sup>	–0.068 (0.0647)	–0.0337 (0.0872)		
$\delta_3$	0.0541 (0.0525)	0.057 (0.0532)	0.0794 (0.0591)	0.0592 (0.0804)		

Source: Author's computations.

Note: Clustered standard errors are reported in parentheses.

<sup>a</sup> Indicates significance at the 10% level.

<sup>b</sup> Indicates significance at the 5% level.

The coefficients are those from the estimation of the reduced form Eq. (3). The regressions also include household- and village-level characteristics and MCI fixed effects.

**Table 5**  
Effect of microcredit on household consumption, (dependent variable: log of total household monthly food consumption expenditure).

	Household land ownership (in decimals)				Adjusted R <sup>2</sup>
	Full sample	Land ≤ 500	Land ≤ 200	Land ≤ 100	
<b>Both men and women treatment variable</b>					
Amount of credit <sup>1</sup>	0.275 <sup>d</sup> (0.107)	0.273 <sup>c</sup> (0.111)	0.209 (0.129)	0.389 <sup>b</sup> (0.201)	0.34–0.44
Mean consumption (Tk.)	2432.7	2384.3	2319.1	2228.9	
Observations	3025	2959	2779	2461	
<b>Women</b>					
Amount of credit <sup>1</sup>	0.301 <sup>c</sup> (0.131)	0.360 <sup>c</sup> (0.145)	0.292 <sup>b</sup> (0.151)	0.419 <sup>b</sup> (0.224)	0.34–0.44
Mean consumption (Tk.)	2406.1	2359.5	2302.8	2216.5	
Observations	2812	2754	2590	2298	
<b>Men</b>					
Amount of credit <sup>1</sup>	0.219 (0.201)	0.154 (0.198)	0.0291 (0.237)	0.0400 (0.253)	0.55–0.56
Mean consumption (Tk.)	2505.2	2436.8	2350.0	2215.4	
Observations	1461	1420	1305	1127	
<b>Test for IVs</b>					
Angrist-Pischke test <sup>1</sup>					0.0000
Kleibergen-Paap F-statistic					4.03
Anderson-Rubin Wald test <sup>a</sup>					0.0618

Source: Author's computations.

<sup>a</sup> p-values.

The standard errors, reported in parentheses, are clustered at the village level.

<sup>b</sup> Indicate significance at the 10% level, respectively.

<sup>c</sup> Indicate significance at the 5% level, respectively.

<sup>d</sup> Indicate significance at the 1% level, respectively.

Each cell corresponds to a separate regression on the treatment variable (which is instrumented), controlling for household-level characteristics and village fixed effects.

<sup>1</sup> The coefficient estimates and the corresponding standard errors are multiplied by the average amount of credit borrowed (assuming a constant marginal benefit from the credit).

**Table 6**  
Effect of microcredit on per capita consumption (dependent variable: log of per capita monthly food consumption expenditure).

	Household land ownership (in decimal)				Adjusted R <sup>2</sup>
	Full sample	Land ≤ 500	Land ≤ 200	Land ≤ 100	
<b>Both men and women treatment variable</b>					
Amount of credit	0.272 <sup>b</sup> (0.107)	0.246 <sup>b</sup> (0.112)	0.197 (0.130)	0.401 <sup>a</sup> (0.215)	0.08–0.2
Mean consumption (Tk.)	453.7	449.9	444.4	435.2	
Observations	3025	2959	2779	2461	
<b>Women</b>					
Amount of credit	0.324 <sup>b</sup> (0.130)	0.350 <sup>b</sup> (0.143)	0.301 <sup>b</sup> (0.147)	0.439 <sup>a</sup> (0.234)	0.08–0.18
Mean consumption (Tk.)	450.5	446.8	442.4	433.2	
Observations	2812	2754	2590	2298	
<b>Men</b>					
Amount of credit	0.0986 (0.198)	0.00245 (0.197)	–0.168 (0.243)	–0.0613 (0.249)	0.33–0.36
Mean consumption (Tk.)	472.8	466.1	459.2	444.7	
Observations	1461	1420	1305	1127	

Source: Author's computations.

Note: The standard errors, reported in parentheses, are clustered at the village level.

<sup>a</sup> Indicates significance at the 10% level.

<sup>b</sup> Indicates significance at the 5% level.

Each cell corresponds to a separate regression on the treatment variable (which is instrumented), controlling for household-level characteristics and village fixed effects.

<sup>1</sup> The coefficient estimates and the corresponding standard errors are multiplied by the average amount of credit borrowed (assuming a constant marginal benefit from the credit).

their male counterparts, as shown in the 2nd and 3rd panels of Table 5. The results show that female borrowers enjoy an increase in consumption of about 42% when we consider households with less than one acre of land. The results for the male borrowers are both statistically and economically insignificant. Note that we have fewer male borrowers (a total of 281).<sup>10</sup> If we consider the entire male and female samples separately, we can see that female borrowers can increase their

<sup>10</sup> Microfinance in Bangladesh is typically offered to women. Therefore, our sample contains fewer male borrowers.



consumption by about 30%, and their male counterparts can increase their consumption by about 22%, although the latter coefficient is statistically insignificant. One possible explanation for this sex-differentiated finding is that the program enhances the intra-household bargaining power (i.e., negotiation among members of a household to arrive at decisions regarding household matters) of the program participant. If women's preferences are oriented more toward food and nutrition, they may choose to spend their marginal income increments in ways that are realized by the food use impact measures. If men spend their marginal incomes differently, then the program may have just as great an impact for men, only we are looking at the wrong output variable. If this argument is true, then our estimates will be downward biased for the male sub-sample and upward biased for the female sub-sample (see, e.g., [Thomas, 1990](#)).

The effects of credit on the household per capita monthly food consumption are presented in [Table 6](#). The coefficients are positive for combined samples and for the female sub-group. For the male sub-sample, the estimates are negative and statistically insignificant for households with less than two acres of land. All participants benefit in terms of magnitudes, with an increase in consumption expenditure of 27%, although women enjoy a greater increase than men, at about 32%. The gain in per capita consumption is 30% when we consider female households holding two acres or less. However, it increases sharply to 44% when we restrict the sample to female borrowers who own less than an acre of land.

The impact estimates in columns 1 and 2 of [Tables 5 and 6](#) will be lower if we exclude households that hold less land (e.g., the households included in column 4), but our sample size does not allow us to do that. However, the households considered in column 4 (those that hold less than one acre of land) are nested in the previous columns, and the fact that the coefficients in column 4 are larger than those in the other columns indicates that we will obtain significantly lower coefficient estimates if we restrict the sample to households with larger amounts of land. The results indicate the heterogeneity in the treatment effects when we consider the groups of men and women separately. We observe positive effects on both women and men in most cases, although the sizes of the effects do differ widely between male and female borrowers. We find slightly larger coefficient estimates for women than for men. In general, poorer households (households that own less land) benefit the most from the program.

Our results are similar to those of [Kaboski and Townsend \(2012\)](#), who find a significant increase in consumption in the case of Thailand. They find a substantial increase in non-durable consumption but no increase in durable consumption. However, their results indicate that the components with the largest responses to the credit programs are housing repairs and vehicle repairs, which are investment-like in the sense that they have a durable aspect to them. Our results are also similar to those of PK, who find the marginal effect of microcredit on consumption to be 18% for women and 11% for men. They also find that 5% of borrowers may get themselves out of poverty each year by borrowing from a microcredit program. Overall, our results suggest a 10% consumption growth per annum relative to non-borrowers. We also discover differential effect according to the gender of the borrowers, a finding which is similar to that of PK who find that microcredit provided to women in Bangladesh has a larger effect than that provided to men. However, our findings do differ from those obtained by [de Mel et al. \(2009\)](#), who claim that the average returns to capital for microenterprise in Sri Lanka are higher for male owners than for female. As previously discussed, many recent studies have been conducted using randomized controlled trials (RCTs) (e.g., [Banerjee et al., 2012](#); [Augsburg et al., 2014](#); [Crepon et al., 2013](#)), and these studies did not find any increase in consumption, with the exception of [Attanasio et al. \(2011\)](#). However, note that most of these recent studies examined the short-run effects of microcredit access perhaps because of the fact that RCTs are harder to implement over a longer period of time. In the short run, borrowers may invest in businesses, with the investment being lumpy, so that we observe some evidence of cutbacks in consumption. However, consumption could eventually increase as the return from investment increases. Therefore, over the medium to long term, one may observe a faster consumption growth among those who have already made the sacrifice and invested than among those who are waiting to invest. Indeed, the findings of [Islam \(2011\)](#) indicate that longer-term participants in microcredit benefit more than short-term participants in terms of their increase in consumption, income, and assets.

#### 5.4. Spillover effects

Our identification strategy is based on the implicit assumption that the spillover effect does not exist. Accordingly, we check whether the program affects the consumption levels of non-treated households that live in the treatment villages. The difference between the unconditional mean household monthly food consumption expenditures of the non-treated households in the program and control villages is less than 1% of their household monthly consumption expenditure. Moreover, no difference is found between the unconditional food consumption expenditures of eligible non-participants in the program and control villages. The estimated regression coefficient is small and negative for the full sample of non-participants, and it is also small but positive for the eligible subsample (the results are not reported here). We also compare eligible non-treated households that have the same probabilities of participation, if the program is available, and again find no indication of spillover effects. Therefore, we find no strong evidence in favor of a positive spillover effect.

## 6. Summary and conclusion

In this paper, we estimate the heterogeneous treatment effect of microcredit by considering the sub-group specific mean treatment effect, in which the groups are categorized based on the targeting criterion of the microcredit program. The results indicate a substantial level of heterogeneity in the causal effect of participation in microcredit. Overall, the results suggest

that the effect of microcredit on the household consumption expenditure is substantial. Limiting our considerations to observations around the eligibility cut-off point, the estimates indicate an average gain of 30–40% in the monthly consumption expenditure of participating households. With the average length of a household's participation in microcredit being about 3.8 years, this length translates to about a 10% increase in consumption per annum. The results indicate that female participants gain more than do male participants. However, the results for men are based on a small sample and should therefore be interpreted with caution.

In general, we find that the less land a household owns, the stronger is the effect of their participation in microcredit. The benefits are low for households that are marginal to the participation decision (households that own more land). Our results indicate that the effects of microcredit loans are not the same across all groups of poor households: the poorest of the poor participants are most likely to benefit from participating.<sup>11</sup> The results also imply that microcredit loans may not be effective for land-rich households. Nevertheless, they are not the focus of the microcredit loans, as these groups are not officially eligible. They are also less likely to participate in a microcredit program in any case. The findings indicate that the simple targeting mechanism of the microcredit program in Bangladesh based on household land ownership is effective. Therefore, the efficiency of the microcredit program can be enhanced by allocating credit to where it will have the greatest effect: the poorest marginal landholding households.

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<sup>11</sup> The results may also have other interpretations. For example, credit may induce poorer households to increase their consumption, whereas it may not have any sizeable effect on the consumption of relatively less poor households, because they may invest their money in long-term projects. However, MCIs require that loans be invested and be repaid within a year, with repayments starting about four weeks after receiving the loan. Therefore, while the poorer households may use loans mainly for augmenting consumption, the data indicate that over 90% of all clients use their loans for productive investments, and that no difference exists between the poorer and less poor households in this respect. Moreover, MCIs monitor the use of these loans, and households cannot sustain higher levels of consumption without investing money because of concerns about repayment.

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