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The Impact of Microcredit on Rural Labour Market in Bangladesh

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Institute of Microfinance (InM)

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Abstract

This paper assesses the impact of microcredit on the rural labour market in Bangladesh using data from a nationally representative large-scale survey. Two aspects of the impact on labour market are investigated – viz., employment at the household level and wage rate at the village level. With regard to the employment effect, the paper adopts a methodology that is capable of decomposing the effect into two parts – one representing the decision of a household to participate in a particular type of employment and the other representing the decision about the amount of employment to be undertaken. The econometrics of the Hurdle model is used for this purpose. The paper looked at both total level of employment and the pattern of employment (i.e., sector and mode of employment) of borrowers, and disaggregated the employment impact by gender and by 'productive' and 'non-productive' users of microcredit. In addition, the paper also considered the possible spill-over effect on non-borrowers. The results show that microcredit has a strong positive effect on the employment level of borrowing households. An average rural household gains 53 persondays of employment in a year as a result of access to microcredit, which amounts to about 19 per cent increase compared to what would obtain without microcredit. Males gain more than females in absolute terms but females gain proportionately more. Both productive and non-productive users of microcredit gain employment but the former gain more. The study did not find any evidence that the increase in employment enjoyed by microcredit borrowers occurs at the expense of non-borrowers. Apart from raising employment at the household level, microcredit also exerts a significant positive effect on the wage rate at the village level; a 10 per cent increase in the spread of microcredit in a village would raise the wage rate by 4.6 per cent.

The Impact of Microcredit on Rural Labour Market in Bangladesh

S. R. Osmani

1. Introduction

Microcredit has by now spread throughout the length and breadth of rural Bangladesh, covering more than half of the rural population. According to a recent study, some 55 per cent of rural households have taken microcredit at some stage in their lives, and nearly 46 per cent of households retain the status of current borrowers (as of 2010).[1] With such vast expansion, microcredit is bound to have direct and indirect repercussion on almost on all aspects of rural life, including rural labour market. Not a great deal is known, however, about these wider effects. While a lot of intellectual effort has been spent in the last couple of decades to assess the impact of microcredit on the economic well-being of the borrowers – in terms of their income, consumption and poverty – much effort has been made to look at the wider impacts.[2]

The impact on labour market is a potentially rich area of enquiry. There have been some studies in the past, yielding useful insights. But most of them drew upon relatively small samples, usually analysed only a small aspect of the labour market and employed methodologies that were at times quite rudimentary. Hossain's (1984) pioneering study of the impact of Grameen Bank did not directly assess the impact on either employment or wages; but by comparing the average number of workers and activity ratio between borrowers and non-borrowers the study inferred a positive impact on employment. No attempt was made, however, to control for the possible effects of other factors. In a follow-up study, Hossain (1988) further examined the employment effect of the Grameen Bank – partly by comparing project and control groups and partly by using the before-and-after method (based on recalled data rather than panel data). Once again, he found a positive effect on employment, but yet again the possible effects of other factors were not controlled for.

One of the earliest attempts to control for the effects of confounding factors was made by Rahman and Khandker (1994). Using a probit regression, they analysed the choice between self-employment and wage employment, after controlling for various individual-level, household-

[1] See Osmani *et al*. (2015). This study was based on a nationally representative household survey covering the whole of rural Bangladesh and was carried out in 2010 by the Institute of Microfinance in Dhaka. The present study is based on the same survey.

[2] Osmani (2014) provides a fairly comprehensive review of the literature on the impact of microcredit on poverty. A rigorous recent assessment of the impact of microcredit on rural income and poverty in Bangladesh can be found in Osmani *et al*. (2015). For an early attempt to assess some of the wider impacts, see Rahman *et al*. (2002). See also the collection of papers in Osmani and Khalily (2011).

level and village-level characteristics that may have a bearing on an individual's choice of activity, and found evidence that microcredit leads to greater self-employment at the cost of wage employment. One of the limitations of this study, however, is that it did not directly distinguish between the behaviour of borrowers and non-borrowers. Instead, the comparison was made between target-group households in villages where some microfinance institution (MFI) was present and target-group households in villages where there were no MFIs. Similar comparison was also made for non-target groups, and to confound matters the study found evidence for substitution of self-employment for wage employment also for non-target group households living in villages served by the Grameen Bank. The latter finding renders it problematic to interpret the observed substitution as being induced by microcredit. In a careful econometric study, Pitt (2000) also found convincing evidence that both female and male credit induce a substitution of agricultural activity away from the wage labour market to owner-cultivation, but this study was confined only to the effect on agricultural employment rather than on overall employment of borrowers.

In one the most careful studies of the employment effect of microcredit, which controlled for possible confounding factors as well as allowed for possible endogeneity of the microcredit variable, Khandker (1998) found that while female borrowing leads to increased female employment, male borrowing reduces both male labour supply and female labour supply. These results are, however, at variance with the findings of Islam and Pakrashi (2014) who also allowed for endogeneity but followed a different methodology from Khandker and used a different data set. They found that both male and female employment increase as a result of participation in microcredit programmes and that male employment in fact increases more than female employment.

The present study revisits the issue of the impact of microcredit on the rural labour market in Bangladesh. It attempts to build upon the existing knowledge in three distinct ways: (1) the study is more comprehensive in scope than the previous ones, (2) it uses an analytical framework and a commensurate econometric methodology that decomposes the employment effect into two parts – one reflecting 'participation' decision and another the 'quantity' decision, and (c) it uses a much larger and nationally representative sample compared to the previous ones.

The present study is more comprehensive than the earlier ones in several ways. First, while the earlier studies looked at employment at the level of individual borrowers, sometimes making a distinction between male and female borrowers, none of them tried to assess the impact of microcredit on the employment behaviour of the household as a unit, combining both male and female labour. The present study attempts to do that, in addition to disaggregating the impact by gender. Second, in both in household-level and gender-specific analysis, the focus of interest is not just on total employment but also on the pattern of employment – i.e., on the allocation of labour between agricultural and non-agricultural activities and between self-employment and wage employment. Third, yet another novelty of the present exercise is that it also tries to assess whether the employment effect depends on the use to which it is put. In particular, the study investigates whether the employment effect varies as between borrowers

who use microcredit mainly for productive purposes and borrowers who use it mainly for other purposes. Fourth, an attempt is made to assess whether microcredit has any spill-over effect on the employment opportunities of non-borrowers. The question of interest here is whether any increase in employment experienced by borrowers occurs at the expense of non-borrowers. Finally, the present study also looks at the impact of microcredit on the wage rate at the village level. Khandker (1998) is one of the few studies which also looked at the wage rate at the village level, and found a significantly positive effect on the wage rate, but did not take into account possible endogeneity of microcredit for village-level analysis (unlike the individual-level analysis of the same study which did correct for endogeneity). The present study takes the endogeneity issue seriously for the analysis of both wage rate at the village level and employment at the household level.[3]

The second distinctive feature of the present study is that it adopts an analytical framework that distinguishes between two components of the employment effect – related to the 'participation' decision and the 'amount' decision of households. The first component pertains to whether a household decides to participate in the labour force or in a particular sector or mode of employment. The second component pertains to the decision about how much time to allocate once the decision has been taken in favour of participation. Islam and Pakrashi (2014) also make this distinction but instead of analysing the two components in an integrated framework they look at the two decisions completely separately. The price of not following an integrated approach, however, is that one would not be able to estimate the total impact on employment combining the two components. The present study adopts an integrated approach by applying the econometrics of the so-called two-part model, also known as the Hurdle model.

The final distinctive feature is that, unlike the existing studies, the present study is based on a nationally representative large-scale rural household survey with a sample size of 6300 households covering all the districts of Bangladesh (except Rangamati). The sample was chosen by following a stratified random sampling procedure and using the same sampling frame that is adopted by the *Household Income and Expenditure Surveys* (HIES) of the Bangladesh Bureau of Statistics.[4]

The paper is organized as follows. Section 2 sets out the analytical framework for studying the impact of microcredit on the employment behaviour of households and explains the logic of the econometric methodology adopted for empirical implementation of the chosen analytical framework. Section 3 presents and discusses the results on employment behaviour at the level of the household. Section 4 deals with the wage effect of microcredit at the village level, and finally Section 5 offers a brief summary of the main findings.

[3] As we shall see, however, tests of endogeneity could not reject the null hypothesis of exogeneity of microcredit in employment analysis, but it did so for the wage analysis. Accordingly, the employment analysis was eventually carried out without adjusting for endogeneity, but necessary adjustment was made for wage analysis by following the instrumental variable approach.

[4] Further details about the survey and the sampling methodology can be found in Appendix A.1 of Osmani *et al*. (2015).

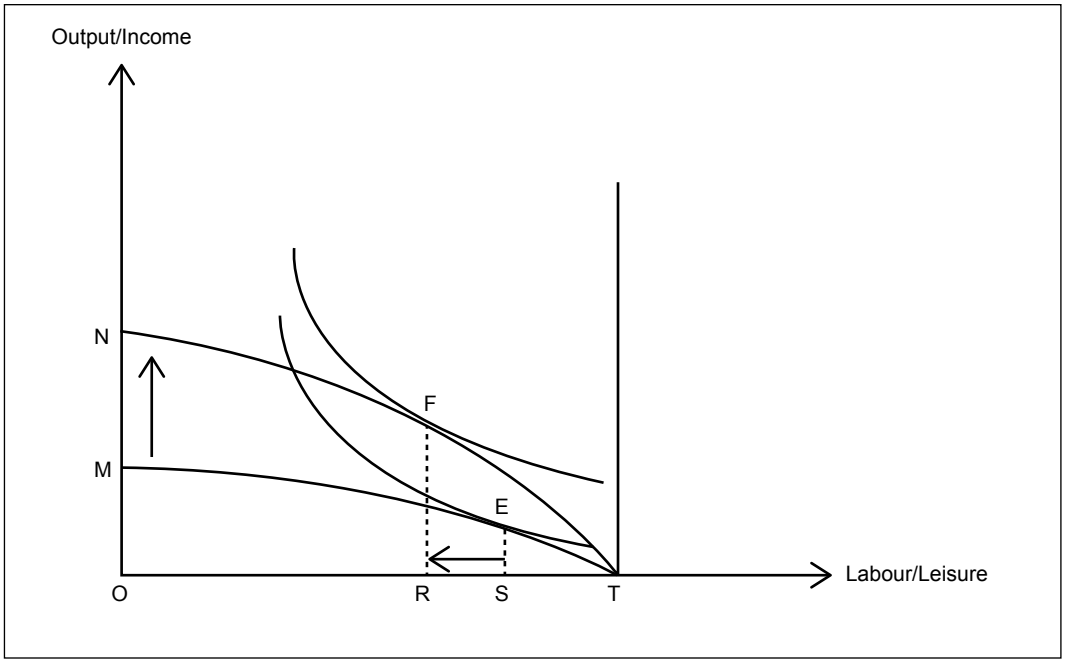
2. Methodological Considerations

Theoretical Issues: Tangency Solutions and Corner Solutions

Access to microcredit is likely to affect the employment behaviour of households by affecting the returns to labour. As access to credit enables a hitherto credit-constrained household to operate its productive activities at a higher scale, the marginal returns to labour will increase, which in turn will induce changes in employment behaviour. Even households who do not use credit mainly for productive purposes may be induced to change their employment behaviour in order to meet the commitment for regular loan repayment. Both the total quantity of employment and the pattern of employment may be affected, where the pattern of employment refers to both sector of employment (e.g., agriculture versus non-agriculture) and the mode of employment (e.g., self-employment versus wage employment).

The effect on total employment may be illustrated with Figure 1. Here we adapt the classic model of labour-leisure choice to a credit-constrained household engaged in a self-employed enterprise. Output and income are measured on the vertical axis and leisure as well as labour supply on the horizontal axis.

Figure 1
Effect of Microcredit on Total Household Employment



A household has OT amount of total potential labour time available at its disposal, which can be allocated either to the productive enterprise or to leisure. Leisure is measured from left to right (i.e., from O towards T) and labour from right to left (i.e., from T towards O) along

the horizontal axis. The technological possibilities of the enterprise are represented by a well-behaved production function (with positive first derivative and negative second derivative), in which output is defined as a function of labour input at given levels of complementary inputs. Zero output is produced at T where the entire available time is consumed as leisure and the maximum possible output is produced at O when the entire available time is used in the enterprise. When the household does not face a credit constraint, and therefore can combine labour with complementary inputs in an optimal manner, it can operate on the unconstrained production function TN, which is the highest possible production function the household can achieve given its skills and technical know-how. If, however, the household happens to be credit-constrained, so that it is obliged to use sub-optimal levels of complementary inputs, it will only be able to operate on a production function that is inside the frontier function TN - for example, TM. The proximate effect of access to microcredit is to enable a household to shift its production possibilities upward from TM to TN.[5]

Under credit constraint, the optimal choice of the household is represented by the point E where the indifference curve (representing the household's preferences for leisure and income) is tangent to the constrained production function TM. At that point, TS amount of labour is employed in the productive enterprise, and the remaining OS amount of time is enjoyed as leisure. When credit becomes available, the household is able to operate on the frontier production function TN, and its optimal point then changes to F. At that point, employment level rises from TS to TR – this is the employment-enhancing effect of microcredit at the household level.

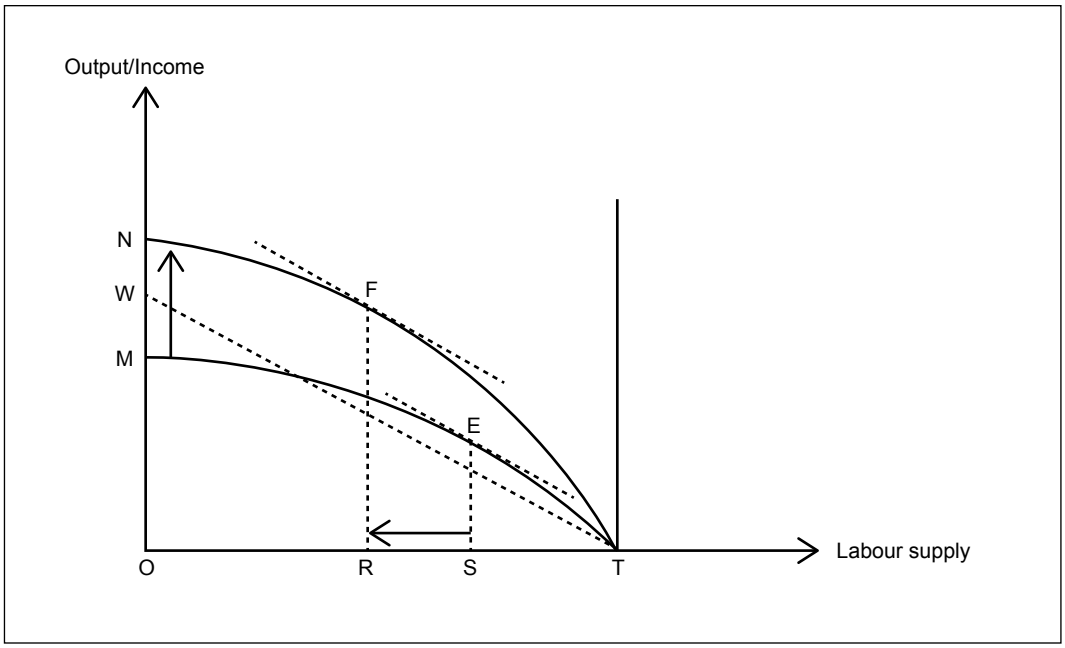
The effect of microcredit on the pattern (as distinct from the level) of employment can be illustrated with Figure 2, where we examine the choice between self-employment and wage employment. For analytical simplicity, we now abstract from the choice between labour and leisure, by taking it as given that the household has already decided to devote a certain amount of time (OT) to income-earning activities; the only remaining question of choice is how to allocate this time between self-employment and wage employment.[6,7] The constrained and unconstrained production functions are denoted, as before, by TM and TN respectively and the market wage rate denoted by the slope of the line TW.

[5] The shift from TM to TN will occur if the access to microcredit completely removes the credit constraint. If, however, the credit constraint is simply eased, but not entirely removed, the production function will shift to somewhere in between TM and TN, but the ensuing analysis will remain valid in its essentials.

[6] It is of course possible to analyse the choice between labour and leisure and the choice between self and wage employment simultaneously by superimposing the indifference curve between labour and leisure onto Figure 2, but this would only complicate the diagrammatic exposition without adding much of substance.

[7] Self-employment is measured from right to left, starting from T and going towards O, and wage employment is measured from left to right, starting from O and going towards T.

Figure 2
Effect of Microcredit on the Mode of Employment



With credit constraint, the optimal choice is at E, where the marginal product of labour in the self-employed enterprise, as given by the slope of the production function TM, is equal to the wage rate, as given by the slope of TW. At this point, TS amount of labour is devoted to the self-employment enterprise and OS amount of labour to wage employment.[8] When credit becomes available, the household moves up to the frontier production function TN, and the optimal point is now at F, where the marginal product of labour equals the wage rate. At this point, the amount of self-employment rises from TS to TR and wage employment declines from OS to OR. Access to microcredit thus brings about a shift from wage employment to self-employment; it does so by raising the marginal product of labour in self-enterprise and thus making self-employment more attractive than wage employment at the margin.[9]

It should be emphasized at this point that the analysis of the impact on total employment and self-employment, as illustrated in Figures 1 and 2 respectively, is partial and incomplete in a very important way. In Figure 1, we show the impact on employment for those households who already had some employment; likewise in Figure 2, we show the impact on self-employment for

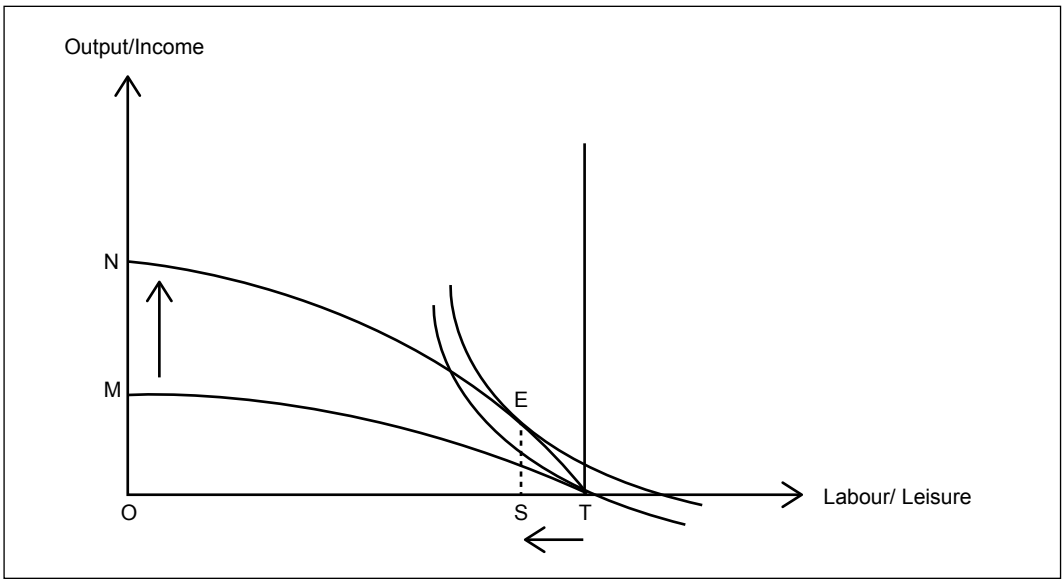
[8] For any point to the right of S, the marginal product of labour in self-employment (slope of the production function) is higher than the wage rate, whereas for any point to the left of S, wage rate is higher than the marginal product of labour in self-employment. That is why, TS amount of labour will be devoted to self-employment, and the remainder will go to wage employment.

[9] It should be noted, however, that in a more complete analysis reduction in wage employment may not be essential for an increase in self-employment. As we have seen in Figure 1, access to microcredit may increase the total amount of employment, which means that it may be possible to accomplish an increase in self-employment without any corresponding reduction in wage employment.

those households who already had some self-employment. But this is only a part of the potential effect of microcredit. Further increase in employment can come when households that had no employment before decide to have positive employment encouraged by the access to credit; likewise, further effect on self-employment can accrue when households which were completely dependent on wage employment before are induced by microcredit to devote at least a part of their labour force for self-employed activities. These cases are illustrated in Figures 3 and 4, for total employment and self-employment respectively.

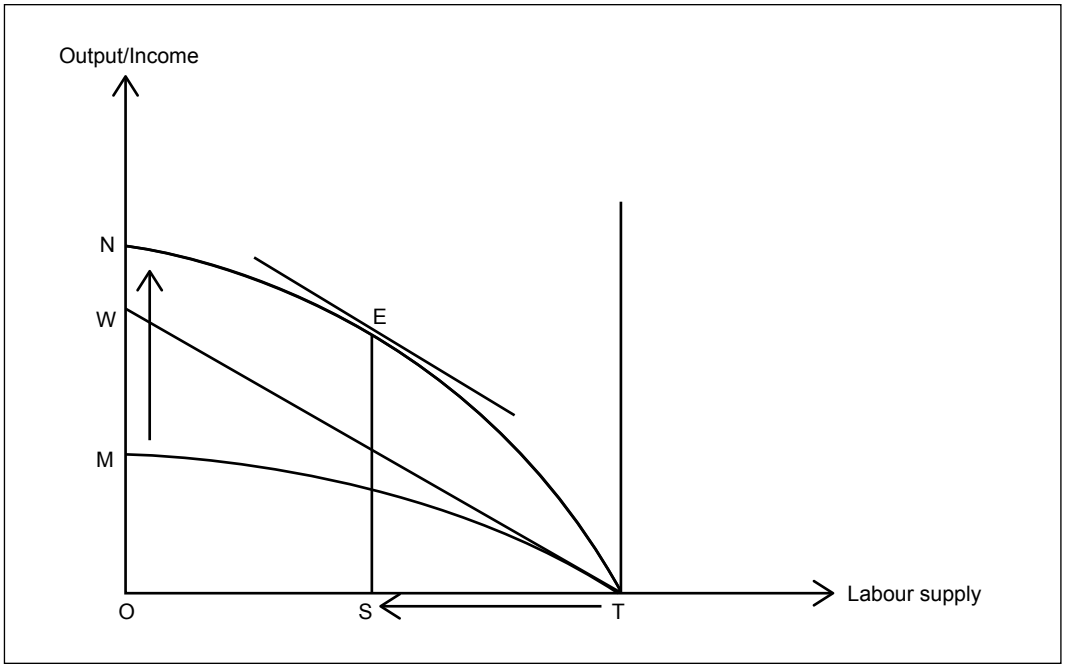
Figure 3 illustrates the case of a household which did not have any employment under credit constraint but access to credit induces it to engage in self-employment.[10] Under credit constraint, with production function TM, the marginal return to labour happens to be always less than the marginal rate of indifferent substitution between labour and leisure (i.e., the opportunity cost of labour in terms of foregone leisure). As a result, the optimal choice takes the form of a 'corner solution' – at T, where the entire potential labour time is enjoyed as leisure. But as access to credit raises the production function to TN, thereby raising the marginal returns to labour, a 'tangency solution' becomes possible, at F, and the household decides to devote TS amount of time to self-employed activities.

Figure 3
Microcredit Turns Corner Solution into Tangency Solution for Total Employment



[10] Lack of employment does not does not necessarily imply lack of income. The household may have access to non-labour income such as remittances, rental income, pensions, social protection, private transfers, etc. Given this cushion of non-labour income, the household may not consider it worthwhile to engage in self-employed activities that yield very low returns to labour under credit constraint; but it may change its mind when access to credit raises the returns to labour.

Figure 4
Microcredit Turns Corner Solution into Tangency Solution for Mode of Employment



For the choice of mode of employment, Figure 4 illustrates a similar case in which a corner solution gives way to tangency solution following relaxation of credit constraint. With credit constraint, the marginal return to labour with the production function TM happens to be less than the market wage at all levels of self-employment; as a result, there is a corner solution at T, where self-employment is nil and the entire available labour time is used for wage employment. However, as the higher production function TN becomes available following access to credit, the marginal return to labour rises above the wage rate up to a point; a tangency solution then occurs at E, where a part of the labour time (TS) is now devoted to self-employment.[11]

The preceding analysis shows that while assessing the impact of microcredit on household employment, we need to take into account two types of effect. The first type, which we might call the direct effect, relates to those households which move from one tangency solution to another (as in Figures 1 and 2). They could conceivably move to a corner solution as well, but the important point is that they started from a tangency solution i.e., they were already involved in the type of employment behaviour we are interested in even in the absence of microcredit; what we want to know is how they would change the amount of that type of employment once they get access to microcredit. The second type, which we may call the indirect effect, relates to those households who move from a corner solution to either a tangency solution (as in Figures 3

[11] It is conceivable that if TN is sufficiently high self-employment will increase all the way up to O, so that one corner solution is replaced by another corner solution at the other extreme - i.e., wage employment is substituted entirely by self-employment.

and 4) or to another corner solution at the opposite end. They are different from the first group in that in the absence of microcredit, they were not involved in the type of employment behaviour we are interested in; and we want to know whether following access to microcredit they would begin to participate in that type of employment, and if so, to what extent. The two types of effects together would constitute the total effect of microcredit.

Suppose, for example, that we want to assess the impact of microcredit on self-employment. The direct effect would relate to those households who already had some self-employment, but the amount of self-employment might increase once they get access to microcredit. By contrast, the indirect effect would relate to those households who had only wage employment and no self-employment at all to begin with, but access to microcredit might induce them to participate in self-employed activities and thus shift at least some of the labour time to self-employment. We need to add these two types of effects in order to measure the impact of microcredit on self-employment. The implication for empirical methodology is that it would be a mistake to focus only on the sub-sample of households who have a positive amount of self-employment with or without access to microcredit. The possibility of corner solution must be recognised i.e., we must allow for the possibility that those who did not engage in self-employment to begin with may be induced to do so once they get access to microcredit.

In short, what we need is the econometrics of corner solutions.12 The trick is to decompose the decision-making process into two parts: the participation decision and the amount decision. In the present context, this means that a household first decides whether to participate in some type of employment, and those who decide to do so then decide the amount of labour time to be devoted to that type of employment. The econometric methodology to be adopted for measuring the impact of microcredit on employment must be able to model both parts of the decision-making process.

The Econometrics of Corner Solution: Two-Part Models

The classic econometric approach towards dealing with corner solutions is the well-known Tobit model, which simultaneously models the participation decision and the amount decision. Although very popular, this model has a number of serious deficiencies, however. First, exactly the same variables are supposed to explain both participation and amount decisions. This is evidently not plausible as a general case, because there may be some variables that may be relevant for the participation decision but not for the amount decision. In the present case, for example, whether the household head's father was a wage labourer or a self-employed farmer may have a bearing on his decision on whether or not to participate in the wage labour market, but may not have any impact on the amount of labour time devoted to wage employment once he decides to participate. Second, the coefficient of every explanatory variable is restricted to have the same sign for the participation decision and the outcome decision. Thus, if some factor increases the probability of household's participation in self-employed activities, it is also

[12] The best available treatment of the econometrics of corner solution can be found in Wooldridge (2010), chapter 17. See also Wooldridge (2009) and Cameron and Trivedi (2005, 2010), chapter 16 in both.

assumed to raise the amount of time devoted to self-employment. While this assumption may be valid in many cases, it would be too restrictive to shut the door to the possibility that some factor may have opposite effects on two parts of the decision. Third, the coefficients of any two explanatory variables are restricted to have the same ratio in the participation equation and the outcome equation. This means, for example, that if an additional year of education has twice the effect of an additional year of experience on the probability of participation in self-employed activities, then education must have exactly twice the impact on the expected amount of time devoted to self-employment as compared with education, for those who decide to engage in self-employment.

These three features can together be summarised by saying that Tobit specifies the same model for participation and amount decisions – i.e., the same mechanism is assumed to underlie both parts of the decision-making process. A more realistic approach would be one that in principle allows different models for the two parts of decision-making. Cragg (1971) proposed precisely such an approach, giving rise to a class of models known as two-part models, also called the Hurdle models.

Following Wooldridge (2010), a general formulation of the two-part model can be given as follows. Let the variable of interest (employment in our case) be a continuous random variable denoted by y, and let s be a binary variable that determines whether y will be zero or positive: $s = 0 \rightarrow y = 0$ and $s = 1 \rightarrow y > 0$. The binary variable s can be interpreted as the participation dummy. In the present context; this means that the households who have decided to participate in the type of employment in question will have $s = 1$ and $y > 0$, and those who have decided not to participate will have $s = 0$ and $y = 0$. In addition, there is a non-negative continuous variable y^*, which is a latent variable in the sense that it is observed only when s = 1 in which case $y^* = y$. The random variable y can now be seen to be generated by the following equation:

$$y = s.y^* \qquad \text{--- (1)}$$

Thus, the variable y is an outcome of two separate processes – s and y^*. We can postulate that the participation decision s depends upon a set of explanatory variables denoted by the vector $\mathbf{z}$, and the latent variable y^* depends on a set of explanatory variables denoted by the vector $\boldsymbol{x}$. In principle, the vectors $\mathbf{z}$ and $\boldsymbol{x}$ can be identical, but they can also be completely different or partially overlapping; or one can be a subset of the other.[13] The two variables s and y^* are also assumed to be characterised by two very different probability distributions. In this sense, two different mechanisms are postulated for the participation decision and the amount decision – this is the essence of the two-part model.

There are two estimating equations for the two parts of the model. In the first part, the participation decision can be modelled either with a logit or a probit model. In this paper we opt for the probit model in which the probability of participation is given by $P(s=1 \mid \mathbf{z}) \Phi(\mathbf{z}\gamma)$, where γ is the

[13] As Wooldridge (2010, chapter 17) explains, however, robust identification of the model can be achieved only if x is a strict subset of z. In our empirical implementation of the model, we have ensured this condition.

vector of parameters associated with the explanatory variables z, and Φ is normal probability distribution. The estimating equation is:

$$s = \mathbf{z}\boldsymbol{\gamma} + \epsilon \quad \text{--- (2)}$$

For the second part, we first note that y^* can only be observed when $s = 1$ i.e., only for positive values of y; as such the estimating equation can be written as

$$y = \boldsymbol{x}\boldsymbol{\beta} + u \quad \text{--- (3)}$$

where, $\boldsymbol{\beta}$ is the vector of parameters associated with the explanatory variables $\boldsymbol{x}$, and, crucially, u follows a distribution that allows for only positive values of y. With this restriction on u, however, it is possible to specify alternative distributions. Cragg himself suggested two – the truncated normal distribution (truncated at the value $-\boldsymbol{x}\boldsymbol{\beta}$) and the lognormal distribution. Accordingly, we have two variants of the two-part model: namely, the truncated normal hurdle (TNH) model and the lognormal hurdle (LH) model. In either case, equation (3) has to be estimated only for the sub-sample that has positive values of y (i.e., only for the 'participants'), whereas equation (2) has to be estimated for the entire sample.

In Cragg's original formulation, the errors terms $\in$ and u were assumed to be independent. Under this assumption, the participation equation (equations (2)) and the amount equation (equation (3)) can be estimated independently. However, the assumption of independence may not always be valid. For instance, common unobserved variables (hidden in both $\in$ and u) may exist that affect both the participation decision and the amount decision. In that event, as Wooldridge (2010) shows, the model can be estimated in the same way as the well-known Heckman Selection model, but with some restriction – in particular, that the y variable should be measured in logarithms rather than in levels. Wooldridge christens this model as 'Exponential Type 2 Tobit model' or, ET2T model, for short.

We tried all three variants of the two-part model – namely, TNH, LH and ET2T.[14] The goodness of fit of the three models was compared by looking at the correlation coefficient between the actual and predicted values of y. For the overwhelming majority of the regressions reported in Section 3, TNH outperformed the other two, albeit only marginally in most cases. In the few cases where one of the other two models fitted better, the difference was also marginal. For the sake of consistency, therefore, we have chosen to use only the results obtained from the TNH model.[15]

[14] Further variation of the two-part model is possible depending on the nature of the amount variable y. For example, when y represents count data rather than a continuous variable, it is possible to use either the Poisson distribution or the negative binomial distribution (Mullahy 1986).

[15] In any case, the three models yield very similar substantive results – in particular, estimates of the marginal effects of microcredit. All the qualitative conclusions we draw would, therefore, remain valid whichever model is used, although there might be some small differences in the magnitudes of the effect of microcredit.

Estimating Marginal Effects for the TNH Model:

The main objective of the present exercise is to estimate the marginal effects of microcredit on households' employment behaviour. But it requires some effort to estimate these effects, as there are no standard commands for executing the TNH model in the existing statistical software packages. With *Stata*, for example, we can estimate equation (2) with the probit command and estimate equation (2) with the 'truncreg' command. But the problem remains that the marginal effects we are interested in cannot be equated directly with the estimated coefficients of either equation. The estimated coefficients can of course be used for calculating the marginal effects, but there is no standard post-estimation command for carrying out the necessary calculations. The procedure we followed for obtaining the marginal effect is explained below.

Marginal effect is defined as the change in the expected value of y due to a small change in an explanatory variable, given the values of other covariates in z and x. One potential complication here is that in the case of corner solution models one can find two different definitions of marginal effect in the literature corresponding to two different concepts of expected value of y – called conditional and unconditional expectations. Conditional expectation is denoted as $E(y|\mathbf{z, x,}\ y>0)$ and stands for the expected values of y only for the participants i.e. only for observations with positive values of y. Unconditional expectation is denoted as $E(y|\mathbf{z, x})$ and stands for the expected value for the entire sample, including both who are at a corner solution (i.e., y = 0) and those who are at the tangency solution (i.e., y>0).[16] Clearly, it is the latter concept that is relevant for estimating the total effect of microcredit – encompassing both direct and indirect effects discussed above.

For the TNH model, the unconditional expectation is given by the following expression (Wooldridge 2010):

$$E(y \mid \mathbf{z},\boldsymbol{x}) = \Phi(\mathbf{z}\gamma)[\boldsymbol{x}\boldsymbol{\beta} + \sigma\lambda(\boldsymbol{x}\boldsymbol{\beta}/\sigma)] \qquad \text{--- (4)}$$

where, σ is the standard deviation of the error term u in equation (3), λ is the Inverse Mills Ratio obtained from equation (3), and other symbols are defined as before. As can be seen from (4), parameter estimates from both equations (2) and (3) are needed to calculate $E(y \mid \mathbf{z},\boldsymbol{x})$ and hence to obtain the marginal effects.

The exact formulation of the marginal effect turns out to be different depending on whether the explanatory variable in question is discrete or continuous. For most of the regressions carried out in Section 3, we used microcredit as a discrete (dummy) variable - taking the value 1 for those who had taken microcredit and 0 for those who hadn't. For a few regressions (when we looked at the spill-over effects on non-borrowers), the relevant variable was continuous (the proportion of households who had taken microcredit in the village in which a household resides.)

[16] The terms conditional and unconditional are slightly misleading, however, since both expectations are actually conditional on the covariates ***z*** and ***x***. What they mean is that the former is additionally conditional on y>0, while the latter is not.

In the dummy variable case, we first obtain two different estimates of $E(y \mid \mathbf{z},\boldsymbol{x})$ using expression (4) – one by setting the value of microcredit variable to 1 for all observations, and the other by setting the value to 0 for all observations, keeping the values of all other covariates as they are, yielding, say, $E_1(y \mid \mathbf{z},\boldsymbol{x})$ and $E_0(y \mid \mathbf{z},\boldsymbol{x})$ respectively. The marginal effect of microcredit is then given as:

$$ME = E_1(y \mid \mathbf{z},\boldsymbol{x}) - E_0(y \mid \mathbf{z},\boldsymbol{x}) \quad \text{--- (5)}$$

For the continuous case, marginal effect is given by the first partial derivative of (4), which is given by the following expression when the explanatory variable in question is indexed by j:

$$ME_j = \gamma_j \, \phi(\mathbf{z}\boldsymbol{\gamma})[\boldsymbol{x}\boldsymbol{\beta} + \sigma\lambda(\boldsymbol{x}\boldsymbol{\beta}/\sigma)] + \Phi(\mathbf{z}\boldsymbol{\gamma}).\beta_j \, \theta(\boldsymbol{x}\boldsymbol{\beta}/\sigma) \quad \text{--- (6)}$$

$$\text{where,} \quad \theta(\boldsymbol{x}\boldsymbol{\beta}/\sigma) = 1 - \lambda(\boldsymbol{x}\boldsymbol{\beta}/\sigma)[(\boldsymbol{x}\boldsymbol{\beta}/\sigma) + \lambda(\boldsymbol{x}\boldsymbol{\beta}/\sigma)] \quad \text{--- (7)}$$

From each of equations (5) and (6), we get one value of marginal effect for each observation, corresponding to the values of the covariates ($\mathbf{z}$, $\boldsymbol{x}$) taken by that observation. In order to get the overall marginal effect, we need to take the mean of all these individual marginal effects - called the average marginal effect (AME). It is these AMEs that we report in Section 3 when we discuss the effect of microcredit on employment behaviour.

In order to assess the statistical significance of these AMEs, we also need to calculate their standard errors. In the absence of any simple closed form expression for these standard errors, we chose to apply the bootstrap method to estimate them.[17]

There remains the task of decomposing the marginal effect into two parts - namely, the direct effect and the indirect effect discussed earlier. Textbook discussions of marginal effects do not deal with this decomposition, but this can be done fairly easily by using the following relationship between conditional and unconditional expectations of y:

$$E(y \mid \mathbf{z},\boldsymbol{x}) = \Phi(\mathbf{z}\boldsymbol{\gamma}) E(y \mid \mathbf{z},\boldsymbol{x}, y>0) \quad \text{--- (8)}$$

For simplicity of notation, let us denote conditional expectation $E(y \mid \mathbf{z},\boldsymbol{x},y>0)$ as C, unconditional expectation $E(y \mid \mathbf{z},\boldsymbol{x})$ as U, and the probability of participation $\Phi(\mathbf{z}\boldsymbol{\gamma})$ simply as Φ. Equation (8) can then be rewritten as:

$$U = \Phi.C \quad \text{--- (9)}$$

Using these notations in the expression for marginal effect (for the discrete case) given by (5), and using subscript 1 for the case where all observations are assigned the value 1 for the microcredit variable and subscript 0 for the case when all observations are assigned the value 0, we can write

[17] Stata's 'bootstrap' command was used for this purpose, applying it on the programme for estimating AMEs for each regression, and using 500 repetitions in every case.

$$ME = U_1 - U_0 = \Phi_1 . C_1 - \Phi_0 . C_0 \quad \text{--- (10)}$$

Using the notation Δ to represent change (so that $\Delta C = C_1 - C_0$ and $\Delta\Phi = \Phi_1 - \Phi_0$), expression (10) can be rewritten after some manipulation as:

$$ME = \Phi_1 . \Delta C + \Delta\Phi . C_0 \quad \text{--- (11)}$$

Equation (11) provides the desired decomposition of the marginal effect. The first part ($\Phi_1 . \Delta C$) is the direct effect, which stems from the change in conditional expectation i.e., from the change in the amount decision made by those households who are 'participating'. The second part ($\Delta\Phi . C_0$) is the indirect effect, which represents the additional change in the amount of employment that stems from the change in the probability of 'participating' i.e., from the decision of some of the households to move away from the corner solution to a tangency solution.[18]

We have also decomposed the marginal effect measured in proportional terms i.e., as percentage of U_0:

$$ME/U_0 = (\Phi_1 . \Delta C)/U_0 + (\Delta\Phi . C_0)/U_0 \quad \text{---(12)}$$

3. Impact of Microcredit on Household Employment Behaviour

In this section, we shall provide empirical estimates of the impact of microcredit on household employment behaviour. After some general remarks about the details of estimation process and interpretation of the marginal effects of microcredit, the major findings are presented in four parts. In the first part, we shall focus on the employment behaviour of households as a whole. We shall then consider the impact by gender. Next, we shall compare the impacts on those borrowers who use credit mainly for productive purpose and those who use it mainly for other purposes. Finally, we shall assess the spill-over effect of microcredit on non-borrowers.

Preliminaries

We shall examine the impact on both aggregate indices such as total employment and unemployment and more disaggregated behaviour such as allocation of labour between different sectors and different modes of employment. To begin with, some summary statistics are presented in Tables 1 and 2.[19] Table 1 shows that on the average households with microcredit

[18] Hoffmann and Kassouf (2005) is the only empirical paper we are aware of that has broken up the marginal effect into direct and indirect effects as defined above (though they have not used these terms), but they have done so in the context of the Heckman Selection model rather than the Truncated Normal Hurdle model as in this paper.

[19] Detailed data on employment over the year preceding the survey was collected separately for each working member of a household by using the recall method. The year was divided into four quarters, and for each quarter the household was asked to report, for each working member, the number of days worked in various types of income-earning activities (both self-employed and wage-employed activities) and the average number of hours worked per day for each type of activity. The information on the number of hours worked was used to convert the actual number of days worked into full-time equivalent days worked by each working member for each type of activity (by assuming full-time work to be equal to 8 hours of work in a day). The persondays of employment reported in this paper refer to these full-time equivalent days.

borrowers have a much higher level of employment than non-borrower households – there is a difference of almost exactly 100 persondays a year. The difference is evident for both males and females, although it is much sharper for males than females.

Table 1
Comparison of EmploymentLevel of Microcredit Borrowers and Non-borrowers

Employment per household (persondays per year)	Borrower	Non-borrower	|t-value|
Total household employment	359.6	259.0	18.58
Employment of male member	325.3	229.3	18.23
Employment of female members	34.3	29.7	1.88

Source: InM Poverty Dynamics Survey 2010.

Table 2
Comparison of EmploymentPattern of Microcredit Borrowers and Non-borrowers

Employment per household (persondays per year)	Borrower	Non-borrower	|t-value|
Self-employment	190.1	131.3	12.46
Wage employment	141.6	93.2	11.72
Agricultural employment	147.8	123.4	6.03
Non-agricultural employment	211.8	135.6	14.41

Source: InM Poverty Dynamics Survey 2010.

Looking at the disaggregated picture by sector and mode of employment in Table 2, we find that higher employment of microcredit borrowers is a pervasive phenomenon, encompassing each sector and each mode of employment. They significantly outperform non-borrowers in both self-employment and wage employment and in both agriculture and non-agriculture.

One cannot immediately conclude, however, from these data that it is microcredit that has enabled borrowers to achieve higher levels of employment. Borrowers and non-borrowers differ from each other in many different ways apart from taking or not taking microcredit, and some of these other differences may also be responsible for the observed higher levels of employment enjoyed by borrowers. Table 3 lists a number of characteristics with regard to which borrowers and non-borrowers differ in statistically significant ways. Several of these differences would predispose borrowers to have a work more than non-borrowers. Take for example, remittance income - both foreign and domestic. Borrowers have much lower levels of both these two types of income, and this makes a difference to employment because our data show that remittance receivers tend to work less. Households who receive foreign remittance work 180 persondays a year on the average while households who do not receive remittance work for 322 persondays. Therefore, since borrowers receive much less remittance income than non-borrowers, they would be expected to work more on this ground alone. Similarly, since borrower households have more members in the working age group (Table 3), they would be expected to have more

persondays of employment, other things remaining the same. All this suggests that in order to isolate the effect of microcredit a multi-variate approach is needed, whereby one can control for the confounding factors that might affect the level and pattern of employment.

Table 3
Comparison of Some Characteristics of Microcredit Borrowers and Non-borrowers

Characteristics	Borrower	Non-borrower	|t-value|
Initial land asset (decimal)	45	94	14.2
Initial non-land physical asset ('000 taka)	42.2	1,20.6	2.5
Education of household head (years of schooling)	3.1	4.4	12.2
Foreign remittance income (taka/capita/year)	1752	7419	11.4
Domestic remittance income (taka/capita/year)	1055	2813	5.5
Dependency ratio (percentage)	33.2	28.0	9.3
Working age members of household (number)	2.93	2.84	2.1
Households headed by single females (percentage)	4.3	7.9	5.9

Notes: (1) Initial non-land physical assets are valued at 2010 prices, using official deflator for private capital formation.

(2) Dependency ratio is defined as the number of dependants (number of household members who are not in the working age group) divided by household size.

(3) Households headed by single females are defined as those in which the female household head is either a widow or divorced/separated from husband.

(4) In case of percentage of households headed by single females, the test-statistic is z instead of t.

Source: InM Poverty Dynamics Survey 2010.

As discussed in Section 2, we propose to estimate a two-part model for this purpose. This model consists of two equations: a participation equation and an amount equation; and the marginal effect of microcredit will be estimated by combining the estimated coefficients of the two equations. The particular model we chose is called the Truncated Normal Hurdle (TNH) model, in which the participation equation is estimated by probit and the amount equation is estimated by truncated normal regression (as implemented by the 'truncreg' command in *Stata*).

The first task, however, is to specify the covariates of microcredit i.e., factors other than microcredit that are likely to affect the amount and the participation decisions. The microcredit variable itself is entered as a dummy variable for the majority of regressions - taking the value of 1 for those households who have taken microcredit in the three years preceding the survey and 0 for the rest. For the amount decision, we include the following household-level and village-level covariates. The household-level covariates include (1) age of the household head - and its square so as to capture any non-linear life cycle effect, (2) education of the household head as measured by years of schooling, (3) a dummy variable representing the gender of the household head, (4) number of male workers in the household, (5) number of female workers in the household, (6) number of dependents in the household, (7) amount of land currently owned by the household (in decimal), (8) a dummy variable representing whether the household receives foreign remittance income or not (1 if it does, 0 otherwise), and (9) a dummy variable representing whether the household receives domestic remittance income or not (1 if it does,

0 otherwise). Village-level characteristics that are likely to affect a household's employment decisions were captured by five covariates: (1) the scope for engaging in non-farm activities in the vicinity of the village, (2) accessibility of the village, (3) climatic vulnerability of the village, (4) a dummy variable representing whether the village is located in a *char* area (1 if it is, 0 otherwise), and (5) the real wage obtaining in the village in the year preceding the survey. The first three of the village-level variables were measured as an ordinal score, with higher values of the score representing greater scope for work, better accessibility, and greater vulnerability respectively.[20] In addition, 62 district dummies were included to capture any additional location-specific variations that might be relevant for employment behaviour.

The justification for including these covariates is fairly self-evident. We shall make only a few brief remarks. First, while constructing the dummy variable for the gender of the household head, we put together male heads and currently married female heads (whose husbands may be living and working away from home) into a single category and assigned the value 0 to them; and the value 1 was assigned to those female heads who were either widowed, or divorced, or separated from husbands. The reason for splitting up female heads in this way is that our earlier analysis showed that it is only the latter category of female heads that were seriously disadvantaged compared to both male heads and currently married female heads. By contrast, currently married female heads were at least no worse off than male heads (Osmani and Latif 2013). Second, while the size of labour force available in a household is likely to have an important effect on its employment behaviour, we thought it wise to split up the labour force into male and female labour force, since the availability of the two types of labour may not have the same impact. For instance, in the particular socio-economic context of rural Bangladesh, availability of male labour is likely to have a bigger impact on total employment than that of female labour. The impact on the sector and mode of employment may also vary depending on the gender of labour. Third, the village-level wage variable was entered in two different ways depending on the task at hand. While dealing with the impact on total employment and mode of employment (i.e., self- versus wage-employment), we used an aggregate wage rate representing both agriculture and non-agricultural activities. However, when the analysis involved sector of employment (agriculture versus non-agriculture), we used to two separate wage variables - one for agriculture and one for non-agriculture.[21]

[20] The detailed procedures of constructing these scores are explained in Osmani *et al*. (2015), Chapters 1 and 8.

[21] A few remarks are in order regarding the construction of the wage variable. There were two potential sources of wage data: the household-level survey and the village-level survey. In the household-level survey, we gathered information for each household member both on the amount of wage labour in various types of farm and non-farm activities and the corresponding wage rate. By combining these member-level data, we can construct a household-level wage rate, and taking their average for all the sample households in a village (35 households in each village), we can construct an average wage rate for the village. Since the sample households were drawn from the village in a purely random manner, the average wage rate thus derived is likely to be representative of the village as a whole. An alternative source is the village-level survey, in which we sought information from key informants regarding the wage rate prevailing in the village in the preceding year - in both agriculture and non-agriculture. For agriculture, we asked for both peak season and lean season wage rates, and for non-agriculture we asked for wage rates for a range of detailed activities. Unfortunately, the data on non-agricultural wages turned out to be either missing or scanty for nearly one-fourth of the villages, which makes it difficult to construct an overall wage rate. For this reason, in this section we used wage data obtained from the household survey. We deflated these wage rates by the price of paddy obtained for the village survey to calculate the real wage, which is what matters for employment decisions.

For the participation equation, we used the same set of variables as listed above, plus a couple more. The additional variables are (1) occupation of the father of the household head, and (2) the initial amount of land with which a household started its journey in life, i.e., the amount of land it inherited at the time it emerged as an independent entity out of parental home. Both these variables are meant to capture the importance of tradition and history in influencing a household's decision to engage in a particular type of employment behaviour. It seems reasonable to argue that while affecting the participation decision these variables will have no bearing on the amount of employment once the decision to participate has been taken. For instance, whether a household head's father worked as a farmer or a wage labourer, or whether he worked in agriculture or non-agriculture, may have some effect on the head's own choice of activity, but once he has made that choice the amount of labour time he wants the household members to devote to that line of activity is likely to be independent of those influences. That is why these two variables have been excluded from the amount equation.

One further issue remains to be addressed before the results can be presented. It relates to the possible endogeneity of the microcredit variable. If some of the unobserved factors that affect the decision to microcredit also affect the employment decisions (the problem of selection on unobservables), or if the employment status itself affects the decision to take microcredit (the problem of reverse causality), the microcredit variable will be endogenous and unless appropriate measures are taken to deal with endogeneity the estimates of effect of microcredit will be biased. In an earlier study, looking at the impact of microcredit on income and poverty in rural Bangladesh, we thoroughly investigated the issue of endogeneity and came to the conclusion that it existed and that its effect was to create a downward bias. Those who take microcredit were found to be disadvantaged in many ways in comparison with those who do not and the unobserved elements of those disadvantages could induce the endogeneity problem because the same disadvantages could also serve to reduce income and increase poverty. As a result, we were required to correct for endogeneity bias and it made a substantial difference to the results (Osmani *et al*. 2015, Chapter 8).

The relevant question in the present context is: are the same disadvantages also likely to affect the employment decisions of borrowers? The answer is not obvious. The disadvantages that restrict the scope for earning income may not necessarily restrict the ability to undertake employment in the same way because even in adversities a household may be able to keep up its employment level, even if it means paltry returns to labour. In fact, if inherent disadvantages have any effect at all, it may operate in the opposite direction by inducing the households to seek more employment. On purely *a priori* grounds, the issue is quite open. Only empirical investigation can throw light on the existence of endogeneity.

We tried to investigate the matter by instrumenting the microcredit variable. As in the case of income and poverty studied in Osmani *et al*. (2015), our chosen instrument was the proportion of microcredit-taking households in the village in which a household resides. This proportion can be taken as a valid instrument since while it may affect a household's decision to take microcredit through demonstration and network effects, it is unlikely to affect employment

decisions directly, especially when most of the location-specific factors that may correlate with it have already been controlled for by including village-level characteristics and district dummies as covariates.

Armed with this instrument, we then tried to estimate the two equations of interest (the participation equation and the amount equation) with a view to testing whether endogeneity was a problem at all. The participation equation was estimated in the framework of a bivariate probit model, which allows consistent estimation of the parameter of a binary endogenous regressor such as our microcredit variable, and for which standard commands are available in the existing statistical software packages (for example, the biprobit command in *Stata*). There was a problem, however, with the amount equation. For reasons explained in Section 2, we chose to estimate this equation as a truncated normal regression, but to our knowledge no standard command is available to carry out this regression consistently with an endogenous regressor.

We had to settle for a compromise. As discussed in Section 2, there are several variants of the hurdle model to choose from – namely, the Truncated Normal Hurdle (TNH) model, the Lognormal Hurdle (LH) model and a Heckman Selection type model known as the Exponential Type 2 Tobit (ET2T) model. We chose the TNH model on the grounds of goodness of fit – i.e., for the vast majority of our regressions the coefficient of correlation between actual and fitted values of the dependent variable was the highest for the TNH model. But the other two models did not perform too badly, in fact the LH model was very close to TNH. In Appendix Table A.1, we provide evidence for this closeness for a sample of regressions with the help of two statistics: viz., the correlation coefficient between actual and fitted values, and the unconditional expectation of the dependent variable.

Given the closeness between TNH and LH models, we decided to test for endogeneity by using the LH model, hoping that whatever evidence we find for the existence of endogeneity in the LH model will apply to the TNH model as well. Both models use probit regression for the participation equation; the difference lies in the amount equation. While the TNH model uses truncated normal regression for this purpose, the LH model applies ordinary least squares (OLS) on the logarithms of the dependent variable. Accordingly, endogeneity can be easily handled in the LH model by adopting the standard instrumental variable estimation methods such as the two-stage least squares (2SLS).

In Appendix Table A.2, we present tests of endogeneity based on bivariate probit estimation of the participation equation and 2SLS estimation of the amount equation, for a subset of the many regressions we have carried out in this section. For bivariate probit, the relevant test is the Wald's test of the correlation coefficient between the errors terms of bivariate probit, and for 2SLS the relevant test is the Durbin-Wu-Hausman F-test of Robust Regression[22], both under the null hypothesis that endogeneity does not exist. As can be seen from the table, none of the estimates of these statistics can reject the null hypothesis at 5 per cent level (let alone 1 per

[22] 2SLS also allows other tests of endogeneity, but when sampling involves clustering, as is the case with our sample, only the Durbin-Wu-Hausman test is possible.

cent level). Although, we have presented the evidence only for a sample of regressions, this result is in fact valid for all the regressions we have carried out in this section. We, therefore, conclude that endogeneity of the microcredit variable is not a problem for the household-level employment decisions.[23] The results reported below are thus based on regressions that treated microcredit as an exogenous variable.

Employment Effects for Households as a Whole

We begin by looking at the employment behaviour of the household as an aggregate, considering the employment of all workers regardless of gender. Both aggregate employment and pattern of employment are of interest; for each case we have estimated a participation equation and an amount equation. The estimated coefficients of the equations for total employment are given in Table 4.

As can be seen from the table, access to microcredit has a positive impact on both the decision to participate in the labour force and to increase the amount of employment for those who participate, and both these impacts are highly statistically significant. Clearly, many households who do not normally participate in the labour force (presumably because they have access to non-labour income) are induced by access to microcredit to do so. And those who are already in the labour force are encouraged to work more, encouraged by the higher returns to labour made possible by access to credit.

Although our principal interest here is in the impact of microcredit, it may be instructive to have a brief look at the role of some of the other factors. As expected, availability of more working age members in the household has a significantly positive impact on both participation and amount decisions. But the gender of the members matters in this regard – availability of male members has a bigger impact than that of female members.[24] This is indicative of both prevailing social norms and objective opportunities that restrict the scope for female participation in labour force. Access to remittance income exerts a negative influence on employment – with regard to both participation and amount, and access to foreign remittance does so more strongly than access to domestic remittance. This is clearly a case of substitution between labour and leisure encouraged by access to non-labour income.

[23] As we shall see, however, in Section 3 below, endogeneity does appear as a real issue when we examine the impact of microcredit on the wage rate at the village level.

[24] Although the coefficients themselves do not measure the marginal impact of the explanatory variables, bigger coefficients do entail bigger impact.

Table 4
Estimates of Equations for Total Household Employment (persondays)

Explanatory variables	Participation equation		Amount equation	
	Coefficient	z-value	Coefficient	z-value
Access to microcredit (dummy)	0.492552	7.23	58.8428	8.14
Number of male workers	1.122780	12.35	127.4717	21.76
Number of female workers	0.359895	7.76	66.6033	11.7
Real wage rate in the village	-0.520036	-1.01	14.5833	0.13
Access to foreign remittance (dummy)	-1.204568	-14.76	-102.2967	-6.05
Access to domestic remittance (dummy)	-0.963287	-12.2	-90.8119	-8.69
Age of the household head (years)	0.071012	5.44	6.8680	4.69
Age of the household head squared (years)	-0.000873	-6.57	-0.0882	-5.52
Gender of the household head (dummy)	-0.667605	-5.69	33.2591	2.07
Schooling of the household head (years)	-0.058090	-7.06	-2.7429	-2.56
Number of dependents	-0.275690	-10.75	-26.4747	-7.34
Current land ownership (decimal)	0.000543	1.21	-0.1391	-3.06
Scope for non-farm work near village (score)	0.077531	0.9	40.8341	3.05
Climatic vulnerability of the village (score)	-0.069547	-0.77	18.6709	1.85
Accessibility of the village (score)	-0.290120	-2.56	-1.0864	-0.07
Whether the village is a *char* (dummy)	-0.208156	-1.45	-16.4273	-0.84
Initial land assets (decimal)	-0.000067	-0.14		
Household head's father's occupation (code)	-0.050839	-2.42		
No. of observations	(6055)		(5466)	

Notes: (1) The participation equation was estimated with the probit method and the amount equation was estimated by the Truncated Normal Regression method (as implemented by the truncreg programme in Stata).

(2) The dummy variables for 'Access to microcredit', 'Access to foreign remittance', 'Access to domestic remittance' and 'Whether the village is a *char*' take the value 1 when 'yes' and 0 when 'no'.

(3) The dummy variable for 'Gender of the household head' takes the value 1 when the household head is either a widow or divorced or separated from husband and 0 when the head is either a male or a currently married female.

(4) For 'Scope for non-farm work near village', 'Climatic vulnerability of the village' and 'Accessibility of the village' higher score signifies greater scope, higher vulnerability and better accessibility respectively. For details of how these scores were constructed, see Osmani *et al*. (2015), chapters 1 and 8.

(5) Initial land assets refer to the land inherited by a household at the time it was first formed as a separate entity.

(6) Household head's father's occupation codes are as follows: 1 for farm self-employment, 2 for farm wage labour, 3 for non-farm self-employment, 4 for non-farm wage labour, 5 for non-farm salaried work, and 6 for others.

(7) Coefficients of district dummies as well as of the constant term are omitted.

Source: InM Poverty Dynamics Survey 2010.

The age of the household head has a non-linear impact, suggestive of the existence of a life cycle effect. The positive coefficient of the age variable and the negative coefficient of its square together imply that employment initially increases with age, but it does so at a decreasing rate and beyond a certain age total employment may actually decline. Education of the household head, like remittance income, also exerts a negative influence, probably signifying a substitution between quality and quantity of employment. Gender of the household head also matters – households with genuinely single female head (either widowed, or divorced or separated) participate less in labour force and have lower levels of employment once they participate, as compared with households whose heads are either males or currently married females. Among the village-level characteristics, scope for non-farm activities in the vicinity of the village is found to raise the level of employment for those who are already in the labour force, although it does not seem to affect the decision to participate as such. By contrast, accessibility of the village affects the decision to participate but not the amount of employment for those who are already participating.

Turning now to the marginal effect of microcredit, which is our main focus of interest, a number of points should be borne in mind while interpreting the numbers presented in the tables below. Recalling our discussion in Section 2, the marginal effects that we present here are based on changes in 'unconditional expectations' of the dependent variable i.e., they reflect the sum of two effects: (1) the 'direct effect' stemming from the amount decision of those who are participating and (2) the 'indirect effect' stemming from the change in the probability of participation. This decomposition of the marginal effects is shown in the tables. Furthermore, the marginal effect and its decomposition are shown in both absolute terms (persondays) and proportional terms. The absolute effect shows the number of persondays by which the dependent variable will change if we move from a scenario where no one has access to microcredit to one where everyone has. The proportional effect shows this change as a percentage of the expected value of the dependent variable that would obtain in the scenario in which no one has access to microcredit. Finally, these effects are shown on 'per household' basis – not summed up for all households; and while calculating the 'per household' effect, the denominator includes all households, not just those who have a positive value of the dependent variable.

Table 5 presents the marginal effect of microcredit on total employment and underemployment of rural households. The first row shows the impact on total employment. In terms of absolute number, access to microcredit is found to increase the amount of employment per household by about 53 persondays in a year, which is statistically significant as well as substantial in magnitude as it amounts to an increase of about 19 per cent from the level that would obtain in the absence of microcredit. In an earlier study, we had found that microcredit increases the income of rural households by about 44 per cent (Osmani *et al*. 2015, Table 8.27). Together these two findings imply that increased employment contributes just under half of the total increase in income generated by microcredit, with the rest coming from improvement in labour productivity that is made possible by access to credit.

Table 5
Marginal Effect of Microcredit on Household Employment: All Workers

Dependent variable	Absolute effect (persondays per year)			Proportional effect (%)		
	Overall	Direct	Indirect	Overall	Direct	Indirect
1. Total employment	53.3***	40.8	12.5	19.1	14.7	4.4
	(10.97)					
2. Underemployment	-10.0***	-5.5	-4.6	-15.4	-8.4	-7.0
	(-4.62)					
3. Employment of underemployed hh	61.1***	55.5	5.6	25.3	23.0	2.3
	(8.01)					
4. Employment of not underemployed hh	38.2***	20.5	17.7	12.4	6.7	5.8
	(7.22)					

Notes: (1) The marginal effects for the first dependent variable (total employment) are based on the regression estimates reported in Table 4. For the remaining three dependent variables, the source regressions are reported in Appendix Tables A.3-A.5.

(2) Figures within parentheses are z-values. Standard errors were computed by the bootstrap method, with 500 repetitions.

(3) The symbol *** indicates significant at 1 per cent level, ** indicates significant at 5 per cent level, and * indicates significant at 10 per cent level. No * indicates not significant.

Source: InM Poverty Dynamics Survey 2010.

The decomposition of the marginal effect shows that by far the major increase in employment (41 out of 53 days) comes about as a result of the 'direct effect' of additional work being done by households who are in labour force. Yet, a not inconsiderable amount - some 23 per cent of the total increase - comes from the 'indirect effect' of microcredit inducing more households to join the labour force.

The second row in Table 5 shows the impact on underemployment at the household level. Underemployment is defined rather conservatively here as a situation in which a worker works for less than 227 days a year.25 Our dependent variable is the extent of underemployment at the household level, which is defined as the combined shortfall of all workers of a household from the norm of 227 days per person. Given the strong impact on employment noted above, it is no surprise to find that microcredit has a strong and statistically significant effect on the extent of underemployment as well. For an average rural household, the extent of underemployment comes down by 10 days, which amounts to about 15 per cent reduction in the shortfall that would obtain in the absence of microcredit.[26]

While microcredit evidently helps to reduce the extent of underemployment, it would be a mistake to presume that only the underemployed households gain additional employment through microcredit. As noted above, underemployment is traditionally defined in a fairly

[25] This definition is line with the definition of underemployment adopted by the Labour Force Surveys of the Bangladesh Bureau of Statistics. More on the definitional issues, see Osmani *et al*. (2015, Chapter 5).

[26] The actual amount of shortfall at the household level was 68 days in 2010, the year in which the survey for the present study was undertaken.

conservative way, so that even those who are not categorised as underemployed may have considerable scope for working more; as a result, microcredit may raise their employment as well. This is precisely what we find. As the final two rows of Table 5 show, households that are categorised as 'not underemployed' also increase their employment in a statistically significant and quantitatively substantial way, albeit somewhat less in comparison with underemployed households. Thus, the increase in employment that we find occurs across the board - embracing both households that are defined as underemployed and those that are not.

In Table 6, we present the marginal effects of microcredit on the pattern of employment, covering both sector and mode of employment. The first two rows of the table deal with mode of employment. As expected, there is a huge contrast between the impacts on self-employment and wage employment. For an average rural household, self-employment increases by about 46 days in a year; the estimate is statistically significant and represents 34 per cent increase over the no-microcredit scenario. Out of the increase of 46 days in self-employment, nearly two-thirds (31 days) occur as the direct effect - as the members of self-employed households work more for their self-enterprise. It is, interesting to note, however, that as much as one-third of the additional employment occurs as the indirect effect, as a result of some households shifting into self-employment induced by the access to microcredit.

Table 6
Marginal Effect of Microcredit on the Pattern of Household Employment: All Workers

Dependent variable	Absolute effect (persondays per year)			Proportional effect (%)		
	Overall	**Direct**	**Indirect**	**Overall**	**Direct**	**Indirect**
1. Self-employment	46.3***	30.8	15.5	34.0	22.6	11.4
	(9.97)					
2. Wage employment	2.4	0.4	2.0	2.1	0.3	17.4
3. Agricultural employment	2.2	1.2	1.0	16.4	0.9	0.7
	(0.57)					
4. Non-agricultural employment	54.6***	19.9	34.7	37.7	13.7	23.9
	(10.10)					
5. Self-employment in non-agriculture	47.2***	7.7	39.5	74.1	12.0	62.0
	(10.30)					
6. Wage employment in non-agriculture	5.4*	0.8	4.7	10.9	1.5	9.4
	(1.77)					

Notes: (1) The source regressions underlying these estimates are reported in Appendix Tables A.6-A.11.

(2) Figures within parentheses are z-values. Standard errors were computed by the bootstrap method, with 500 repetitions.

(3) The symbol *** indicates significant at 1 per cent level, ** indicates significant at 5 per cent level, and * indicates significant at 10 per cent level. No * indicates not significant.

Source: InM Poverty Dynamics Survey 2010.

That microcredit should lead to an increase in self-employment is only to be expected, for after all the main purpose of taking microcredit is to engage in self-enterprise activities more fruitfully. It is more interesting to observe what happens to wage employment. In particular, one would like to know whether the increase in self-employment occurs at the expense of wage employment. Our estimates suggest not: there is in fact a small positive marginal effect on wage employment, although it is not statistically significant. Apparently, microcredit does not induce any net substitution between wage and self-employment.

How does one reconcile this result with the substantial increase in self-employment that follows from access to microcredit? A partial answer is that as far as the direct effect on self-employment is concerned, there need not be any substitution away from wage employment into self-employment because self-employed households may simply utilize their underemployed labour for this purpose - and as we have seen, this may be true even of the households that are technically deemed not to be underemployed as well as those who are (Table 5). In other words, to the extent that households draw upon underemployed labour time self-employment can increase without substituting wage employment.

But then what about the indirect effect? If, as our figures suggest, as much as one-third of the increase in self-employment occurs as a result of the indirect effect of households shifting into self-employment, where are those households shifting from - if not from wage labour? Again, a partial answer is that they could be shifting from 'no employment' status - i.e., perhaps those who were living on non-labour income before are induced to engage in self-employment once microcredit becomes available. In fact, as we saw in Table 5, over a fifth of the microcredit-induced increase in total employment occurs as a result of such shift from not-employed status to employed status (representing the 'indirect effect' on total employment).

While these answers can explain how an increase in self-employment can occur without a corresponding reduction in wage employment, they cannot rule out the possibility of some substitution of wage employment for self-employment. In fact, there is good deal of empirical support for the idea that substitution indeed occurs. In a well-known study by Hossain (1988, 2002), when the self-employed borrowers were asked what they did before microcredit came along, many of them answered that they used to work as wage labourers. Careful econometric studies by Khandker (1998), Pitt (2000) and Islam and Pakrashi (2014) also found evidence for substitution of self-employment for wage employment. How is it then that we don't find a statistically significant negative effect on wage employment?

One can only speculate, but it is plausible to argue that access to microcredit might induce two opposing effects on wage employment. One of them is negative, representing the substitution effect that we have been discussing so far. This will occur as microcredit makes self-employment more attractive at the margin by raising the relative return to self-employed labour (recall Figure 2 in Section 2). But there can be a positive effect as well, through two distinct channels. First, as households use microcredit to expand the scale of their self-enterprise, they may find it necessary to increase their engagement in the wage labour market as well in order to meet the demand for regular weakly repayments. This will be particularly true of those enterprises

that do not yield a regular flow of income; in those cases, wage income may come in handy to bridge the mismatch between cash inflow and cash outflow in their enterprise. Second, if households use microcredit mainly for non-productive purposes, as many of them do, they may be obliged to look for higher wage income in order to meet their debt obligations.[27] If these positive effects roughly cancel out the negative substitution effect, this could explain why we do not find any statistically significant effect on wage employment one way or the other. The upshot of this argument is that microcredit may well induce some substitution of self-employment for wage employment, but the data may not reveal it if the positive effects on wage employment discussed above happen to offset it.

The impact on sectoral distribution of employment is shown in rows 3 and 4 of Table 6. It is evident that almost the entire increase in household employment occurs in the non-agricultural sector. Although there appears to be a small positive effect on agriculture, it is not statistically significant. One should of course expect the bulk of the additional employment to be created in the non-agricultural sector, because that is where the use of microcredit has traditionally been concentrated. But the absence of any effect on agriculture is slightly surprising in view of the well-known fact that microcredit is increasingly being used for agricultural activities in recent years. Perhaps, the impact of this trend on employment is still not strong enough to be captured clearly by econometric techniques. Alternatively, it is quite possible that the effect in agriculture is felt more on productivity improvement than on employment generation.

When non-agricultural employment is broken down by mode of employment, we find, not surprisingly, that it is self-employment that dominates but there is some evidence for a positive impact on wage employment as well. The impact is much smaller compared to that on self-employment (only 5 days of wage employment as opposed to 47 days of self-employment) and the estimate is statistically significant only at 10 per cent level. But at least there is some indication that a positive effect on wage employment that we had been speculating about earlier may have some real basis in the non-agricultural sector.[28]

The Gender Dimension of the Impact on Employment

One of the most celebrated features of the microcredit movement, especially as it has been practised in Bangladesh, is that from the very outset the lenders have focussed primarily on female borrowers. As the practice of microcredit has evolved, males have increasingly been brought into the fold as well, but the predominance of female borrowers continues to be a unique feature of this sector. While several reasons for this female bias have been discussed in the literature, the microcredit lenders themselves have always justified this bias in terms of their developmental objective of empowering poor rural women. Accordingly, a vast literature has grown up assessing and debating the empowerment effect of microcredit.

[27] We shall see evidence in support of this phenomenon later in this section when we discuss the employment effects separately for productive and non-productive users of microcredit.

[28] As we shall see below, this possibility is even more real for those borrowers who do not use their loan mainly for productive purposes.

An important strand of this literature has tried to assess the extent to which microcredit has actually enabled women to engage in productive employment, which was then used it as a metric of empowerment. There is indeed some merit in seeing productive employment as an indicator of empowerment, but this indicator needs to be interpreted with caution. In particular, no or little increase in female employment cannot necessarily be interpreted as absence of empowerment. From the point of view of efficient division of labour within the household, there is no reason to expect a one-to-one relationship between who brings credit and who uses it for productive purposes. Given the social norms and the objective opportunities prevailing in rural Bangladesh, it may be entirely rational for a household to make its male members mainly responsible for utilizing the credit, even if a female member happens to be the borrower. However, the fact that male members have been entrusted with the task of utilizing the credit does not necessarily imply that female borrowers will be deprived of the empowerment effect. Indeed, the very fact that the loan brought in by the female member has enabled the household to raise its production possibilities may be deeply empowering for her.[29] Nonetheless, it is of interest of know how the employment effect of microcredit is distributed between the male and female members of a household.

Table 7 presents the marginal effects on total employment and underemployment separately for male and female members of a household. Both males and females are found to increase their levels of employment following access to microcredit. In absolute terms, male members experience a much larger increment of employment than female members; thus while male employment rises by 43 days a year female employment rises by just 8 days. This finding thus confirms the popular perception that even though it is mostly women who bring in credit, it is mostly men who use the money for productive purposes.[30] But this finding should not be construed as females gaining less than males as a result of microcredit, because even without microcredit female members would have worked less than males in income-earning activities. What matters here is proportional increase; and the table shows that relative to the scenario without microcredit females gain by 29 per cent while males gain by 17 per cent. Thus, females actually gain proportionately more than males in terms of employment.

[29] For a flavour of the debate around this issue, see *inter alia* Goetz and Gupta (1996), Kabeer (2001), Osmani (2007) and Ngo and Wahhaj (2012).

[30] Islam and Pakrashi (2014) also found that the effect on male labour supply is more pronounced than that on female's, but this result contradicts Khandker's (1998, p.48) early finding that male labour supply invariably declines regardless of whether the loan is taken by males or females.

Table 7
Marginal Effect of Microcredit on Employment by Gender

Dependent variable (per household)	Absolute effect (persondays per year)			Proportional effect (%)		
	Overall	Direct	Indirect	Overall	Direct	Indirect
1. Total employment						
Male	42.6***	30.6	12.0	17.0	12.2	4.8
	(9.95)					
Female	8.1***	-0.26	8.3	29.1	-0.9	30.0
	(3.35)					
2. Underemployment						
Male	-10.5***	-6.4	-4.1	-17.3	-10.5	-6.8
	(-4.90)					
Female	1.7	-1.1	2.8	14.7	-9.3	23.4
	(1.38)					

Notes: (1) The source regressions underlying these estimates are reported in Appendix Tables A.12-A.15.

(2) Figures within parentheses are z-values. Standard errors were computed by the bootstrap method, with 500 repetitions.

(3) The symbol *** indicates significant at 1 per cent level, ** indicates significant at 5 per cent level, and * indicates significant at 10 per cent level. No * indicates not significant.

Source: InM Poverty Dynamics Survey 2010.

It is also interesting to observe the contrasting ways in which males and females gain additional employment. Looking at the decomposition between direct and indirect effects, the gain in male employment appears to come predominantly as a direct effect i.e., as a result of 'participating' males working more following access to microcredit. By contrast, the gain in female employment comes almost entirely as the indirect effect i.e., from increased probability of participation. This implies that with the help of credit female members of the households shift some of their time from household chores to income-earning activities.[31]

This contrast also has a bearing on the estimated marginal effects on underemployment. Table 7 shows that male members are able to reduce their underemployment considerably and in a statistically significant way, but there is no significant change in female underemployment. The latter result follows solely from the fact that females mostly shift from household chores to 'gainful' employment and this shift does not directly reduce underemployment because the concept of underemployment pertains to those who are in the labour force – i.e., underemployment will go down only when those who are already in the labour force work more.

[31] To some extent this contrast could be a consequence of definition. While defining female labour, many activities that generate income but do so only in a small scale - such as poultry raising, animal rearing, etc. - are classified as part of household chores, and females who engage in no other income-earning activities would be classified as being outside the labour force. However, when access to credit enables them to undertake the same activities in a larger scale, the time spent on these activities would be considered as gainful employment and the females would then be classified as belonging to the labour force. For this reason, such females would be found to be shifting from household chores to gainful employment, leading to a high proportion of indirect effect in terms of our analytical framework, even though they are simply spending more time on the same activities, which should ideally be counted as direct effect.

Gender aspects of the impact on the pattern of employment can be seen from Table 8. Most of the findings are in line with what we observed earlier for the household as a whole - viz., for both males and females, the gain in employment comes mainly from self-employment rather than wage employment although there is no evidence of substitution away from wage employment either, and it is in the non-agricultural sector that these gains in self-employment are mostly found. Furthermore, in an all cases where both genders have gained, male gain has been higher than female gain in absolute terms, but not necessarily in proportional terms.

A couple of findings deserve special mention. First, while we found earlier that there was no significant increase in agricultural employment at the household level, we now find that female workers do actually increase their employment in agriculture following access to microcredit. For them, it's a substantial increase – amounting to about 38 per cent increase relative to the scenario without microcredit, but perhaps because this increase is quite small in absolute terms (and also very small relative to total household employment) it is not captured in a statistically significant way at the household level. Second, while we previously observed that there was only weak evidence for increase in wage employment in non-agriculture at the household level, we now find quite strong evidence that male members do increase their wage employment in non-agriculture. The twin channels through which we speculated that access to microcredit may lead to an increase in wage employment do seem to work for male members after all.

Comparison between Productive and Non-Productive Borrowers

Not everyone who takes microcredit uses it for productive purposes; many use it either partially or wholly for non-productive activities such as augmenting household consumption, paying for marriage and dowry, repayment of other loans, and so on. The proportion of borrowers of the latter type is by no means negligible. In an earlier study we found that some 43 per cent of microcredit borrowers in our sample claim to have used microcredit mainly for non-productive purposes; we dub them as 'non-productive' borrowers as opposed to 'productive' borrower who use credit mainly for either directly income-generating activities or for augmentation of assets (Osmani *et al*. 2015, Table 8.13). The large presence of non-productive borrowers naturally invites the question: do these borrowers also benefit from higher employment or does the benefit accrue only or primarily to the productive borrowers? We investigate this question below by comparing the impact of microcredit on the employment of these two groups of borrowers, but first a couple of remarks are in order by way of clarification.

Table 8
Marginal Effect of Microcredit on the Pattern of Employment by Gender

Dependent variable (per household)	Absolute effect (persondays per year)			Proportional effect (%)		
	Overall	Direct	Indirect	Overall	Direct	Indirect
1. Self-employment						
Male	38.4***	25.7	12.7	30.5	20.4	10.1
	(8.81)					
Female	7.0***	1.7	5.3	66.4	16.2	50.2
	(4.33)					
2. Wage employment						
Male	3.9	0.4	3.5	3.9	0.4	3.5
	(1.18)					
Female	-0.5	-1.5	1.0	-4.8	-13.8	9.0
	(-0.41)					
3. Employment in agriculture						
Male	-1.37	0.03	-1.40	-1.12	0.02	-1.14
	(0.0)					
Female	3.7***	-0.3	3.9	38.2	-3.0	41.1
	(2.94)					
4. Employment in non- agriculture						
Male	50.4***	17.9	32.5	39.9	14.1	25.7
	(0.0)					
Female	3.9***	-3.8	7.6	20.8	-20.2	40.9
	(0.0)					
5. Self-employment in non- agriculture						
Male	42.8***	6.5	36.3	71.7	10.9	60.8
	(9.86)					
Female	4.0***	0.5	3.5	97.5	11.9	85.6
	(3.12)					
6. Wage employment in non-agriculture						
Male	7.6***	2.5	5.1	18.5	6.1	12.5
	(2.68)					
Female	-1.3	-1.7	0.4	-15.5	-20.7	5.2
	(-1.11)					

Notes: (1) The source regressions underlying these estimates include the full set of covariates as in Appendix Tables A3-A15. The estimates of regression coefficients are not reported but can be obtained from the author upon request.

(2) Figures within parentheses are z-values. Standard errors were computed by the bootstrap method, with 500 repetitions.

(3) The symbol *** indicates significant at 1 per cent level, ** indicates significant at 5 per cent level, and * indicates significant at 10 per cent level. No * indicates not significant.

Source: InM Poverty Dynamics Survey 2010.

First, a non-productive borrower, by our definition, does not necessarily spend all the money in non-productive uses. Anyone who claims to have spent over half the loan for non-productive purposes is classified in the non-productive category, which means that even a borrower of this type may have spent close to half the loan for productive activities. Second, and more to the point, the well-known fungibility problem may drive a wedge between what a borrower says about how she has used the money and how she may have actually used it. For example, if someone invests in a productive activity by using up the savings meant for daughter's wedding and then pays for the wedding after taking microcredit, she may be classified as a non-productive borrower, but in a real sense her loan has been used productively. For these reasons, the description of a non-productive borrower should not be taken literally. The implication for our present purpose is that it is entirely possible for the so-called non-productive borrowers to gain employment as well, although one would expect the magnitude of the gain to be somewhat smaller on the average than that of productive borrowers.

This is indeed what we observe from Table 9. For both categories of borrowers, access to microcredit has led to increased employment - for the household as a whole and also separately for male and female workers. All the estimates are statistically significant and quantitatively substantial. As expected, non-productive borrowers enjoy somewhat lower gain of employment - 41 days per year per household as compared with 63 days for productive borrowers. What is interesting, however, is that this difference arises solely from male employment. With regard to female employment, non-productive borrowers actually experience a marginally higher gain - 10 days a year for an average household as against 8 days for productive borrowers.

Looking into the distribution of employment by sector and mode, we find confirmation of the general pattern that non-productive borrowers also gain additional employment - especially self-employment in non-agriculture, albeit to a lesser extent than productive borrowers (Table 10). This suggests that the so-called non-productive borrowers do after all utilize at least part of the loan - perhaps a sizeable part - for productive purposes, and engage in self-employment just as the productive borrowers do, even if not as much as the latter.[32]

There is, however, one significant exception to the general pattern that deserves attention - namely, wage employment, especially wage employment in non-agriculture. This is one area in which non-productive borrowers actually gain more than productive borrowers. In fact, there is a hint that productive borrowers reduce their wage employment - indicating a shift from wage labour towards working for self-enterprise with the help of microcredit, although the estimates are not statistically significant. By contrast, non-productive borrowers increase their wage employment in non-agriculture in absolute amount - by almost 10 days a year per household which amounts to about 20 per cent increase from their wage employment in the scenario without microcredit, and the increase is statistically significant.

[32] This would explain, at least partly, our finding from an earlier study that non-productive borrowers also gain higher income and enjoy lower poverty with the help of microcredit, like the productive borrowers, albeit to a lesser extent (Osmani *et al*. 2015, Chapter 8).

Table 9
Marginal Effect of Microcredit on Employment by Category of Borrower

Dependent variable (per household)	Absolute effect (persondays per year)			Proportional effect (%)		
	Overall	Direct	Indirect	Overall	Direct	Indirect
1. Total employment						
Productive	62.5***	46.9	15.6	22.8	17.1	5.7
	(10.92)					
Non-productive	41.2***	30.7	10.4	15.4	11.5	3.9
	(6.85)					
2. Male employment						
Productive	50.8***	35.3	15.3	20.6	14.3	6.2
	(10.30)					
Non-productive	29.8***	20.9	8.9	12.5	8.7	3.7
	(5.67)					
3. Female employment						
Productive	7.8***	0.35	7.5	27.8	1.2	26.6
	(2.70)					
Non-productive	9.5***	1.4	8.1	33.1	4.8	28.3
	(3.01)					

Notes: (1) The source regressions underlying these estimates include the full set of covariates as in Appendix Tables A3-A15. The estimates of regression coefficients are not reported but can be obtained from the author upon request.

(2) Figures within parentheses are z-values. Standard errors were computed by the bootstrap method, with 500 repetitions.

(3) The symbol *** indicates significant at 1 per cent level, ** indicates significant at 5 per cent level, and * indicates significant at 10 per cent level. No * indicates not significant.

Source: InM Poverty Dynamics Survey 2010.

This finding lends plausibility to the hypothesis presented earlier that insofar as some non-productive borrowers do use most of their loan for activities that do not generate any income, they may be obliged to work more in the wage labour market in order to meet their debt obligation. It is also interesting to observe the decomposition of this increase into direct and indirect effect (row 6 of Table 10). Almost the entire increase in wage employment in non-agriculture accrues as an indirect effect, i.e., through increased probability of participation, which implies that many non-productive borrowers who did not previously engage in wage labour market do so for the first time in order to find the money with which to repay debts.

On the other hand, our findings do not provide support for the other hypothesis that even the productive borrowers may have to seek more work in the wage labour market in order to bridge a possible mismatch between inflow and outflow of cash in their enterprises. Perhaps they have other means of managing the mismatch.

Table 10
Marginal Effect of Microcredit on the Pattern of Employment by Category of Borrower

Dependent variable (per household)	Absolute effect (persondays per year)			Proportional effect (%)		
	Overall	Direct	Indirect	Overall	Direct	Indirect
1. Self-employment						
Productive	65.1***	42.6	22.5	47.6	31.1	16.5
	(11.47)					
Non-productive	17.4***	12.5	4.8	13.1	9.5	3.6
	(3.3)					
2. Wage employment						
Productive	-4.2	-2.2	-2.0	-4.0	-2.1	-1.9
	(-1.05)					
Non-productive	10.0**	3.9	6.1	9.4	3.7	5.7
	(2.21)					
3. Employment in agriculture						
Productive	4.9	3.2	1.7	3.7	2.4	1.3
	(1.13)					
Non-productive	-2.1	-0.3	-1.8	-1.7	-0.2	-1.5
	(-0.43)					
4. Employment in non- agriculture						
Productive	59.3***	24.4	34.9	41.5	17.1	24.4
	(9.43)					
Non-productive	44.8***	13.5	31.3	31.9	9.6	22.3
	(6.62)					
5. Self-employment in non- agriculture						
Productive	61.2***	11.5	49.8	98.1	18.4	79.8
	(10.68)					
Non-productive	26.3***	1.1	25.2	41.8	1.7	40.1
	(4.69)					
6. Wage employment in non-agriculture						
Productive	-0.1	0.3	-0.4	0.2	0.6	-0.8
	(-0.03)					
Non-productive	9.5**	1.2	8.3	20.0	2.5	17.4
	(2.47)					

Notes: (1) The source regressions underlying these estimates include the full set of covariates as in Appendix Tables A3-A15. The estimates of regression coefficients are not reported but can be obtained from the author upon request.

(2) Figures within parentheses are z-values. Standard errors were computed by the bootstrap method, with 500 repetitions.

(3) The symbol *** indicates significant at 1 per cent level, ** indicates significant at 5 per cent level, and * indicates significant at 10 per cent level. No * indicates not significant.

Source: InM Poverty Dynamics Survey 2010.

Impact of Microcredit on Non-Borrowers

Although the proximate effect of microcredit would fall naturally on the borrowers, there could be some spill-over effects on the non-borrowers as well. These effects could operate through many channels within a general equilibrium framework, involving both product markets and labour market. As far as the labour market channel is concerned, which is the focus of the present study, two major types of effect may be distinguished - the wage effect and the employment effect. As the spread of microcredit affects the labour allocation decisions of a large number of households, there will inevitably be some knock-on effects on the labour market - from both demand and supply sides. This will have a consequence for the equilibrium wage, and this may constitute a major channel through which non-borrower households that engage in the market for wage labour could be affected. In addition, there may also be an effect on the employment opportunities open to them as a consequence of the employment choices made by borrowers. The wage effect will be analysed in Section 4; here we focus only on the employment effect.

The literature on microcredit recognises that the spill-over effect on non-borrowers' employment can in principle go in two opposite directions. One effect in the positive direction stems from the possibility that as access to microcredit encourages the borrowers to engage in self-employment by shifting away from wage labour (à la Figure 2 in Section 2), non-borrowers may find more opportunities for wage employment for themselves (Hossain, 1988). Another possibility is that as borrowers expand their scale of enterprise with the help of microcredit, and grow up to the level of microenterprise and beyond, they might begin at some stage to engage wage labour to supplement family labour; this will raise the employment opportunities for non-borrowers as well.

As opposed to these potentially positive effects, one may postulate a negative effect by invoking the concept of demand constraint. If the overall market demand for commodities produced by rural non-farm households remains more or less stagnant, any increase in the employment (and production) of microcredit borrowers would have to come at the expense of non-borrowers (Osmani 1989). Of course, market demand is highly unlikely to have remained constant; but the point remains that if demand does not grow fast enough to accommodate the growing employment of borrowers, the employment of non-borrowers is bound to suffer. In that event, much of the additional employment of borrowers would simply be a redistribution of employment away from non-borrowers, as in a zero-sum game.

In view of these conflicting possibilities, it is some interest to learn what has in fact been the net effect on non-borrowers as microcredit has expanded rapidly in rural Bangladesh in the recent past. We investigated this issue by adopting the same analytical framework and essentially the same econometric methodology as used for borrowers, with the exception that the specification of the microcredit variable had to be different in this case. The relevant variable in this case is the spread of microcredit in the village in which a non-borrower happens to reside. The hypothesis is that if microcredit does affect the employment of non-borrowers one way or the other, then the employment of non-borrowers living in a village with greater spread of microcredit should differ systematically from that of non-borrowers living in villages with lesser spread, other things remaining the same. So the question we posed was: does the employment of non-borrowers vary systematically with the spread of microcredit in the villages in which they respectively live?

Our findings are summarised in Table 11. The most salient message of this table is that whether we look at total employment or the pattern of employment the spread of microcredit has had no visible impact on non-borrowers. Looking at both the participation equation and the amount equation separately, none of the coefficients of either total employment or sector of employment or mode of employment is found to be statistically significant.

This finding can be interpreted in one of two ways: either, the positive and negative effects discussed above cancelled each other out; or, neither the positive nor the negative effects were strong enough to affect the employment of non-borrowers appreciably one way or the other. Our own judgement is that the latter interpretation is perhaps closer to the truth. On the positive side, we had noted the possibility that if borrowers shift away from wage employment into self-employment this would open up greater employment opportunities for non-borrowers. But in our preceding analysis we found no evidence of a net shift of this kind; any such shift by productive borrowers seems to be neutralized by the tendency of non-productive borrowers to delve more into wage labour in order to meet their debt obligations.

There remains the possibility, however, of a positive impact through the demand for wage labour on the part of those borrowers who have scaled up their activities up to the level of microenterprise. But it is arguable that the proportion of such microenterprises in the overall microcredit sector is still quite small for the effect to be visible at the aggregate level. The story on the negative side is probably that rapid economic growth of the last couple of decades prevented the demand side from imposing a binding constraint, so that the additional employment enjoyed by borrowers did not have to occur at the expense of non-borrowers. In other words, the overall growth of the economy was fast enough to convert a possible zero-sum game into a positive sum game, in which borrowers could expand their employment and production without displacing the non-borrowers. Thus, neither the positive effect nor the negative effect was apparently strong enough to make an impact one way or the other.

Table 11
Effect of Microcredit on the Employment of Non-Borrowers: All Workers

Dependent variable (persondays per household)	Participation Equation		Amount Equation	
	Coefficient	z-value	Coefficient	z-value
1. Total employment	0.00490	1.49	-0.04820	-0.08
2. Self employment	-0.00016	-0.06	-0.99424	-0.58
3. Wage employment	0.00054	0.18	0.50000	1.19
4. Agricultural employment	0.00272	0.81	-0.12975	-0.15
5. Non-agricultural employment	0.00461	1.38	-0.42445	-0.62

Notes: (1) The source regressions underlying these estimates include the full set of covariates as in Appendix Tables A3-A15. The estimates of regression coefficients are not reported but can be obtained from the author upon request.

(2) The symbol *** indicates significant at 1 per cent level, ** indicates significant at 5 per cent level, and * indicates significant at 10 per cent level. No * indicates not significant.

Source: InM Poverty Dynamics Survey 2010.

4. Impact of Microcredit on Rural Wage

The spread of microcredit may affect rural wages through a number of channels operating though both the demand side and supply side of the market for wage labour. Without claiming to be exhaustive, the following channels may be identified on the demand side.

(1) To the extent that capital, especially working capital, is complementary to labour, the existence of credit constraint implies that household labour may not be supplied up to the optimal amount, given land and other resources. Labour will remain underutilized. In that event, by easing the credit constraint, access to microcredit will also enable a household to increase the amount of labour input. This increased demand for labour may be met partly by higher self-employment of family labour but partly it may also result in higher demand for wage labour if household labour force is not large enough to supply the optimal labour input. In the latter case, demand for hired labour will go up in the labour market. Similar effects should occur when access to credit enables a household to scale up its level of productive activities, even if it were not credit-constrained to begin with. As microenterprises grow in size, demand for wage labour is likely to go up.

(2) Theoretically, demand for wage labour may also increase because of the well-known 'income effect' on the supply of labour. Higher income made possible by microcredit may induce some borrowers to consume more leisure and supply less labour - the classic case of backward-bending supply curve of labour. This is not a very likely scenario for the poor borrowers, but may well happen for the relatively well-off borrowers, and if this happens some of the borrowers may want to substitute self-employment with hired workers thus pushing up the demand for wage labour.

(3) Theoretically, however, it is also possible to think of the opposite scenario in which demand for wage labour may tend to fall. Use of hired labour typically involves some moral hazard as it may prove difficult to monitor their work effectively. When the productive activities in which hired labour is employed yield low returns, the cost of moral hazard - in terms of lost income - is also small in absolute amount. If, however, access to credit allows a household to engage in activities with higher return, the cost of moral hazard will also go up correspondingly. In that event the borrowers may decide to substitute wage labour with family labour, thus reducing the demand for wage labour.

On the supply side, the following major channels may be identified, again without trying to be exhaustive.

(1) It is well-known that borrowers often use microcredit for purposes other than directly productive activities - for example, for augmenting assets and for meeting essential consumption needs. Since such uses do not directly yield additional income, the question arises as to how the households find the wherewithal to repay the loans. One possibility is that they might try to earn additional wage income. Those who are already in the labour force may choose work longer hours; in addition, those who are not in the labour force may be obliged to enter it.[33] In either case, supply of labour will go up in the market for wage labour.

[33] We found evidence for the latter phenomenon in Section 3.

(2) A similar effect may occur even when credit is used for productive purposes. This may happen because of the compulsion to make regular weekly repayments. If credit is used for self-employed activities such as farming or animal rearing, where the returns may not come in regular intervals to match the demand for weekly repayment, borrowers may choose to divert a part of household labour force to wage labour, which can generate a more regular flow of income. This would help bridge the mismatch between inflows and outflows of cash; and incidentally it would also give a boost to the supply of wage labour.[34]

(3) A long tradition of efficiency wage theory maintains that in poor economies supply of labour is constrained by nutritional deprivation. This has clear implications for the impact of microcredit on labour supply. If access to microcredit enables a household to raise its nutritional status, its members may be able to work longer and harder. This may result in higher self-employment in some cases, but it may also raise the supply of wage labour in the labour market if the borrower households tend to rely mainly on wage labour for their livelihood.

(4) It is, however, also possible to conceive of mechanisms whereby supply of wage labour may tend to decline. Going back to the first mechanism on the demand side discussed above, in which the easing of credit constraint is supposed to provide greater possibility of self-employment, it is conceivable that some of the increased self-employment may occur with corresponding reduction in wage labour. The scenario is one in which under credit constraint people choose to engage in wage labour instead of pursuing self-employment as the returns to self-employed labour might be very low in the presence of credit constraint, but as the access to microcredit eases the constraint they might engage in greater self-employment by abandoning wage labour (as in Figure 2 in Section 2). The supply curve will shift up in that event.

(5) There is yet another channel through which microcredit may push the supply curve upward - by affecting the reservation wages of workers. If microcredit succeeds in raising the returns to self-employed labour, this will have the effect of raising the reservation wages of workers, resulting in an upward shift of the supply curve.

It is thus evident that microcredit may affect the market for wage labour in multifarious ways - through both demand and supply sides of the market, and each side may be affected either positively or negatively. On purely *a priori* grounds, therefore, the effect of microcredit on the wage rate must be deemed to be ambiguous. What the net effect would be is essentially an empirical matter. In this section, we try to estimate the nature of the effect in the specific context of rural Bangladesh.

Estimation Methodology

We investigate the issue by carrying out a village level analysis, taking each of our 180 villages as a unit of observation. Our hypothesis is that if microcredit has any systematic effect on

[34] We did not find empirical support for this hypothesis in Section 3, but the theoretical possibility remains.

rural wages, then village-specific wage rates should vary systematically with the spread of microcredit in the respective villages. The hypothesis is tested by estimating a relationship of the following kind:

$$W=f(C,\mathbf{Z}) \qquad \text{--- (13)}$$

where, W stands for village-level nominal wage rate, C stands for the spread of microcredit as measured by the percentage of households taking microcredit in a village, and $\mathbf{z}$ a vector of other village-level characteristics that may have a bearing on the wage rate. In choosing the elements of $\mathbf{z}$, we treat the above relationship as a reduced form equation so that both demand-side and supply-side variables would enter $\mathbf{z}$ subject to the availability of data.

We had two sources of data at the village level: (a) a household census of the entire village that was conducted prior to conducting the sample survey[35] and (b) a village survey in which information on a large number of characteristics of the villages were collected from key informants. Our main variable of interest – viz., the spread of microcredit as measured by the proportion of households in the village taking microcredit - was obtained from census data. For the rest of the variables ($\mathbf{z}$), we drew upon both sources, and after a good deal of experimentation – mainly with a view to minimizing the problem of multicollinearity – we chose to include the following variables.

There are four land-related variables – viz., average size of land per household, the distribution of land within the village as measured by the Gini coefficient, the proportion of one-cropped agricultural land andthe proportion of three-cropped agricultural land. Four variables are included to capture some of the characteristics of the people and households of the village that may have a bearing on one or the other side of the labour market - viz., the average level of schooling of the household heads, the proportion of landless households, the proportion of households with members working abroad, and the proportion of households with members working away in the urban centres of the country. There are four village characteristics that have potential relevance for the labour market – viz., the remoteness of the village as measured by the average distance of the village from a number of important facilities (such as urban centres, schools, market place, health centres, etc.), accessibility of the village measured as an ordinal variable with higher values representing better accessibility, the scope of working in various non-farm activities in the vicinity of the village measured as an ordinal variable with higher values representing better scope, and a dummy variable representing whether the village belongs to a *char* are or not (with value 1 if yes, 0 otherwise). In addition, we included dummies for the six (old) administrative divisions in which a village lies, with a view to capturing relevant locational heterogeneities that may not be adequately captured by the village-level variables we have chosen. Finally, we included a variable representing the average price of paddy obtaining in the year preceding the survey. The role of this variable is work as the deflator of the nominal wage (our dependent variable), because after all it is the real wage that the factors described above

[35] While the main purpose of the census was to create a sampling frame for drawing the sample, a number of basic information about each household was obtained at the time of the census.

are supposed to affect operating from either the demand side or the supply side of the labour market.[36]

As far as the nominal wage rate is concerned, we had a choice between two sources of data. One of them is the village survey, which was designed to collect data on the peak-period and slack-period wage rates in agriculture, as well as on average annual wage rates in a variety of non-farm activities. But as noted in Section 3, the information collected on non-farm wages appear to be scanty for nearly a fifth of the villages. One option was, therefore, to use the agricultural wage rate alone – averaging the peak and slack period wages – and take it as a proxy for overall wage rate in the village. The other option was to use the wage rates collected from the household survey data, to average them for the sample in the village, and treat this average as representing of the village as a whole. We chose both options, but for the sake of comparability, we only used the data on agricultural wage obtained from the household survey, resulting in two separate specifications of equation (13).[37]

The next issue to consider is the possible endogeneity of the microcredit variable in the wage equation. It is entirely conceivable that the factors that lead to faster spread of microcredit in a village – for example, favourable economic conditions - also lead to higher wages. Unless those factors are adequately controlled for by the covariates included in the wage equation, the endogeneity bias may well arise. There are tests for endogeneity that can warn about the possibility of such bias, but in order to carry out these tests, we need to find proper instrument for the microcredit variable. If the tests point to the presence of endogeneity bias, the same instruments can then be used for estimating the effect of microcredit in an unbiased (strictly speaking, consistent) manner.

Our chosen instrument is the length of time for which microfinance institutions have been active in the village, a piece of information that we obtained from the village survey. It stands to reason that the longer the MFIs have been active in the village, the greater would be the spread of microcredit, other things remaining the same. On the other hand, the length of MFIs' involvement is unlikely to affect the wage rate of the village directly.[38] As such, the length of MFIs' involvement in the village would appear to be a valid instrument. Unfortunately, as we have only a 'just identified' equation (i.e., exactly one instrument for one endogenous regressor), we cannot conduct statistical tests for checking the validity of instruments (which

[36] An alternative procedure would have been to use real wage (nominal wage deflated by paddy price) directly as the dependent variable. But this procedure would implicitly impose the restriction that nominal wage adjusts to the price level in exactly the same proportion everywhere. Our chosen procedure was meant to allow for the possibility that the adjustment of wage to change of price may differ in different geographical locations.

[37] For the sake of completeness, we also tried the overall wage rate obtained from household survey, combining both agricultural and non-agricultural wage rates, but this did not lead to any qualitative difference to the results, especially with regard to the effect of microcredit.

[38] It is possible, however, that this variable might be correlated with the wage rate indirectly insofar as it is correlated with some of the village characteristics that may have a direct effect on the wage rate - for example, remoteness or accessibility of the village, and so on. But since, we believe, we have included adequate number of such covariates in the wage equation, the instrument will not have any significant residual correlation with the wage rate after controlling for the covariates.

require 'overidentifying restrictions'). There are, however, a couple of other things we can do – viz., we can conduct tests for the 'relevance' of the instrument i.e., whether it does have a good correlation with the endogenous regressor after controlling for the covariates and also whether the instrument is 'weak' or not (i.e., whether its relevance, if its exists, is weak or strong in some well-defined statistical sense). As we shall see, our chosen instrument passes both these tests in a statistically significant way.

Discussion of Results

We first estimated both specifications of the wage equation with the two-stage least squares (2SLS) method to allow for endogeneity of the microcredit variable. Tests of endogeneity showed, however, that the problem was present only in the first specification (when we used agricultural wage rate obtained from the village survey) but not in the second specification (when we used the agricultural wage rate comprising obtained from the household survey). In Table 12, we present two different tests - one based on Wooldridge's robust score and the other on Durbin-Wu-Hausman robust regression. The null hypothesis in each case is that the regressor in question is exogenous and the relevant test-statistic in each case is the F-statistic. As can be seen from the table, the hypothesis of exogeneity is firmly rejected for the first specification at less than 5 per cent level of significance but cannot be rejected for the second specification. Accordingly, the estimates of the wage equation we present below are based on 2SLS regression for the first specification (to allow for endogeneity) and on OLS regression for the second specification.

Table 12
Tests of Endogeneity of the Microcredit Variable in the Wage Equation

	F-statistic	p-value
First specification (agricultural wage from village survey)		
Robust score	4.25	0.0392
Robust regression	5.14	0.0248
Second specification (agricultural wage from household survey)		
Robust score	0.17	0.6812
Robust regression	0.15	0.6983

Notes: (1) Both specifications of the wage equation were estimated by 2SLS, using as instrument the length of time for which microfinance institutions have been active in the village, and including the full set of covariates as in Table 14.

Before presenting the results, however, let us check the appropriateness of the chosen instrument (used in the first specification) in terms of 'relevance' test and 'weakness' test. The relevance test consists simply in checking the statistical significance of the coefficient of the instrumental variable in the first-stage regression on the endogenous regressor. The weakness test is a Robust F-test of the extent of contribution made by the instrument towards explaining the endogenous variable, after controlling for the covariates in the first-stage regression. The results of these tests are reported in Table 13.

Table 13
Tests of Relevance and Weakness of the Instrumental Variable

Test of Relevance	coefficient	t-value
	1.242	3.92
Test of weakness	**F-statistic**	**p-value**
	15.4	0.0001

Notes: (1) These statistics are based on the first-stage regression of the 2SLS regression on wage equation (first specification). In this first-stage regression, the endogenous variable (spread of microcredit) was regressed on the instrument (length of MFI presence) and a set of covariates. The full results of the first-stage regression are reported in Appendix Table A.16.

The test of relevance shows that the coefficient of the instrumental variable (length of MFI involvement in the village) has a positive effect on the spread of microcredit and this effect is highly significant (at 1 per cent level or less). The instrument is obviously highly correlated with the spread of microcredit, even after controlling for the effects of the covariates. The next test shows whether this correlation can be regarded as sufficiently strong or not. A widely used rule of thumb proposed by Staiger and Stock (1997) is that a value of F less than 10 should be considered to be weak. Since the computed F-statistic (15.4) is above this cut-off point, our chosen instrument cannot be called weak by this criterion. These tests lend credibility to the estimates of the first specification of the wage equation, which was estimated by the 2SLS method to take account of endogeneity of microcredit.

The estimates of both specifications are reported in Table 14. Looking first at the first specification (using wage rate from the village survey), the spread of microcredit is seen to exert an upward pressure on agricultural wage rate and the effect is statistically significant at 5 per cent level. The magnitude of the effect is also quite substantial. The elasticity of wage rate with respect the spread of microcredit is estimated at 0.46, which means that if the spread of microcredit is doubled the agricultural wage rate will increase by as much as 46 per cent, holding other covariates at their mean values.[39]

In huge contrast to all this, the alternative specification using agricultural wage data from the household survey does not show any effect of microcredit at all. Before trying to make sense of this contrast, let us first look at the effect of microcredit separately on peak-season and slack season wages, based on village survey. The decomposition into peak-season and slack-season effects is a matter of interest in itself; as it turns out, it also holds the clue towards explaining the contrasting results of the two specifications.

The regression results for the peak and slack season wage rates are reported in Table 15. Both these variables were obtained from the village survey. The equation for the peak season wage was estimated by the 2SLS method as the tests of endogeneity shows that the microcredit

[39] It is instructive to note that if this equation is estimated by OLS, without allowing for endogeneity of microcredit, the positive effect disappears and the coefficient turns out be statistically insignificant. This implies that we have a 'negative' endogeneity bias in this case, which is consistent with the negative endogeneity bias that we found in an earlier study when we looked at the effect of microcredit at the household level (Osmani *et al*. 2015, Chapter 8). The negative bias suggests, contrary to a common view, that microcredit goes more to those individuals and locations that have some unobserved inherent disadvantage.

variable was endogenous in this equation. The chosen instrument was the same as before - viz., the length of MFIs' involvement in the village. However, the slack season equation was estimated by OLS as the test could not reject the null hypothesis of exogeneity.

Table 14
Estimates of Wage Regression at the Village Level

Explanatory variables	Specification 1		Specification 2	
	Coefficient	z-value	Coefficient	z-value
Spread of microcredit (% of borrowers)	1.64**	2.05	0.39	0.42
Inequality of land distribution (Gini)	173.53*	1.76	51.73	0.60
Land owned by average household (decimal)	-0.16	-0.96	-0.13	-1.01
Accessibility of the village (score)	-12.43	-1.44	-9.51	-0.85
Remoteness of the village (km)	0.19	0.12	0.11	0.08
Scope for non-farm work near village (score)	23.00***	3.46	10.47	1.56
Average schooling of household heads (years)	6.45*	1.76	2.03	0.68
Households with workers abroad (%)	0.93*	1.70	-0.21	-0.32
Households with workers in towns (%)	0.04	0.10	0.21	0.82
Proportion of one-cropped land (%)	0.06	0.42	0.11	1.03
Proportion of three-cropped land (%)	0.31*	1.80	0.25*	1.67
Proportion of landless households (%)	-1.17	-1.23	-0.29	-0.40
Whether the village is a *char* (dummy)	12.43	0.99	3.06	0.23
Average price of paddy (Taka/kg)	0.08**	2.03	0.04	1.42
Barisal division (dummy)	-1.67	-0.11	-3.32	-0.26
Chittagong division (dummy)	16.24	1.01	20.36	1.60
Dhaka division (dummy)	15.00	0.91	-2.75	-0.21
Khulna division (dummy)	-39.26**	-2.02	-36.05**	-2.38
Rajshahi division (dummy)	-51.21***	-3.37	-48.42***	-4.08
No. of observations	(177)		(173)	

Notes: (1) In 'Specification 1', wage rate is the simple average of the peak-season and slack-season agricultural wage rates as obtained from the village survey; in 'Specification 2', wage rate is obtained from the household survey and is measured as the average of wage rates received throughout the year by all members of the sample households in a village, working in both farm and non-farm sectors.

(2) 'Remoteness of the village' is measured as the average distance of the village from a range of facilities such as market place, urban centre, banks, etc.

(3) For Accessibility of the village' and 'Scope for non-farm work near village' higher score signifies better accessibility and greater scope respectively. For details of how these scores were constructed, see Osmani *et al*. (2015), chapters 1 and 8.

(4) The dummy variable for 'Whether the village is a *char*' takes the value 1 when 'yes' and 0 when 'no'.

Source: InM Poverty Dynamics Survey 2010.

It is evident from Table 15 that microcredit exerts a positive effect on the wage rate only in the peak season and not in the slack season. This is not surprising. If the spread of microcredit creates a pressure in the labour market – in terms of additional net demand (or equivalently, reduced net supply) – the pressure is less likely to bite in the slack season when labour is in excess supply. It is only in the peak season, when the labour market is already tight, that the additional pressure generated by microcredit is likely to make its effect felt. The elasticity of peak season wage turns out to be 0.6 – considerably higher than the elasticity of the average wage rate (0.46), which is as it should be since there is no effect on the slack season wage rate.

Table 15
Estimates of Regressions for Peak and Slack Season Wage Rates at the Village Level

Explanatory variables	Peak Season		Slack Season	
	Coefficient	z-value	Coefficient	z-value
Spread of microcredit (% of borrowers)	2.39***	2.57	-0.03	-0.16
Inequality of land distribution (Gini)	196.94	1.52	158.99*	1.80
Land owned by average household (decimal)	-0.20	-0.87	-0.07	-0.61
Accessibility of the village (score)	-20.26*	-1.81	0.24	0.04
Remoteness of the village (km)	0.28	0.13	0.25	0.18
Scope for non-farm work near village (score)	29.56***	3.50	17.07***	2.84
Average schooling of household heads (years)	5.88	1.20	6.41**	2.05
Households with workers abroad (%)	1.21*	1.76	0.19	0.41
Households with workers in towns (%)	0.17	0.37	-0.20	-0.71
Households with workers in towns (%)	0.17	0.37	-0.20	-0.71
Proportion of three-cropped land (%)	0.42**	1.98	0.19	1.13
Proportion of landless households (%)	-1.42	-1.11	-0.86	-1.07
Whether the village is a *char* (dummy)	12.90	0.87	4.24	0.35
Average price of paddy (Taka/kg)	0.08*	1.73	0.06**	2.16
Barisal division (dummy)	-10.89	-0.55	14.98	1.04
Chittagong division (dummy)	20.96	1.07	13.12	0.93
Dhaka division (dummy)	23.34	1.07	5.34	0.40
Khulna division (dummy)	-48.86*	-1.84	-30.05**	-2.08
Rajshahi division (dummy)	-60.89***	-3.03	-39.23***	-3.17
No. of observations	(177)		(177)	

Notes and Source: See, Table 14.

The contrast between peak season and slack season effects can probably shed some light on the reason behind the contrasting results for the two alternative specifications of the average wage equation shown in Table 14. The clue lies in the way the two averages were calculated. In

the first specification, based on village survey, the average wage rate was constructed by taking a simple unweighted average of two wage rates – one for the peak season and one for the slack season. In the second specification, based on household survey, the average wage rate is based on all the wages received by the members of the sample households throughout the year, covering both slack and peak periods. Since slack season happens to span a much longer period of time than the peak season, the average in the second specification implicitly gives a much bigger weight on the slack season wage than on the peak season wage. By contrast, in the first specification, the weights are equal by construction. Recalling that microcredit affects only the peak season wage and not the slack season wage, it is now easy to see why the second specification of the average wage equation does not reveal any effect of microcredit; the non-effect of the slack season simply swamps the positive effect of the peak season by virtue of its bigger weight. However, in the first specification, where the weights are equal, the non-effect of the slack season serves to reduce the magnitude of the average effect but cannot eliminate it completely.

Based on this explanation, we may conclude, despite the contrasting results for alternative specifications of the wage equation, that microcredit does exert a positive effect on rural wages in Bangladesh and that the effect is visible mainly in the peak agricultural season. There remains the question, however, of the transmission mechanism i.e., what are the channels through which this effect is transmitted. Earlier in this section we outlined several possible transmission mechanisms – some operating on the demand side of the labour market and some on the supply side, and some effects are positive serving to push up the wage rate and some are negative serving to push it down. Unfortunately, our data are not refined enough to identify the effects of each of these mechanisms; so we cannot explain why exactly the positive effects seem to outweigh the negative effects. This clearly remains an important area for future research.

At this stage, we can at best make an educated guess. As noted earlier, a positive effect may stem from the withdrawal of borrowers from wage labour, thereby tightening the labour market from the supply side. However, in Section 3, we found no solid evidence for such withdrawal. There was a hint of withdrawal on the part of the borrowers who use their loans mainly for productive purposes, in that the coefficient of the microcredit variable in the equation for wage employment was found to be negative for them, but it was not statistically significant. On the contrary, there was solid evidence that the borrowers who do not use their loans mainly for productive purposes actually supply more labour in the wage labour market – this should exert a negative influence on the wage rate. Another positive effect may emanate from the demand side as borrowers who are able to scale up their productive activities to the level of microenterprise and beyond may demand more wage labour to supplement their family labour. But again we did not find any clear support for this effect while assessing the impact on the wage employment of non-borrowers, and speculated that while this effect probably exists it may not yet be strong enough to be visible at the macro level.

In view of these findings, we can only speculate that the positive effect probably stems mainly from the increase in reservation wages that must occur as a result of higher incomes earned

by a large fraction of the rural work force that are able to increase the returns to self-employed labour with the help of microcredit. In an earlier study, we found that access to microcredit helps raise average household incomes by about 43 per cent (Osmani *et al*. 2015, Chapter 8). Given this order of magnitude of the income effect of microcredit, it is not at all implausible that the reservation wages should rise high enough to exert a strong positive effect on the rural wage rate.

5. Summary of Findings

This paper has tried to assess the impact of microcredit on the rural labour market in Bangladesh using data from a nationally representative large-scale survey. Two aspects of the impact on labour market were investigated - viz. employment at the household level and wage rate at the village level. While assessing the impact on employment, the paper looked at both total employment and pattern of employment (i.e., sector and mode of employment) of borrowers, and disaggregated the employment impact by gender and by 'productive' and 'non-productive' users of microcredit. In addition, the paper also considered the possible spill-over effect on non-borrowers. The analytical framework adopted for studying the impact on employment allowed for two kinds of effects - a 'direct' effect resulting from additional work performed in a line of activity in which a household was already engaged and an 'indirect' effect stemming from households entering a new line of activity induced by access to microcredit. This framework was econometrically implemented by using the two-part model, also known as the Hurdle model. While estimating the impacts on employment and wages, the econometric methodology allowed for the possible endogeneity of the microcredit variable and adopted the instrumental variable approach when tests indicated the existence of endogeneity. The major findings of the study may be summarised as follows.

(1) Microcredit has a strong positive effect on the employment level of the members of borrowing households. An average household gains 53 persondays of employment in a year as a result of access to employment, which amounts to about 19 per cent increase from the employment level that would obtain without microcredit.

(2) The gain in employment occurs in two ways: (a) many households who did not previously have any gainful employment (perhaps because they had access to non-labour income) decide to pursue self-employed activities induced by the higher returns to labour made possible by microcredit, and (b) households whose members were already employed in some form work even more, thus reducing the extent of underemployment. On the average, underemployment comes down by about 15 per cent. The second effect, which we call the 'direct effect', is by far the predominant one, accounting for nearly three-quarters of the total gain in employment.

(3) Although it is mostly women who bring in credit, it is the male members of households for whom the employment effect turns out to be much bigger in absolute amount. For an average household, male employment increases by 43 persondays a year as against 8 days of female employment. It would be wrong to conclude, however, that male employment rises

disproportionately more. Since female employment is much lower even in the absence of microcredit, the increase happens to be higher for females in proportional terms - 29 per cent for them as against 17 per cent for males.

(4) Almost the entire increase in employment at the household level occurs in the non-agricultural sector, with hardly any increase in agricultural employment. However, when the employment effect is disaggregated by gender, female members are found to increase agricultural employment by a modest amount.

(5) As one would expect, self-employment, especially in non-agricultural activities, is where most of the effect of microcredit is concentrated, accounting for nearly 90 per cent of the increase in total employment.

(6) It is interesting to observe, however, that wage employment also increases, albeit in a modest way. Further investigation shows that this increase occurs mainly for male members, working in non-agricultural activities, and especially in those households who do not use their loans mainly for productive purposes.

(7) The extent of employment effect differs depending on the use of microcredit. As expected, households that use loans mainly for productive purposes gain more employment compared to the households who use their loans mainly in unproductive ways. It is important to note, however, that even the latter category of households gains substantial amount of employment - 41 persondays a year per household as against 63 persondays for productive users of loans.

(8) Apart from the difference in the magnitude of aggregate employment gain, another notable difference between 'productive' and 'non-productive' borrowers lies in the effect on wage employment. For 'non-productive' borrowers, wage employment goes up - by nearly 10 persondays a year per household in non-agricultural activities, which represents a 20 per cent increase over what would obtain in the absence of microcredit. This is understandable because if a household does not use credit to finance productive activities, it may find it necessary to work more in the wage labour market in order to meet its debt repayment obligations. By contrast, there is no increase in wage employment for 'productive' borrowers; if anything, there is a hint of some withdrawal from wage employment but the effect is not statistically significant.

(9) We could not find any significant spill-over effect of microcredit on non-borrowers - either negative or positive. This implies, on the one hand, that the increase in employment enjoyed by microcredit borrowers represents a net addition to rural employment - it did not come at the expense of non-borrowers. On the other hand, this finding also implies that any additional demand for wage labour generated by the microenterprises run by microcredit borrowers is still not significant enough to be visible at the macro level.

(10) Apart from affecting employment at the household level, microcredit also exerts a significant positive effect on the wages rate at the village level. The elasticity of the agricultural wage rate is estimated at 0.46, which means that a 10 per cent increase in the spread of microcredit would raise the wage rate by 4.6 per cent.

(11) The effect of microcredit on rural wages is visible only in the peak season; the slack season wage remains unaffected. This is entirely plausible since any upward pressure created by microcredit in the labour market is likely to bite mainly in the peak season when the labour market gets tight rather than in the slack season when excess supply of labour tends to prevail.

(12) One of the unanswered questions of the present study is: exactly what are the transmission mechanisms through which microcredit exerts a positive effect on rural wages. On the basis of the available evidence, we find the most plausible explanation to lie in the increase in reservation wages that is likely to occur as a result of higher incomes generated by microcredit. However, further research is clearly needed in this area.

References

Cameron, A. C. and Trivedi, P. K. (2005). *Microeconometrics: Methods and Applications*. Cambridge University Press: Cambridge.

Cameron, A. C. and Trivedi, P. K. (2010). *Microeconometrics Using Stata*. Revised edition. Stata Press: Texas.

Cragg, J. (1971). "Some Statistical Models for Limited Dependent Variables with Applications to the Demand for Durable Goods", *Econometrica*, 51: 751-763.

Goetz, A.and 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.

Hoffmann, R. and Kassouf, A. L. (2005). "Deriving Conditional and Unconditional Marginal Effects in Log Earnings Equations Estimated by Heckman's Procedure", *Applied Economics*, 33: 1303-1311.

Hossain, M. (1984). *Credit for the Poor: The Grameen Bank in Bangladesh*. Research Monograph no. 4. Bangladesh Institute of Development Studies: Dhaka.

Hossain, M. (1988). *Credit for Alleviation of Rural Poverty: The Grameen Bank in Bangladesh*. Research Report no. 65. International Food Policy Research Institute: Washington, D.C.

Hossain, M. (2002). "Credit for the Alleviation of Rural Poverty: The Experience of Grameen Bank in Bangladesh", in Rahman, A., Rahman, R. I., Hossain, M. and Hossain, S. M. (eds.) *Early Impact of Grameen: A Multi-Dimensional Analysis*. Grameen Trust: Dhaka.

Islam, A. and Pakrashi, D. (2014) "The Microcredit Puzzle: Labour Supply Behaviour of Rural Households inBangladesh". Discussion paper no.24/14. Department of Economics, Monash University: Australia.

Kabeer, N. (2001). "Conflicts over Credit: Re-Evaluating the Empowerment Potential ofLoans to Women in Rural Bangladesh."*World Development*, 29(1): 63-84.

Khandker, S. R. (1998). *Fighting Poverty with Microcredit: Experience in Bangladesh*. Oxford University Press: New York.

Mullahy, J. (1986). "Specification and Testing of Some Modified Count Data Models", *Journal of Econometrics*, 33: 341-365.

Ngo, T. M. P.and Wahhaj, Z. (2012). "Microcredit and Gender Empowerment",*Journal of Development Economics*, 99(1): 1-12.

Osmani, L. N. K. O. (2007). "A Breakthrough in Women's Bargaining Power: The Impact of Microcredit", *Journal of International Development*, 19: 695-716.

Osmani, S. R. (1989). "Limits to the Alleviation of Poverty Through Non-Farm Credit", *Bangladesh Development Studies*, XVII(4).

Osmani, S. R. (2014). "Has Microcredit Helped the Rural Poor of Bangladesh? An Analytical Review of the Evidence so Far". Working Paper No. 23. Institute of Microfinance: Dhaka.

Osmani, S. R. and Khalily, M. A. B. (2011). *Readings in Microfinance: Reach and Impact*. Institute of Microfinance and the University Press Limited: Dhaka.

Osmani, S. R., Ahmed, M., Latif, M. A. and Sen, B. (2015). *Poverty and Vulnerability in Rural Bangladesh*. University Press Limited and Institute of Microfinance: Dhaka.

Pitt, M. M. (2000) "The Effect of Non-Agricultural Self-Employment Credit on Contractual Relations and Employment in Agriculture: The Case of Microcredit Programmes in Bangladesh", *Bangladesh Development Studies*, XXVI(2&3).

Rahman, A., Rahman, R. I., Hossain, M. and Hossain, S. M. (eds.) (2002)*Early Impact of Grameen: A Multi-Dimensional Analysis*. Grameen Trust: Dhaka.

Rahman, R. I. and Khandker, S. (1994). "Role of Targeted Credit Programmes in Promoting Employment and Productivity of the Poor in Bangladesh", *Bangladesh Development Studies*, XXII(2&3).

Staiger, D. and Stock, J. (1997). "Instrumental Variables Regression with Weak Instruments", *Econometrica*, 65:557-586.

Wooldridge, J. M. (2009). "Hurdle and 'Selection' Models". Powerpoint presentation. Available at: http://www.iza.org/teaching/wooldridge-course-09/course_html/docs/slides_twopart_5_r1.pdf

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*. Second edition. MIT Press: Cambridge, Mass.

Appendix Table A.1
Comparison between TNH and LH Models for a Sample of Employment Equations

Dependent variable (persondays per year)	Correlation coefficient between actual and fitted values		Unconditional expectation of the dependent variable	
	TNH	LH	TNH	LH
Total household employment (all workers)	0.646	0.632	302.7	310.0
Total employment of male workers	0.690	0.677	271.9	278.4
Total employment of female workers	0.485	0.478	31.6	32.5
Self-employment (all workers)	0.451	0.431	158.7	162.8
Wage employment (all workers)	0.567	0.562	114.2	114.6
Employment in agriculture (all workers)	0.526	0.509	133.9	139.1
Employment in non-agriculture (all workers)	0.530	0.527	171.2	173.0
Self-employment in agriculture (all workers)	0.527	0.487	71.1	72.9
Wage employment in agriculture (all workers)	0.510	0.505	62.9	63.3
Self-employment in non-agriculture (all workers)	0.390	0.382	86.9	87.8
Wage employment in non-agriculture (all workers)	0.435	0.421	52.7	54.0

Notes: (1) TNH model refers to the Truncated Normal Hurdle model and LH model refers to the Lognormal Hurdle model.

(2) Both models consist of two equations – one for the participation decision and for the amount decision. In both models, the participation equation is estimated by probit. The amount equation is estimated by Truncated Normal Regresstion (as implemented by the trunreg command in Stata) in the TNH model and by Ordinary Least Squares on the logarithms of the dependent variable in the LH model.

(2) 'Unconditional expectation' of the dependent variable refers to the expected value for the sample as a whole, not just the sub-sample that chose to 'participate' in a particular employment decision.

Appendix Table A.2
Test of Endogeneity of Microcredit for a Sample of Employment Equations

Dependent variable (persondays per year)	Participation Equation		Amount Equation	
	χ^2	p-value	F	p-value
Total household employment (all workers)	0.755	0.385	0.102	0.750
Total employment of male workers	1.479	0.224	0.710	0.401
Total employment of female workers	1.775	0.183	0.347	0.557
Self-employment (all workers)	0.572	0.450	3.894	0.050
Wage employment (all workers)	0.380	0.846	3.003	0.085
Employment in agriculture (all workers)	2.423	0.120	0.006	0.938
Employment in non-agriculture (all workers)	0.277	0.599	1.052	0.307
Self-employment in agriculture (all workers)	2.198	0.138	0.865	0.354
Wage employment in agriculture (all workers)	0.007	0.932	1.095	0.297
Self-employment in non-agriculture (all workers)	0.159	0.691	2.113	0.148
Wage employment in non-agriculture (all workers)	0.395	0.530	0.112	0.916

Notes: (1) The participation equation was estimated by bivariate probit, for which the relevant test of endogeneity is Wald's χ^2 test of the correlation coefficient of the errors terms of bivariate probit equations.

(2) The amount equation was estimated by 2SLS, for which the relevant test (for a clustered sample) is the F-test of Durbin-Wu-Hausmann Robust Regression.

(3) In case of both equations, the null hypothesis is no endogeneity. If p-value is greater than 0.05, the null hypothesis cannot be rejected at 5% significance level or less.

Table A.3
Estimates of Equations for Underemployment at the Household Level (persondays)

Explanatory variables	Participation equation		Amount equation	
	Coefficient	z-value	Coefficient	z-value
Access to microcredit (dummy)	-0.1166451	-2.76	-31.40633	-3.49
Number of male workers	0.6211032	21.27	94.46246	12.74
Number of female workers	0.1044612	3.56	61.4588	8.57
Real wage rate in the village	-0.4496432	-0.87	71.87663	0.91
Access to foreign remittance (dummy)	0.1765886	2.59	84.27576	7.10
Access to domestic remittance (dummy)	0.1742628	2.72	23.46733	2.01
Age of the household head (years)	0.0381782	4.37	3.865209	2.01
Age of the household head squared (years)	-0.0002724	-3.12	-0.0183096	-1.05
Gender of the household head (dummy)	-0.9706716	-8.77	63.5499	3.17
Schooling of the household head (years)	-0.0222475	-3.63	4.985777	4.39
Number of dependents	-0.1616431	-10.95	-37.06394	-8.38
Current land ownership (decimal)	0.0002801	0.98	0.0263677	0.99
Scope for non-farm work near village (score)	-0.1757651	-2.71	-19.27941	-1.50
Climatic vulnerability of the village (score)	0.0306224	0.45	-18.72397	-1.78
Accessibility of the village (score)	-0.0714992	-0.77	0.5871238	0.04
Whether the village is a *char* (dummy)	0.144501	1.18	0.6617705	0.05
Initial land assets (decimal)	0.0011149	3.56	---	---
Household head's father's occupation (code)	-0.0461845	-3.49	---	---
No. of observations	(6195)		(2773)	

Notes: (1) The participation equation was estimated with the probit method and the amount equation was estimated by the Truncated Normal Regression method (as implemented by the truncreg programme in Stata).

(2) The dummy variables for 'Access to microcredit', 'Access to foreign remittance', 'Access to domestic remittance' and 'Whether the village is a *char*' take the value 1 when 'yes' and 0 when 'no'.

(3) The dummy variable for 'Gender of the household head' takes the value 1 when the household head is either a widow or divorced or separated from husband and 0 when the head is either a male or a currently married female.

(4) For 'Scope for non-farm work near village', 'Climatic vulnerability of the village' and 'Accessibility of the village' higher score signifies greater scope, higher vulnerability and better accessibility respectively. For details of how these scores were constructed, see Osmani *et al*. (2015), chapters 1 and 8.

(5) Initial land assets refer to the land inherited by a household at the time it was first formed as a separate entity.

(6) Household head's father's occupation codes are as follows: 1 for farm self-employment, 2 for farm wage labour, 3 for non-farm self-employment, 4 for non-farm wage labour, 5 for non-farm salaried work, and 6 for others.

(7) Coefficients of district dummies as well as of the constant term are omitted.

Source: InM Poverty Dynamics Survey 2010.

Table A.4
Estimates of Equations for Employment of Underemployed Households (persondays)

Explanatory variables	Participation equation		Amount equation	
	Coefficient	z-value	Coefficient	z-value
Access to microcredit (dummy)	0.3116772	2.61	91.31035	7.20
Number of male workers	0.3966363	4.40	177.4398	22.32
Number of female workers	0.1601105	1.88	81.72558	9.60
Real wage rate in the village	-0.3606172	-0.48	53.96154	0.51
Access to foreign remittance (dummy)	-0.6294064	-4.13	-110.9022	-4.61
Access to domestic remittance (dummy)	-0.6467463	-4.63	-82.27336	-4.42
Age of the household head (years)	0.0215463	0.94	5.930356	2.00
Age of the household head squared (years)	-0.0003018	-1.32	-0.0700552	-2.29
Gender of the household head (dummy)	0.0092457	0.02	2.794376	0.06
Schooling of the household head (years)	-0.0617181	-3.91	-9.329182	-5.62
Number of dependents	-0.0660899	-1.50	-41.65258	-7.25
Current land ownership (decimal)	0.0008017	1.67	-0.1422753	-2.69
Scope for non-farm work near village (score)	0.125176	0.89	14.8144	0.87
Climatic vulnerability of the village (score)	-0.2358163	-1.48	18.50322	1.38
Accessibility of the village (score)	-0.4138533	-1.64	-11.56915	-0.67
Whether the village is a *char* (dummy)	-0.5791302	-2.71	-10.13274	-0.46
Initial land assets (decimal)	0.0007007	1.17	---	---
Household head's father's occupation (code)	-0.1333777	-3.64	---	---

Notes and Source: See Appendix Table A.3

Table A.5
Estimates of Equations for Employment of Not Underemployed Households (persondays)

Explanatory variables	Participation equation		Amount equation	
	Coefficient	z-value	Coefficient	z-value
Access to microcredit (dummy)	0.6268571	7.68	25.67889	3.91
Number of male workers	1.597305	14.56	152.1547	19.48
Number of female workers	0.5500532	8.50	65.26771	9.59
Real wage rate in the village	-0.3014504	-0.51	-41.87717	-0.57
Access to foreign remittance (dummy)	-1.596567	-12.57	-34.50976	-2.11
Access to domestic remittance (dummy)	-1.236092	-10.97	-55.63239	-5.44
Age of the household head (years)	0.0963728	4.30	9.463725	6.99
Age of the household head squared (years)	-0.0011947	-5.07	-0.1041688	-7.19
Gender of the household head (dummy)	-0.572161	-3.84	0.3251519	0.02
Schooling of the household head (years)	-0.0584949	-5.60	-2.092246	-2.39
Number of dependents	-0.4063841	-12.02	-31.52168	-9.22
Current land ownership (decimal)	0.0013054	2.40	0.0548372	1.24
Scope for non-farm work near village (score)	-0.007666	-0.08	27.70242	3.03
Climatic vulnerability of the village (score)	-0.0216105	-0.20	20.51448	2.71
Accessibility of the village (score)	-0.3445887	-2.57	-2.302349	-0.22
Whether the village is a *char* (dummy)	0.0409508	0.22	-10.60386	-0.86
Initial land assets (decimal)	-0.0014002	-2.23	---	---
Household head's father's occupation (code)	-0.0067118	-0.27	---	---
No. of observations	(3679)		(3191)	

Notes and Source: See Appendix Table A.3

Table A.6
Estimates of Equations for Self-employment at the Household Level (persondays)

Explanatory variables	Participation equation		Amount equation	
	Coefficient	z-value	Coefficient	z-value
Access to microcredit (dummy)	0.2927417	7.13	122.9054	6.35
Number of male workers	0.3542119	9.28	131.4849	8.59
Number of female workers	0.0385652	1.37	75.87271	5.14
Real wage rate in the village	-0.5700322	-1.36	-48.76171	-0.20
Access to foreign remittance (dummy)	-0.4533297	-7.36	-74.00796	-2.17
Access to domestic remittance (dummy)	-0.5101979	-9.03	-143.9004	-4.75
Age of the household head (years)	0.055556	6.59	1.419204	0.38
Age of the household head squared (years)	-0.0005506	-6.21	-0.0390417	-1.01
Gender of the household head (dummy)	-0.6350265	-7.33	-70.92155	-1.33
Schooling of the household head (years)	-0.01616	-2.75	-0.453935	-0.19
Number of dependents	-0.060895	-4.02	-15.08295	-1.79
Current land ownership (decimal)	0.0026816	6.20	0.1299648	1.98
Scope for non-farm work near village (score)	-0.0270846	-0.35	98.1415	2.97
Climatic vulnerability of the village (score)	0.0548071	0.73	46.71607	1.65
Accessibility of the village (score)	-0.2162392	-2.24	40.68819	1.08
Whether the village is a *char* (dummy)	-0.079753	-0.55	25.08198	0.44
Initial land assets (decimal)	-0.0003269	-0.93	---	---
Household head's father's occupation (code)	-0.0719956	-4.96	---	---
No. of observations	(6195)		(4361)	

Notes and Source: See Appendix Table A.3

Table A.7
Estimates of Equations for Wage Employment at the Household Level (persondays)

Explanatory variables	Participation equation		Amount equation	
	Coefficient	z-value	Coefficient	z-value
Access to microcredit (dummy)	0.0289403	0.64	1.133812	0.18
Number of male workers	0.3275073	11.96	85.47353	13.65
Number of female workers	0.0643679	2.13	44.94847	5.58
Real wage rate in the village	-0.1665437	-0.40	123.4525	1.38
Access to foreign remittance (dummy)	-0.704564	-9.25	-47.50083	-2.58
Access to domestic remittance (dummy)	-0.2835462	-4.05	-14.92359	-1.23
Age of the household head (years)	0.0147664	1.60	4.36438	2.58
Age of the household head squared (years)	-0.0002861	-2.97	-0.05274	-2.83
Gender of the household head (dummy)	-0.1820467	-1.99	52.86297	2.81
Schooling of the household head (years)	-0.1087059	-19.27	-2.126483	-1.83
Number of dependents	-0.091602	-6.25	-13.14941	-3.73
Current land ownership (decimal)	-0.006271	-11.00	-0.6834226	-9.04
Scope for non-farm work near village (score)	-0.1488285	-2.28	8.834149	0.69
Climatic vulnerability of the village (score)	-0.0112059	-0.16	-10.48952	-1.04
Accessibility of the village (score)	-0.155673	-1.78	5.69171	0.35
Whether the village is a *char* (dummy)	-0.0260383	-0.27	-15.67336	-0.63
Initial land assets (decimal)	-0.000316	-0.74	---	---
Household head's father's occupation (code)	-0.0194654	-1.35	---	---
No. of observations	(6195)		(2720)	

Notes and Source: See Appendix Table A.3

Table A.8
Estimates of Equations for Agricultural Employment at the Household Level (persondays)

Explanatory variables	Participation equation		Amount equation	
	Coefficient	z-value	Coefficient	z-value
Access to microcredit (dummy)	0.0203994	0.49	4.123006	0.35
Number of male workers	0.3226792	8.96	78.99992	8.82
Number of female workers	0.1020012	3.63	41.03754	4.13
Real wage rate in the village	0.1381087	0.23	272.1928	1.19
Access to foreign remittance (dummy)	0.2534167	0.55	-91.32235	-0.56
Access to domestic remittance (dummy)	-0.4482185	-6.27	-74.57889	-2.54
Age of the household head (years)	-0.3260157	-4.83	-52.06469	-2.39
Age of the household head squared (years)	0.070152	7.78	8.053426	2.95
Gender of the household head (dummy)	-0.0007051	-7.61	-0.0946618	-3.31
Schooling of the household head (years)	-0.8759216	-8.45	-99.11985	-2.73
Number of dependents	-0.0505455	-8.12	-22.62298	-8.52
Current land ownership (decimal)	-0.111962	-7.27	-13.52362	-2.32
Scope for non-farm work near village (score)	0.001654	3.78	-0.0747558	-1.49
Climatic vulnerability of the village (score)	-0.1840171	-2.45	-39.88292	-1.64
Accessibility of the village (score)	0.0162513	0.19	-6.898754	-0.35
Whether the village is a *char* (dummy)	-0.2978332	-2.99	-45.10587	-1.61
Initial land assets (decimal)	-0.0049941	-0.03	---	---
Household head's father's occupation (code)	0.0000573	0.14	---	---
No. of observations	(5810)		(3869)	

Notes and Source: See Appendix Table A.3

Table A.9
Estimates of Equations for Non-agricultural Employment at the Household Level (persondays)

Explanatory variables	Participation equation		Amount equation	
	Coefficient	z-value	Coefficient	z-value
Access to microcredit (dummy)	0.3861007	9.39	45.74568	4.61
Number of male workers	0.330698	11.48	106.9297	13.19
Number of female workers	0.1264946	4.03	57.48408	7.38
Real wage rate in the village	0.4215356	0.59	53.51308	0.47
Access to foreign remittance (dummy)	-0.9599521	-1.96	-52.45984	-0.58
Access to domestic remittance (dummy)	-0.7475397	-11.32	-60.09748	-3.03
Age of the household head (years)	-0.5823028	-9.06	-67.43491	-4.46
Age of the household head squared (years)	0.0015122	0.17	3.173068	1.85
Gender of the household head (dummy)	-0.0001043	-1.17	-0.0391591	-2.11
Schooling of the household head (years)	0.1792414	2.05	76.13002	3.59
Number of dependents	0.0304841	4.68	4.340282	3.59
Current land ownership (decimal)	-0.0613638	-3.64	-24.01901	-5.88
Scope for non-farm work near village (score)	-0.0004303	-1.88	-0.0450285	-0.95
Climatic vulnerability of the village (score)	0.2244448	2.82	43.83043	3.01
Accessibility of the village (score)	0.0974879	1.29	0.0210346	0.00
Whether the village is a *char* (dummy)	0.1437125	1.37	29.30624	1.49
Initial land assets (decimal)	-0.1018038	-0.72	---	---
Household head's father's occupation (code)	-0.0007906	-3.45	---	---
No. of observations	(5810)		(3184)	

Notes and Source: See Appendix Table A.3

Table A.10
Estimates of Equations for Non-agricultural Self-employment at the Household Level (persondays)

Explanatory variables	Participation equation		Amount equation	
	Coefficient	z-value	Coefficient	z-value
Access to microcredit (dummy)	0.4639964	11.36	29.55432	2.23
Number of male workers	0.1697896	6.67	82.73133	7.14
Number of female workers	0.0205046	0.63	39.03868	4.08
Real wage rate in the village	0.1029655	0.21	-101.0354	-0.89
Access to foreign remittance (dummy)	-1.1700940	-3.45	31.3099	0.33
Access to domestic remittance (dummy)	-0.3748733	-5.14	-19.90476	-0.77
Age of the household head (years)	-0.5300223	-7.84	-29.39649	-1.28
Age of the household head squared (years)	-0.0024000	-0.29	1.210518	0.51
Gender of the household head (dummy)	-0.0000165	-0.19	-0.0225395	-0.89
Schooling of the household head (years)	-0.2247951	-2.06	21.0274	0.58
Number of dependents	0.0086293	1.52	1.30706	0.85
Current land ownership (decimal)	-0.0036515	-0.21	-9.695206	-2.05
Scope for non-farm work near village (score)	0.0002821	1.68	-0.0040703	-0.07
Climatic vulnerability of the village (score)	0.0725801	1.01	58.54742	3.40
Accessibility of the village (score)	0.0741696	0.98	4.304908	0.23
Whether the village is a *char* (dummy)	0.1230985	1.25	21.0956	1.03
Initial land assets (decimal)	-0.0780476	-0.61	---	---
Household head's father's occupation (code)	-0.0007203	-3.22	---	---
No. of observations	(5810)		(1707)	

Notes and Source: See Appendix Table A.3

Table A.11
Estimates of Equations for Non-agricultural Wage Employment at the Household Level (persondays)

Explanatory variables	Participation equation		Amount equation	
	Coefficient	z-value	Coefficient	z-value
Access to microcredit (dummy)	0.0831477	1.71	5.099403	0.41
Number of male workers	0.2860232	11.13	81.37349	7.85
Number of female workers	0.0955966	2.91	37.43047	2.77
Real wage rate in the village	-0.2430102	-0.30	251.2627	1.36
Access to foreign remittance (dummy)	0.1357258	0.22	-11.06009	-0.09
Access to domestic remittance (dummy)	-0.4824099	-5.96	-69.33234	-2.22
Age of the household head (years)	-0.1409203	-2.04	-41.53401	-1.92
Age of the household head squared (years)	-0.0010573	-0.11	-0.7734561	-0.28
Gender of the household head (dummy)	-0.0001081	-1.06	0.0061812	0.21
Schooling of the household head (years)	0.3571419	3.72	94.41853	3.21
Number of dependents	-0.0520892	-7.42	2.39807	1.08
Current land ownership (decimal)	-0.0786396	-4.76	-5.452347	-0.98
Scope for non-farm work near village (score)	-0.0041843	-5.54	-0.4531719	-3.25
Climatic vulnerability of the village (score)	0.1455962	1.62	-15.21502	-0.73
Accessibility of the village (score)	0.1144882	1.26	-43.30024	-2.22
Whether the village is a *char* (dummy)	0.0793405	0.60	33.78742	1.14
Initial land assets (decimal)	-0.1320179	-0.68	---	---
Household head's father's occupation (code)	-0.0006397	-1.08	---	---
No. of observations	(5810)		(1258)	

Notes and Source: See Appendix Table A.3

Table A.12
Estimates of Equations for Male Employment at the Household Level (persondays)

Explanatory variables	Participation equation		Amount equation	
	Coefficient	**z-value**	**Coefficient**	**z-value**
Access to microcredit (dummy)	0.4649738	7.12	44.63494	6.88
Number of male workers	1.493792	12.97	124.4615	20.41
Number of female workers	0.1360905	2.87	36.19026	7.75
Real wage rate in the village	-0.463062	-0.95	76.54913	0.85
Access to foreign remittance (dummy)	-1.104024	-12.01	-83.77995	-5.18
Access to domestic remittance (dummy)	-0.8854588	-10.31	-77.83749	-7.57
Age of the household head (years)	0.0585905	5.11	2.886291	2.06
Age of the household head squared (years)	-0.0007524	-6.29	-0.0447963	-2.81
Gender of the household head (dummy)	-1.676128	-12.9	-24.84413	-1.04
Schooling of the household head (years)	-0.0426929	-5.59	-2.80005	-3.12
Number of dependents	-0.1433618	-5.74	-5.651674	-1.96
Current land ownership (decimal)	0.0004998	1.07	-0.1294829	-2.86
Scope for non-farm work near village (score)	0.1799659	2.37	31.53591	2.73
Climatic vulnerability of the village (score)	-0.081225	-0.99	14.30381	1.46
Accessibility of the village (score)	-0.2482632	-2.75	5.730923	0.43
Whether the village is a *char* (dummy)	-0.0923368	-0.76	-16.45515	-1.03
Initial land assets (decimal)	0.0000301	0.06	---	---
Household head's father's occupation (code)	-0.0501126	-2.15	---	---
No. of observations	(6160)		(5186)	

Notes and Source: See Appendix Table A.3

Table A.13
Estimates of Equations for Female Employment at the Household Level (persondays)

Explanatory variables	Participation equation		Amount equation	
	Coefficient	z-value	Coefficient	z-value
Access to microcredit (dummy)	0.2191898	4.32	-2.487361	-0.16
Number of male workers	-0.1309253	-3.10	-0.579452	-0.06
Number of female workers	0.5493514	11.68	47.798220	3.45
Real wage rate in the village	-0.7985734	-1.80	-21.165010	-0.16
Access to foreign remittance (dummy)	-0.2007614	-2.05	-95.292660	-3.25
Access to domestic remittance (dummy)	-0.2320027	-2.82	-12.386960	-0.53
Age of the household head (years)	0.046403	3.27	8.805901	2.50
Age of the household head squared (years)	-0.0005034	-3.28	-0.091974	-2.48
Gender of the household head (dummy)	0.815929	8.49	34.540540	1.69
Schooling of the household head (years)	-0.0031214	-0.45	1.116159	0.56
Number of dependents	-0.4519148	-13.81	-6.727281	-0.87
Current land ownership (decimal)	0.0003783	1.60	0.027529	0.56
Scope for non-farm work near village (score)	-0.0470643	-0.58	40.163390	2.62
Climatic vulnerability of the village (score)	0.0402363	0.54	-7.225932	-0.41
Accessibility of the village (score)	-0.0778688	-0.71	5.766800	0.25
Whether the village is a *char* (dummy)	-0.1266729	-0.96	35.299880	0.84
Initial land assets (decimal)	-0.0009933	-2.98	---	---
Household head's father's occupation (code)	0.0202013	1.29	---	---
No. of observations	(6160)		(834)	

Notes and Source: See Appendix Table A.3

Table A.14
Estimates of Equations for Male Underemployment at the Household Level (persondays)

Explanatory variables	Participation equation		Amount equation	
	Coefficient	z-value	Coefficient	z-value
Access to microcredit (dummy)	-0.1166451	-2.76	-39.86706	-3.97
Number of male workers	0.6211032	21.27	109.9174	13.42
Number of female workers	0.1044612	3.56	24.8833	3.36
Real wage rate in the village	-0.4496432	-0.87	94.20832	1.11
Access to foreign remittance (dummy)	0.1765886	2.59	94.34159	6.91
Access to domestic remittance (dummy)	0.1742628	2.72	34.00571	2.90
Age of the household head (years)	0.0381782	4.37	4.785913	2.00
Age of the household head squared (years)	-0.0002724	-3.12	-0.0209423	-0.97
Gender of the household head (dummy)	-0.9706716	-8.77	48.53471	1.56
Schooling of the household head (years)	-0.0222475	-3.63	6.515328	5.41
Number of dependents	-0.1616431	-10.95	-22.53484	-4.88
Current land ownership (decimal)	0.0002801	0.98	0.0545261	1.70
Scope for non-farm work near village (score)	-0.1757651	-2.71	-12.29412	-0.84
Climatic vulnerability of the village (score)	0.0306224	0.45	-19.12063	-1.63
Accessibility of the village (score)	-0.0714992	-0.77	10.14397	0.65
Whether the village is a *char* (dummy)	0.1445010	1.18	27.53581	1.46
Initial land assets (decimal)	0.0011149	3.56	---	---
Household head's father's occupation (code)	-0.0461845	-3.49	---	---
No. of observations	(6195)		(2397)	

Notes and Source: See Appendix Table A.3

Table A.15
Estimates of Equations for Female Underemployment at the Household Level (persondays)

Explanatory variables	Participation equation		Amount equation	
	Coefficient	z-value	Coefficient	z-value
Access to microcredit (dummy)	0.1505596	2.64	-13.48516	-1.63
Number of male workers	-0.0799098	-1.93	1.489518	0.31
Number of female workers	0.6433027	12.71	34.51257	5.91
Real wage rate in the village	-0.6468203	-1.71	-48.54169	-0.64
Access to foreign remittance (dummy)	0.0356992	0.35	26.01888	2.36
Access to domestic remittance (dummy)	-0.0098043	-0.14	8.806644	0.80
Age of the household head (years)	0.0385904	2.66	0.1385215	0.09
Age of the household head squared (years)	-0.0004410	-2.82	0.0043586	0.32
Gender of the household head (dummy)	0.2539522	2.53	-18.49521	-1.47
Schooling of the household head (years)	-0.0136930	-1.77	1.09239	0.98
Number of dependents	-0.4110826	-12.60	-6.048409	-1.83
Current land ownership (decimal)	-0.0002748	-0.65	-0.0306059	-1.37
Scope for non-farm work near village (score)	-0.1186626	-1.63	-2.899122	-0.27
Climatic vulnerability of the village (score)	0.0767349	1.18	-10.24971	-1.26
Accessibility of the village (score)	-0.0668349	-0.67	-22.93454	-1.80
Whether the village is a *char* (dummy)	-0.0956677	-0.90	-18.16606	-1.04
Initial land assets (decimal)	-0.0003100	-0.65	---	---
Household head's father's occupation (code)	0.0099801	0.52	---	---
No. of observations	(6160)		(553)	

Notes and Source: See Appendix Table A.3

Appendix Table A.16

First-Stage Regression of the 2SLS Regression on Wage Rate at the Village Level

Explanatory variables	Dependent variable: Spread of Microcredit	
	Coefficient	**z-value**
Length of MFI Involvement (years)	1.24190	3.92
Inequality of land distribution (Gini)	17.69037	0.56
Land owned by average household (decimal)	0.06505	1.00
Accessibility of the village (score)	4.98511	1.57
Remoteness of the village (km)	0.27474	0.57
Scope for non-farm work near village (score)	-1.11254	-0.50
Average schooling of household heads (years)	-0.27558	-0.24
Households with workers abroad (%)	-0.46591	-2.88
Households with workers in towns (%)	-0.08583	-0.71
Proportion of one-cropped land (%)	-0.04050	-1.01
Proportion of three-cropped land (%)	-0.01430	-0.31
Proportion of landless households (%)	0.02725	0.09
Whether the village is a *char* (dummy)	-7.19583	-2.38
Average price of paddy (Taka/kg)	-0.00050	-0.05
Barisal division (dummy)	5.19891	0.88
Chittagong division (dummy)	-0.01292	0.00
Dhaka division (dummy)	-2.76395	-0.51
Khulna division (dummy)	-2.55989	-0.37
Rajshahi division (dummy)	-0.61042	-0.11
No. of observations	(177)	

Notes and Source: See, Table 14 in the text.

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The Institute of Microfinance (InM) is an independent non-profit organisation established primarily to meet the research and training needs of national as well as of global microcredit programmes. Initiated and promoted by Palli Karma-Sahayak Foundation (PKSF) on 1 November 2006, the Institute is principally funded by UKaid, Department for International Development (DFID) through its Promoting Financial Services for Poverty Reduction (PROSPER) Programme. InM has an excellent team of professionals in research, training and knowledge management. InM draws research scholars from reputed universities here and abroad. The major services that InM provides are research on poverty, microfinance, enterprise development, impact assessment and evaluation of microfinance programmes. Beside research, InM provides microfinance related training, capacity building support and knowledge management services to microfinance institutions and other development organisations.

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