Microfinance and Poverty Reduction: Evidence from A Longitudinal Household Panel Database

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The effectiveness of microfinance in reducing poverty remains a subject matter of academic as well as policy interest. Assessment of microcredit interventions is often flawed by the shortcomings associated with the data and empirical methodologies employed that fail to tackle such issues as non-random participation and self selection of programme participants influenced by their unobserved characteristics. This paper makes an attempt to overcome these problems by making use of a unique longitudinal panel household database on Bangladesh. The empirical results seem to provide strong evidence of positive impact of microfinance as the cumulative household borrowing is found to be significantly and positively influencing household per capita income and asset-holding and inversely related to the probability of a household's falling below the poverty line. The results imply that if all the eligible non-participant households are brought under microfinance, the poverty headcount ratio for this group would fall by seven percentage points. There is also the evidence of smaller microfinance institutions being more effective in anti-poverty programmes.

I. INTRODUCTION

Poverty alleviation is the most important policy objective in Bangladesh, and almost all development initiatives either directly or indirectly attempt to contribute to this mammoth endeavour. The role of microcredit in this regard has been a

subject matter of continued interest. Policymakers, development partners and researchers often confront an apparently puzzling mismatch between "micro-success" and "macro-failure" in poverty alleviation experiences of Bangladesh. Various evaluations of individual microcredit programmes find them highly successful in stark contrast to a very modest impact of these interventions at an aggregate level. The question is thus: if microfinance has been so successful why is the rate of poverty reduction so low?

The debate concerning the effectiveness of microcredit has also been featured in the academic literature. Although the related empirical findings are mixed, the weight of evidence favours a positive association between poverty reduction and microcredit participation (BIDS 1990, Hossain 1998, Khandaker 2003, Pitt and Khandaker 1998, Zohir *et al.* 2001). Most of the studies assessing microfinance interventions have focused on cross-section data to analyse their effects on the socio-economic conditions of member households. However, such analyses could be seriously flawed because of various sources of bias. In a cross section of households where borrowers of microcredit are found to have lower poverty incidence, there are two possible interpretations: either poverty is effectively dealt with or the interventions scheme select relatively better-off households. The latter reasoning could also imply participants self-selecting into programmes, which may be influenced by their inherent and unobserved characteristics. Therefore, a household could graduate out of poverty because of characteristics such as ability, enterprising capacity, etc. rather than microcredit. Since these are unobservable, the improvement in economic well-being may wrongly be attributed to programme participation. Similarly, a programme might also be targeted to a village with characteristics favourable to better economic conditions thereby influencing the poverty outcome. Pitt and Khandker (1998) have convincingly showed that the endogeneity of both microfinance and programme participation is a very serious issue and failure to address the problem could lead to misleading evidence.

There have been only a few attempts to address the above mentioned endogeneity problems associated with non-random programme participation and self-selection. For example, while using cross-section data Pitt and Khandker employed a quasi-experimental survey design to resolve the problem, Khandaker (2003) exploited the advantage of panel data with observations for two years in dealing with the issue. Although these two studies provide important insights, it is important to examine the effect of microcredit by using a longer panel dataset. In this backdrop, the main contribution of this paper is to examine the relationship between poverty reduction and participation in microcredit programmes, using a unique dataset that has gathered information on a large sample of households over a fairly long period of time. This dataset has been generated by the Palli Karma

Sahayak Foundation (PKSF), which was set up by the Government of Bangladesh in 1990 to monitor the activities of microfinance institutions (MFIs) in the country. With a view to assessing programme impacts, PKSF has developed a longitudinal database comprising more than 3,000 households with so far four rounds of repeat surveys—one each undertaken in 1999, 2000, 2001 and 2004-05.

The PKSF panel database attracts a lot of interest in studying the effects of microfinance on poverty as it provides an opportunity of effectively addressing such problems as differences in initial conditions (both observable and unobservable) between the programme participants and non-participants and other heterogeneity biases. Poverty analysis with this database would also be of interest because of two other reasons. Firstly, according to most recent national estimates, absolute poverty in Bangladesh declined by about six percentage points between 2000 and 2004—from 49.8 per cent to 44 per cent.[1] The PKSF data will allow finding out if the rate of poverty reduction for the programme households is higher than that of the national rate. And, secondly, microcredit impact assessments in Bangladesh are overwhelmingly dominated by taking into consideration of programmes run by such large NGOs as the Grameen Bank, BRAC, Proshika and ASA. The performance of smaller MFIs has not been studied rigorously. Since a large number of PKSF panel households are members of relatively small MFIs, the analysis will also help understand the relative effectiveness of NGOs by their size and thereby help make a comprehensive assessment of microfinance programmes.

The structure of this paper is as follows: after this introductory section, Section II introduces the PKSF panel database, describing the sampling method and size, household classification, and other relevant issues; Section III provides poverty measures by different household groups in terms of their participation in MFIs; Section IV devises the panel data estimation framework and reports the regression results to capture the effect of microfinance on poverty measures; and finally, Section V concludes.

II. DATA

The PKSF panel has been generated under its Monitoring and Evaluation Study (MES) programme. When initiated in 1999, a three-stage sampling procedure was followed to select the villages for survey. First, 13 PKSF NGOs—known as partner

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[1] This a much improved performance compared to the rate of reduction achieved between 1995-96 and 2000, when absolute poverty reduced from 51 per cent to 49.8 per cent (i.e. at a rate of 0.3 percentage point per annum). Official statistics suggest much faster rates of reduction for the early 1990s when the proportion of population below the poverty line fell from about 58.8 per cent in 1991-92 to 51 per cent in 1995-96.

organisations (POs)—were selected purposively so that they contained organisations of different sizes and types. Second, areas of operation (thanas) were selected purposively when there were more than one thanas covered by the POs.[2] And, third, within the selected PO operation areas, all villages were grouped into four categories, viz. (i) villages with no Pos/NGOs (control villages), (ii) villages with PKSF POs only, (iii) villages with both PKSF POs and other NGOs, and (iv) villages with other NGOs, but not POs. The category as specified under (iv) was excluded since the basic objective of the MES was to evaluate the impact of PKSF POs. From the rest of three village categories a number of 91 villages were chosen for survey. In order to select the household units in the panel, a census was carried out in these villages that classified all households into four groups on the basis of their "eligibility" for microfinance targeting and actual programme participation. 'Eligibility' determines whether a household should be targeted as a potential programme participant in the first place. Following the practice of most NGOs in Bangladesh, households possessing only up to 50 decimals of land were considered as eligible for microcredit participants. The four groups of households were defined as: (i) households that were eligible and participating either in PKSF POs or NGOs (eligible participants), (ii) households that were eligible but were not included in any of the microcredit programme (eligible non-participants), (iii) households that were not eligible according to the land-holding criterion but were participating in PO/NGO programmes (non-eligible participants), and (iv) households that were not eligible and were not participating in any microcredit programmes (non-eligible non-participants). Sample households within each group were drawn randomly from the census to finally generate 3,026 households—2,735 from 80 programme villages and 291 from 11 control villages.

Sample households did not remain stable during the four survey rounds. A number of households moved out of the survey areas, resulting in "missing" units, while some households split-up. For convenience, split households were combined together, whenever possible, and treated them as a single unit in the analysis. After dropping the missing units and combining split units together, there were 2,729 households for which data existed for every round of surveys, which formed the basis of the empirical analyses presented below. Within this fixed set of households, the programme participation rate, i.e. the proportion of households participates in microcredit (i.e. both in PKSF POs and other NGOs), declined during the sample period: from 63 per cent in 1998 to 43.5 per cent in 2004-05.[3] In contrast, amongst

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[2] Thanas are local administrative units. There are more than 460 thanas in the country.
[3] Similarly, within the sample households the participation rate in the PKSF POs also fell from 44 per cent in 1998 to 31.5 per cent in 2004-05.

the control households programme participation had increased from less than 2 per cent in 1998 to about 10 per cent in 2004.[4]

TABLE I
COMPOSITION OF THE PKSF PANEL IN TERMS OF THE PARTICIPATION STATUS OF HOUSEHOLDS

Category	Programme village	Control village	All	Eligible	Non-eligible	All
Never participants	560 (22.5)	77 (31.6)	638 (23.4)	329 (20.8)	306 (26.9)	635 (23.4)
Regular participants	797 (32.1)	5.0 (2.0)	803 (29.4)	518 (32.7)	285 (24.8)	803 (29.3)
Occasional participants	1,128 (45.4)	162 (66.3)	1,291 (47.2)	737 (46.5)	554 (48.2)	1,291 (47.2)
All	2,485 (100.0)	244 (100.0)	2,729 (100.0)	1,584 (100.0)	1,148 (100.0)	2,729 (100.0)

Note: Figures in parentheses are percentages of the column total. Eligibility is based on households' possession of up to 50 decimals of cultivable land in 1998.

Since the initiation of survey in 1999, a large number of sample households have demonstrated significant variations in their programme participation behaviour. While there are households that have maintained their non-participation status (never participants) vis-à-vis those that have been in the programmes all along (regular participants) covering all four survey periods, between these two extreme cases, there are occasional participants including the households that have left the POs for good, rejoined the programme after their initial drop-outs, and become members for the first time at some later stage during the sample period. Table I shows that while 23 per cent of households have never participated in microcredit schemes, regular participants comprise 29.4 per cent of the sample. Thus, the group of occasional participants account for as high as 47.2 per cent of the sample. Table I also provides the distribution of households by their eligibility status, defined at the initiation of the panel in 1999, across the three different categories mentioned above. It is found that about a quarter of non-eligible households have been regular participants but 21 per cent of eligible households never considered joining NGO/PO microcredit programmes.

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[4] In fact, microfinance programmes are found to have encroached into areas that were selected as the control villages at the time of the first survey in 1998.

III. MEASURING POVERTY INCIDENCE

Most popular poverty measures consider the incidence, depth and severity of poverty. Using the Foster-Greer-Thorbeck (FGT) formulation, they can be specified as:

$$P_\alpha = \frac{1}{n} \sum_{i=1}^{q} \left[(z - y_i)/z \right]^\alpha$$

where, when $\alpha = 0$, the headcount ratio or the poverty incidence is obtained; the poverty gap ratio corresponds to $\alpha = 1$; and, following the most common practice, the severity of poverty gap corresponds to $\alpha = 2$. The headcount ratio simply measures the proportion of people below the poverty line, while the poverty gap estimates on average how far below the poverty line are the poor as a proportion of the line.[5] Since the poverty gap ratio ignores the variation in incomes amongst the poor, the squared poverty gap provides the statistical second moment of the distribution.[6]

The above measures first require setting-up of a poverty line. Following Ravallion and Sen (1996), BBS (2003), and World Bank and Asian Development Bank (2003), the cost-of-basic-needs (CBN) approach has been used here to construct such a poverty line. According to this method, a normative basic needs bundle of goods is specified and the poverty line corresponds to the cost of this basket of goods plus some additional allowances for non-food basic needs.[7] In Bangladesh, there is a broad consensus about the composition of the basic needs bundle. To allow for regional variation in prices, 13 PKSF sample PO area-specific food poverty lines—one each for four rounds of survey—have been constructed using the information on sample households' consumption of food items that are included in the normative basket and prices paid to procure them.[8] As done in

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[5] In other words, the poverty gap ratio expresses the amount of money which would be needed to raise the poor from their present incomes (y) to the poverty line (z), as proportion of the poverty line, and averaged over total population. For the non-poor, the distance between their incomes and the poverty line is considered zero.

[6] Squaring individual poverty gaps would imply that bigger gaps count for more than the smaller ones, and hence the measure captures the severity of poverty in population.

[7] The basket is chosen in such a way so that it is sufficient to reach a predetermined caloric requirement (i.e. on average 2,112 kcal per person per day) consistent with the consumption behaviour of the poor.

[8] The PKSF sample households come from 13 districts, namely, Barisal, Bogra, Chittagong, Feni, Kurigram, Madaripur, Meherpur, Munshiganj, Netrokona, Panchagarh, Satkhira, Sirajganj, and Tangail.

Ravallion and Sen (1996), the allowance for non-food basic consumption is fixed at 35 per cent of the food poverty line. Comparison of the constructed poverty lines vis-à-vis aggregate household incomes allows one determining poverty incidence, depth and severity of sample household units. A second set of poverty lines have also been constructed to identify the households in extreme poverty.[9]

The estimated poverty measures for various household groups are reported in Table II. On the whole, the proportion of households in the PKSF panel below the income poverty line has fallen from about 74.7 per cent in 1998 to about 63.9 per cent in 2004-05. That is, absolute poverty has declined by about 11 percentage points over the seven years of the panel period. Regular participants experience a rate of decline of 10.2 percentage points: from 78.5 to 68.3 per cent. They had the highest poverty incidence in the beginning of the sample in comparison with the lowest for the never participant group. The extent of fall in the headcount ratio for never participating households has been almost identical to that of regular participants.

For the proportion of households living in extreme poverty, a pattern almost similar to the above is discernible. The overall headcount ratio declined from about 63 to 51 per cent. Regular participants registered a decline of about 12 percentage points, which is 2 percentage points lower than that of the group of never participants. The trend in poverty gap ratio between these two groups also appears to be quite similar.

Two critical factors complicate the assessment of the impact of microfinance when comparison is made between regular and never participants. Regular participants may represent most vulnerable households requiring longer-term support compared to others that could leave MFIs relatively early. If the effect of microcredit on drop-out households on average is positive, consideration of regular participants only would undermine programme effectiveness. Furthermore, households belonging to the never participant group could comprise mostly the non-target households and, consequently, their initial characteristics could be different from those of target households. There is also the evidence of non-target households' enrolling into microfinance programmes (Rahman and Razzaque 2000), allowing the possibility of any reported poverty reduction effects being dominated by these households.

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[9] Following BBS (2003), the extreme poverty lines are based on the cost associated with a predetermined food basket that is to provide 1,805 kcal per person per day.

In light of the above, never and regular participants have further been sub-grouped into eligible and non-eligible categories. A close look at Table II would reveal that poverty reduction for both has been dominated by the performance of non-target (non-eligible) households. Between 1998 and 2004-05, the headcount ratio for non-eligible never participants had declined by about 17 percentage points in comparison with 13 percentage points for non-eligible regular participants. What is, however, most striking is the difference in poverty incidence rates of the eligible-regular participants and eligible never participants. The poverty incidence for eligible never participants fell from 75 per cent in 1998 to 70 per cent in 2004-05 as against of the decline from 81 to 72 per cent for target regular participants. That is, while for regular eligible participants the headcount ratio on average dropped by 1.3 percentage points per year, the comparable figure for eligible non-participants was only 0.7 percentage point. Similarly, the extreme poverty headcount ratio for regular eligible households declined from 68 to 57 per cent in contrast to a slower pace of reduction from 62 to 54 per cent for the non-eligible never participant households.[10]

Amongst the sample PKSF POs, two are large, two are medium and the rest nine are small.[11] Table III presents poverty measures by PO sizes. It is found that amongst the regular participants, poverty incidence for both medium and small POs has declined 12 percentage points each in contrast to some rise in the headcount ratio for the large ones. The number of regular large participants in the sample was found to be quite low and therefore one should be careful about drawing inferences from this alone. The poverty gap ratio for the regular participants in the small and medium size POs has also declined substantially. Nevertheless, poverty measures seem to suggest that the relatively small POs are effective in anti-poverty programmes.

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[10] There is, however, no noticeable difference in the reduction of the poverty gap ratios for the two groups.

[11] This classification is due to PKSF itself. The two large POs belonging to ASA and Proshika are naturally large, as these are amongst the biggest microcredit institutions in Bangladesh. Thangamara Mohila Sabuj Shangha (TMSS) and Society of Social Services (SSS) are categorised as medium POs, while all others are mainly locality based small organisations.

TABLE II
POVERTY MEASURES BY VARIOUS HOUSEHOLD GROUPS AND ELIGIBILITY STATUS

	Head count ratio (proportion of households living in moderate poverty)				Poverty gap ratio				Squared poverty gap ratio				Proportion of households below the extreme poverty line			
Participation Status	1998	1999	2000	2004	1998	1999	2000	2004	1998	1999	2000	2004	1998	1999	2000	2004
Never participants	0.699	0.669	0.632	0.591	0.339	0.318	0.281	0.241	0.206	0.196	0.168	0.130	0.589	0.556	0.519	0.454
- of which eligible	0.751	0.754	0.696	0.701	0.356	0.334	0.299	0.277	0.211	0.189	0.170	0.142	0.623	0.617	0.562	0.536
- of which non-eligible	0.644	0.579	0.563	0.475	0.322	0.301	0.263	0.203	0.200	0.204	0.165	0.118	0.553	0.492	0.472	0.367
Regular participants	0.785	0.743	0.702	0.683	0.338	0.314	0.271	0.257	0.181	0.173	0.137	0.126	0.660	0.585	0.560	0.537
- of which eligible	0.807	0.788	0.757	0.724	0.342	0.323	0.294	0.268	0.179	0.172	0.146	0.128	0.680	0.608	0.606	0.566
- of which non-eligible	0.744	0.663	0.604	0.609	0.331	0.298	0.231	0.237	0.185	0.175	0.121	0.122	0.625	0.544	0.477	0.486
Occasional Participants	0.746	0.742	0.698	0.635	0.347	0.348	0.294	0.267	0.203	0.218	0.161	0.148	0.630	0.611	0.554	0.515
- of which eligible	0.78	0.784	0.703	0.665	0.376	0.357	0.324	0.286	0.223	0.244	0.201	0.179	0.667	0.645	0.609	0.556
- of which non-eligible	0.72	0.735	0.657	0.579	0.350	0.320	0.279	0.223	0.198	0.171	0.175	0.125	0.583	0.565	0.512	0.496
All	0.747	0.727	0.685	0.639	0.343	0.332	0.285	0.258	0.198	0.217	0.156	0.137	0.629	0.592	0.548	0.508
- of which eligible	0.786	0.790	0.743	0.700	0.354	0.345	0.308	0.277	0.198	0.193	0.163	0.141	0.663	0.639	0.603	0.556
- of which non-eligible	0.690	0.637	0.604	0.557	0.327	0.314	0.253	0.233	0.198	0.250	0.146	0.132	0.581	0.526	0.471	0.441

Source: Author's estimates from PKSF Panel Survey.

TABLE III
**POVERTY MEASURES BY SIZE (LARGE, MEDIUM AND SMALL) AND TYPES
(CREDIT-ONLY AND CREDIT-PLUS) OF POS**

Participation status by PO size	Head count ratio				Poverty gap ratio				Squared poverty gap ratio				Proportion of households extreme poverty			
By Size	1998	1999	2000	2004	1998	1999	2000	2004	1998	1999	2000	2004	1998	1999	2000	2004
Regular participants in large POs	0.696	0.739	0.652	0.726	0.300	0.331	0.289	0.348	0.164	0.185	0.163	0.178	0.565	0.652	0.609	0.65
Regular participants in medium POs	0.765	0.676	0.647	0.647	0.340	0.275	0.218	0.231	0.187	0.133	0.091	0.095	0.618	0.618	0.471	0.588
Regular participants in small POs	0.787	0.756	0.638	0.661	0.300	0.312	0.239	0.225	0.143	0.165	0.114	0.103	0.654	0.598	0.520	0.512
Occasional participants in large POs	0.675	0.698	0.731	0.619	0.344	0.350	0.277	0.230	0.210	0.226	0.139	0.111	0.585	0.576	0.552	0.467
Occasional participants in medium POs	0.680	0.651	0.633	0.552	0.273	0.233	0.205	0.185	0.146	0.124	0.093	0.085	0.554	0.415	0.399	0.399
Occasional participants in small POs	0.730	0.720	0.669	0.707	0.325	0.304	0.261	0.300	0.175	0.172	0.135	0.165	0.646	0.554	0.518	0.574

IV. PANEL DATA ESTIMATION AND RESULTS

Panel Estimation Framework

The mean comparison of poverty incidence either 'before' and 'after' programme participation or between regular participants and never participants, using cross section data, are likely to be subject of serious problems, as highlighted in the introductory section. These problems can be tackled most effectively with the help of panel data. Khandker (2003) points out three compelling reasons for using panel survey over cross-section survey in assessing the impact of any intervention, as (1) cross-section analysis may not be a robust method for addressing endogeneity, (2) with panel data the fixed effects method of econometric estimation is more useful than considering the application of land-holding eligibility criterion by programmes to control for initial conditions of households, and (3) cross-section data provides short-term programme effects, while the long-term implications can be captured with panel data that generate data over several time periods. Because of all these advantages, the PKSF panel data promises providing an effective assessment of microfinance interventions.

To illustrate the effectiveness of the panel model in assessing the programme effect, let us first consider a cross-section model pooled over time periods:

$$Y_{it} = \alpha + \beta X_{it} + u_{it} \tag{1}$$

where, Y is (are) the variable(s) of interest to be explained (e.g., household income, poverty status, wealth, etc), X contains a number of explanatory variables, and u is the classical white noise term. The subscript i denotes the cross section dimension ($i = 1, 2, 3, ..., N$), while t captures time periods ($t = 1, 2, 3, ..., T$). This is the standard pooled case where intercepts and slope coefficients are homogenous across all N cross-sections and through all T periods. With the availability of panel data, (1) can be modified to take into account heterogeneity across individuals and to reduce the omitted variable bias. Conditional on the set of X_{it} variables, the effects of all omitted or excluded variables are driven by three types: (i) individual varying but time period invariant (e.g., inherent enterprising skills, industriousness, ability), (ii) time period varying but individual invariant (overall economic growth influencing households' conditions), (iii) both individual varying and time period varying. If Z_i is individual-varying but time-invariant and D_t is individual non-variant but time-varying factors, equation (1) can be written as:

$$Y_{it} = \alpha + \gamma Z_i + \beta X_{it} + \lambda D_t + u_{it} \tag{2}$$

It is impossible to estimate γ and λ directly, but defining the products $\gamma Z_i = \gamma_i$ and $\lambda D_t = \lambda_t$, equation (2) can be written as:

$$Y_{it} = \gamma_i + \lambda_t + \beta X_{it} + u_{it} \tag{3}$$

Therefore, the fixed effects of the omitted variables have been absorbed into the intercept term and in the specification actually replace it. The term γ_i can be interpreted as a set of intercept terms for each individual in the panel and the term λ_t can be interpreted as a set of time period intercept terms for each year of the panel.[12] The use of panel data has clearly tackled the omitted variable bias. What is however even more striking about the advantage of the panel data framework is the fact that, it is not required to have *a prior* knowledge with regard to possible sources of heterogeneity bias. The fixed effects will sweep out all individual effects that remain invariant over time, while the time effects will control for all time-varying but individual-invariant factors.[13]

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[12] This method is known as the fixed effects method. Under an alternative method, it can be assumed that the effects of numerous omitted individual and time varying effects are each individually unimportant but collectively comprise a significant random model variable. This interpretation uses the specification of what is known as the random effects model. This choice between the fixed effects and random effects involves a trade-off between consistency and reliability. The fixed effects formulation sacrifices degrees of freedom in order to attain consistency because an effect is estimated for each individual cross-section unit. On the other hand, while the random effects approach gives inconsistent parameter estimates if there is correlation between the country specific effects and the regressors, it is more efficient in the absence of correlation.

[13] Consider equation (2) above, but without the D_t variable: $Y_{it} = \alpha + \gamma Z_i + \beta X_{it} + u_{it}$. Since Z remains the same every time period, taking lag of this would result: $Y_{it-1} = \alpha + \gamma Z_i + \beta X_{it-1} + u_{it-1}$. Subtracting the latter from the former yields: $Y_{it} - Y_{it-1} = (\alpha - \alpha) + \beta(X_{it} - X_{it-1}) + \gamma(Z_i - Z_i) + u_{it} - u_{it-1}$. That is: $\Delta Y_{it} = \beta \Delta X_{it} + \Delta u_{it}$. In other words, taking the first difference has eliminated the unobservable ability effects. An alternative treatment procedure is the following:

with the basic model: $Y_{it} = \alpha + \gamma Z_i + \beta X_{it} + u_{it}$ (A)

If group means are computed and defined as:

$$\overline{Y}_i = \frac{1}{T} \sum_{i=1}^{T} Y_{it} \quad \overline{X}_i = \frac{1}{T} \sum_{i=1}^{T} X_{it} \quad \overline{Z}_i = \frac{1}{T} \sum_{i=1}^{T} Z_{it} \quad \overline{u}_i = \frac{1}{T} \sum_{i=1}^{T} Y_{it}$$

and the average relationship is defined as: $\overline{Y}_i = \alpha + \beta \overline{X}_i + \gamma Z_i + \overline{u}_i$ (B)

Subtracting (B) from (A): $\left(Y_{it} - \overline{Y}_i\right) = \beta(X_{it} - \overline{X}_i) + (u_{it} - \overline{u}_i)$

In the regression analysis a number of hypothesis are being tested. At the outset, it is of particular interest to know if household incomes are positively influenced by microfinance. The next objective is to examine the relationship between the progress towards poverty alleviation or 'graduation' and programme participation. Often a distinction is made between what are known the 'threshold view' and "process view" of graduation (Zohir *et al.* 2001). The threshold view is defined as the process when people graduate out of poverty, while the process view would imply graduation with long-term sustainability. In this paper, the threshold view is represented by a poor household's moving above the poverty line and in the regression analysis it will tested whether microfinance has any role to play in this process. On the other hand, for the process view of graduation the relationship between microcredit participation and asset accumulation by the households will be examined. Apart from these, poverty measures associated with income and poverty gap ratios are also modelled. Finally, the hypothesis that poverty reduction performance differs amongst different sizes of POs is also tested.

Depending on the nature of the dependent variables, relevant regression models are estimated. Along with time effects, the models are also estimated with individual household level fixed effects, unless otherwise mentioned. Therefore, the village level endogeneity problem is also resolved. The set of explanatory variables comprises a number of usual household characteristics such as sex, age, squared age, and marital status of the household head, highest education obtained by any of the male and female members in the households, and dependency ratio, which is defined as the ratio of the number of persons in the age bracket 0-14 and above 60 to the number of persons in the age group of 15-59, along with two different measures for participation in microfinance. In the first measure of microfinance participation, total (cumulative) household borrowing is used, while the second measure considers the length of programme participation (in years). The estimated models separate out the effects of microfinance by the gender of programme participants.

Panel Regression Results

Tables IV and V summarise the main results. As reported in Table IV, controlling for unobservable heterogeneity and observable factors, the panel regression results show that the effect of total household borrowing (from microfinance programmes) on per capita income is positive and statistically

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Therefore, transformation of the original equation by taking deviations from the group means eliminates omitted factors that vary over groups (cross-section units) but are fixed across time. The application of OLS to the transformed equation provides unbiased and consistent estimates.

significant at less than one per cent level. Since non-eligible households also participate in the microfinance, it is important to investigate whether the positive effect of microfinance is attributable to the participants in the non-eligible category alone. Therefore, in another regression the group of non-eligible households has been dropped. At this, the coefficient on total borrowing did not register any qualitative change in terms of sign, magnitude and statistical significance. It is a common practice to see the effect of gender differentiated participation and borrowing effects. When total borrowing was replaced by the length of programme participation, only the female participation is found to have a significant impact on per capita income of both the entire sample and for the eligible group.[14] These findings are consistent with the results reported in Khandker (2003), in which the household per capita expenditure is positively and significantly associated with female borrowings but not with credit received by males.[15] Regression results for the income gap model are qualitatively similar to those of the per capita income.[16]

Accumulation of assets is to be considered as an important measure of sustainability of the economic well-being of households. In comparison with income, it is relatively easy to estimate the value of the stock of assets. Since a number of households did not have any tangible assets (thus with zeros for asset value), the relevant model is estimated using the panel tobit estimation technique. The empirical estimation of the asset model turns out to be quite satisfactory, with all the explanatory variables bearing plausible signs and registering statistical significance at less than one per cent error probability level. As expected, the cumulative household borrowing has a significant effect on the accumulation of household assets.[17] In contrast to the per capita model, the length of programme participation by males is found to be positively and significantly influencing the asset build-up, while the statistical significance of female participation is also retained. Similar results also hold for the eligible group. It is worth noting that the effect of female participation on assets for the eligible groups is more than double the comparable effect obtained for the entire sample.

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[14] Although not reported, it has been found that while both male and female borrowings have positive impacts on household per capita income, only the latter is statistically significant.

[15] Note that along with the length of participation in the regression model, the square of length of participation is also added. It is expected that the coefficient on the squared variable will be negative.

[16] This is also logical since income gap is estimated as household per capita income less the moderate poverty line income.

[17] Additional experiments carried out revealed that, although both the male and female credit effects are statistically significant, the coefficient on female borrowing was bigger. The imposition of the restriction that the two effects were the same was rejected.

TABLE IV
PANEL REGRESSION RESULTS FOR PER CAPITA INCOME, INCOME GAP, AND ASSET

Independent variables	Dependent variable: per capita income (Panel Fixed Effects Model)				Dependent variable: Income gap (Panel Fixed Effects Model)				Dependent variable: Log(Asset) (Panel Tobit Model with Random Effects)			
	Entire panel		Eligible groups		Entire panel		Eligible groups		Entire panel		Eligible groups	
Sex of the household head (if female = 1)	415.54***	769.09***	309.27***	551.79***	394.33***	745.60***	284.80**	529.64***	1.4022***	1.4343***	1.3747***	1.3872***
	(110.28)	(169.83)	(113.11)	(145.29)	(110.15)	(169.70)	(113.00)	(145.16)	(.0657)	(.0668)	(.0789)	(.0796)
Age of the household head	11.09**	11.36***	11.88***	11.61***	9.84**	10.27**	10.01**	10.07**	.0111***	.0111***	.0061***	.0066***
	(4.366)	(4.38)	(4.27)	(4.31)	(4.36)	(4.37)	(4.26)	(4.31)	(.0015)	(.0015)	(.0020)	(.0020)
Square of the age of the household head	-.0192**	-.020**	-.018**	-.018**	-.0173*	-.0184*	-.0161*	-.0161*	.000011***	-.000011	-.000004	-.000004
	(.0094)	(.009)	(.008)	(.008)	(.0094)	(.0094)	(.0083)	(.0083)	(.000004)	(.000004)	(.000005)	(.000005)
Marital status of the household head	71.20*	74.40*	61.66*	59.01	57.84	62.46	50.55	49.71	2.6344***	2.6448***	2.5730***	2.5815***
	(39.88)	(40.06)	(36.22)	(36.36)	(39.84)	(40.01)	(36.18)	(36.33)	(.0315)	(.0315)	(.0428)	(.0428)
Highest education achieved by any male member of the household	-5.03	-4.45	-11.00	-11.61	-6.25	-5.56	-13.04*	-13.37*	.0507***	.0484***	.0405***	.0410***
	(8.10)	(8.11)	(7.49)	(7.51)	(8.09)	(8.10)	(7.48)	(7.50)	(.0037)	(.0038)	(.0051)	(.0051)
Highest education achieved by any female member of the household	1.34	.48	6.80	4.57	-.7788	-1.39	3.63	1.99	.0553***	.0583***	.0659***	.0676***
	(7.46)	(7.48)	(8.01)	(8.08)	(7.45)	(7.47)	(8.00)	(8.08)	(.0039)	(.0040)	(.0059)	(.0060)
Dependency ratio	-111.23	-117.95	-197.19	-182.36	-110.63	-116.29	-197.01	-183.95	-.3042***	-.2923***	-.3238***	-.3195***
	(159.29)	(159.23)	(140.15)	(140.22)	(159.10)	(159.04)	(140.01)	(140.10)	(.0767)	(.0777)	(.0983)	(.0990)
Male female ratio of the household	34.71	66.95	-225.20	-225.12	58.84	81.49	-205.59	-216.45		-.2207**	-.1236**	-.1477
	(245.20)	(242.53)	(213.40)	(212.51)	(244.92)	(242.24)	(213.19)	(212.32)		(.0989)	(.1207)	(.1217)
Total household borrowing	.0054***		.0051***		.0043***		.0042***		.000007***		.000009***	
	(.0015)		(.0012)		(.0015)		(.0012)		(.0000007)		(.0000009)	
Male programme participation years		15.16		3.64		7.46		-3.10		.0487***		.0618***
		(36.92)		(34.80)		(36.88)		(34.77)		(.0117)		(.0170)
Female programme participation years		18.04***		24.77***		12.89*		19.35***		.0112***		.0234***
		(6.77)		(6.31)		(6.76)		(6.31)		(.0029)		(.0038)
Square of male programme participation years		-.28		.02		-.16		.12		-.0013***		-.0015***
		(.97)		(.90)		(.97)		(.90)		(.0004)		(.0006)
Square of female programme participation years		-.07		-.10***		-.05		-.08**		-.00002		-.00009***
		(.05)		(.04)		(.05)		(.04)		(.00002)		(.00003)
Constant	163.20	108.69	234.41	197.17	-441.42*	-491.67**	-346.71*	-383.65*	6.0218***	6.1372***	6.1328***	6.1206***
	(229.78)	(229.43)	(205.32)	(204.97)	(229.52)	(229.15)	(205.11)	(204.79)	(.0748)	(.0905)	(.1142)	(.1153)
Sample size	11,601	11,601	6,767	6,767	11,601	11,601	6,767	6,767	10,446	10,446	5,986	5,986

Note: Income gap is measured as household per capita income less the moderate poverty line. Asset regression results have been estimated using the random effects model as the fixed effects estimates were computationally not feasible. Figures in the parentheses are standard errors. Statistical significance at one, five and 10 per cent levels are denoted by ***, **, and *.

TABLE V
PANEL REGRESSION RESULTS FOR POVERTY MEASURES

Independent variables	Dependent variable: If household is below the moderate poverty line (Conditional Fixed Effects Model)				Dependent variable: If household is below the Extreme poverty line (Conditional Fixed Effects Model)				Dependent variable: Poverty-gap ratio (Random Effects Panel Regression)			
	Entire panel		Eligible groups		Entire panel		Eligible groups		Entire panel		Eligible groups	
Sex of the household head (if female = 1)	-.37 (.14)	-1.08*** (.23)	-1.27*** (.30)	-.51** (.22)	-.174 (.144)	-.85*** (.22)	-.38* (.22)	-1.10*** (.29)	-.0644*** (.0125)	-.0661*** (.0126)	-.0517*** (.0138)	-.0531*** (.0139)
Age of the household head	-.0223*** (.0061)	-.0223*** (.0062)	.05 (.03)	.0467 (.036)	.029 (.023)	.039* (.022)	.061** (.033)	.07** (.03)	-.0006** (.0002)	-.00068** (.00029)	-.00008 (.00008)	-.000007 (.0003)
Square of the age of the household head	.000035*** (.000011)	.000036*** (.000012)	-.00081** (.00037)	-.00066* (.00036)	-.00051** (.00022)	-.0006*** (.0002)	-.00086** (.00035)	-.0010*** (.0003)	-.00000009 (.0000008)	-.0000000004 (.0000008)	-.0000014 (.0000009)	-.000001 (.0000009)
Marital status of the household head	-.132** (.059)	-.13** (.05)	-.16** (.08)	-.160* (.082)	-.085 (.054)	-.09* (.05)	-.040 (.073)	-.04 (.07)	-.0266*** (.0049)	-.0278*** (.0049)	-.0194*** (.0058)	-.0205*** (.0058)
Highest education achieved by any male member of the household	.0257** (.0123)	.02** (.01)	.02 (.01)	.026 (.019)	.023** (.011)	.02** (.01)	.035* (.020)	.03* (.02)	-.0027*** (.0007)	-.0026*** (.0007)	-.0012 (.0008)	-.0013 (.0009)
Highest education achieved by any female member of the household	-.0191* (.0110)	-.01 (.01)	-.04** (.02)	-.048** (.021)	-.024** (.010)	-.02** (.01)	-.041** (.020)	-.04* (.02)	-.0050*** (.0007)	-.0051*** (.0007)	-.0066*** (.0010)	-.0068*** (.0010)
Dependency ratio	1.9539*** (.2251)	1.98*** (.22)	2.48*** (.30)	2.45*** (.29)	2.306*** (.21)	2.32*** (.21)	3.01*** (.28)	3.01*** (.28)	.3186*** (.0145)	.3197*** (.0146)	.3707*** (.0169)	.3711*** (.0170)
Male female ratio of the household	.57 (.35)	.63* (.35)	.67 (.47)	.65 (.47)	.49 (.33)	.64** (.32)	.46 (.43)	.56 (.43)	.0906*** (.0187)	.0938*** (.0188)	.0856*** (.0214)	.0883*** (.0215)
Total household borrowing	-.000007*** (.000002)			-.000007*** (.000002)	-.000008*** (.000002)			-.000009*** (.000003)	-.000001*** (.0000001)			-.000001*** (.0000001)
Male programme participation years		-.05 (.04)	-.02 (.07)			-.05 (.05)	-.04 (.08)			-.0048** (.0023)		-.0045 (.0031)
Female programme participation years		-.018** (.009)	-.02* (.01)			-.013 (.009)	-.03** (.01)			-.0021*** (.0005)		-.0023*** (.0006)
Square of male programme participation years		-.00007 (.00140)	-.00099 (.00228)			.0003 (.0011)	-.0006 (.0031)			.00007 (.00009)		.00025 (.00011)
Square of female programme participation years		-.00033 (.00023)	.000047 (.000137)			-.0003 (.0002)	.00004 (.00014)			.00001** (.000005)		.000014*** (.000005)
Constant									.2266*** (.0170)	.2246*** (.0171)	.1735*** (.0199)	.1740*** (.0200)
Sample size	5,944	5,944	3,212	3,212	6,872	6,872	3,932	3,932	11,601	11,601	6,767	6,767

Note: Figures in the parentheses are standard errors. Statistical significance at one, five and 10 per cent levels are denoted by ***, **, and *.

In Table V, three poverty measures are being modelled. First, it is being examined whether microfinance helps reduce the probability of falling below the poverty line. In this case, since the dependent variable is dichotomous in nature, the conditional logit fixed effects model is estimated. The borrowing and length of participation variables in these regressions always bear negative signs, suggesting that even after controlling for heterogeneity biases participation in microfinance reduces the log-odds ratio of falling into poverty. The effect of total household borrowing turns out to be highly significant. However, only the length of programme participation of female is found to be significant.[18] Similarly, a rise in cumulative household borrowing reduces the probability of being extremely poor while the variable denoting the length of female participation is inversely related to the same probability in the sample for the eligible group. The last set of results in Table V also shows that the estimated poverty gap ratio is negatively influenced by credit received from microfinance programmes and also by the length of participation of male and female members.

Is Small Really Beautiful?

The relatively small POs were found to be doing better in terms of recording faster poverty reduction rate. Here, the relative performance of POs is examined by utilising the panel data framework.[19] For this, the panel household is regrouped to consider only those households that took some loans from NGOs. This essentially eliminates never participant households to make a direct comparison amongst the POs of different sizes feasible. The comparison is done by incorporating intercept and slope dummies for small- and medium-sized POs with the large ones being the base category. Table VI contains the relevant regression results. In the first regression, it is tested whether small POs are (significantly) different in how they influence the per capita income of their borrowers. Both the intercept (small) and slope (small × borrowing) dummies turn out to be statistically significant at the one per cent level. The slope dummy is positive, suggesting that compared to other POs, small POs have a steeper upward sloping borrowing effect. The negative intercept dummy can be interpreted as, other things being equal, small PO borrowers having

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[18] Our experiments showed that both for the entire sample and eligible group, the credit to women had significant negative effect on the probability of households' falling into poverty. The comparable effect of male credit was found to be mixed: for the entire sample it was significant at the 10 per cent level, while for the eligible group the estimated coefficient was not significantly different from zero.

[19] The panel framework has an important advantage in this regard, as it can now capture individual membership in each NGO/PO, thereby giving more observations.

lower per capita income. These two results are indicative of a greater impact of small POs on per capita income. Similar dummies for medium fail to register statistical significance, implying that there is no statistically significant difference between medium and large POs.

TABLE VI
EFFECTS OF MICROFINANCE BY PO SIZE (LARGE, MEDIUM AND SMALL)

Independent variables	Dependent variables					
	Per capita income		Headcount index		Log (Asset)	
Sex of the household head (if female =1)	536.16*** (146.29)	535.84*** (146.35)	-1.12*** (.32)	-1.13*** (.32)	1.31*** (.08)	1.314*** (.086)
Age of the household head	6.01 (3.73)	6.06 (3.74)	.06* (.03)	.070** (.034)	.0076*** (.0019)	.0077*** (.0019)
Square of the age of the household head	-.0090 (.0074)	-.0090 (.0074)	-.00071** (.00034)	-.00073** (.00034)	-.000006 (.000005)	-.000006 (.000005)
Marital status of the household head	41.71 (33.87)	41.86 (33.88)	-.178** (.079)	-.178** (.079)	2.670*** (.039)	2.669*** (.039)
Highest education achieved by any male member of the household	-4.08 (6.47)	-4.08 (6.48)	.016 (.013)	.016 (.013)	.0340*** (.0045)	.0341*** (.0045)
Highest education achieved by any female member of the household	-4.78 (6.43)	-4.79 (6.44)	-.012 (.013)	-.012 (.013)	.0428*** (.0046)	.0429*** (.0046)
Dependency ratio	-391.01*** (137.19)	-391.36*** (137.22)	2.29*** (.30)	2.27*** (.31)	-.319*** (.095)	-.316*** (.095)
Male female ratio of the household	-363.15* (214.33)	-362.83* (214.45)	.88* (.50)	.90* (.50)	-.22* (.12)	-.22* (.12)
Total household borrowing	.0036*** (.0011)	.0037*** (.0012)	-.000009*** (.000002)	-.000008*** (.000002)	.000009*** (.0000008)	.000009*** (.0000009)
small	-194.06*** (70.68)	-192.28*** (71.01)	-.094 (.160)	-.07 (.16)	-.082 (.057)	-.078 (.057)
medium		10.41 (138.92)		.38 (.34)		.08 (.10)
Small × Total household borrowing	.0087*** (.0021)	.0086*** (.0021)	(-.000002) (.000004)	-.000003 (.000004)	.000002 (.000001)	.0000030*** (.0000018)
Medium × Total household borrowing		-.0010 (.0033)		-.0000146* (.000008)		-.0000002 (.000002)
Constant	655.78*** (198.85)	652.45 (199.32)			6.29*** (.11)	6.28*** (.11)
Sample size	6,774	6,774	3,373	3,373	6,170	6,170

Note: Never participant households have been excluded from these regressions. Figures in the parentheses are standard errors. Statistical significance at one, five and 10 per cent levels are denoted by ***, **, and *.

In terms of households' graduating out of moderate poverty, the small effect is not significant. However, the asset equation shows small PO participants accumulating more assets out of their borrowings relative to their medium and large

counterparts taken together. In poverty and asset regressions as well, the dummy for medium POs are not significantly different from the base category. The results thus seem to suggest "small is beautiful" in terms of its effect on household per capita income and asset accumulation. The reason for not finding any significant differential impact on poverty might be that small POs' target households are poorer than those of large and medium microcredit organisations.[20] Although not much information available on the possible reason for small POs' superior performance, informal discussions with some of the field investigators associated with the fourth round of PKSF panel survey revealed that since small POs operated in a particular locality, their staff were also from the same community as their borrowers. This allowed small POs easy accessibility to the borrowers, contributing to better supervision. On the other hand, management staff of the larger POs often came from a completely different locality and often with different dialects. Own community staff of small POs may have been an important factor in motivating their borrowers.

Simulating the Impact of Microfinance

The results of the regression analysis therefore clearly show the favourable impact of microfinance. Using the obtained results, it is possible to simulate the impact of poverty reduction due to micro-credit programme.[21] To demonstrate this, the per capita income estimates are used here. With the estimated marginal impact of borrowing, the increase in household incomes due to microfinance is first calculated.[22] This amount when subtracted from household incomes provides a "counterfactual" reflecting the without borrowing situation. The simulation outcomes, as presented in Table VII, show that without the microfinance the headcount ratio (the proportion of households below the moderate poverty line income) for 2004 would have increased from 64 per cent to 71 per cent. On the other hand, if all households, including eligible non-participants and non-eligible non-participants, are given a credit equivalent to the average amount of the sample households, the poverty rate could have declined to 44 per cent.

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[20] This is also reflected in the negative value of the intercept dummy representing small POs in column 1 of Table VI.

[21] Khnadker (2003) provides a similar simulation exercise.

[22] This is done using different parameters for male and female borrowing and for different groups such as eligible and non-eligible. The increase in incomes is not calculated for non-participant households.

TABLE VII
SIMULATED IMPACT OF MICROFINANCE ON POVERTY

Participant groups	Survey rounds	Estimated poverty rates (actual situation)	Without microfinance situation (simulated situation)	Average credit given to all households in the sample
Non-eligible	1998	0.69	0.71	0.39
	1999	0.64	0.68	0.33
	2000	0.60	0.65	0.22
	2004	0.56	0.62	0.19
Eligible	1998	0.79	0.81	0.75
	1999	0.79	0.82	0.74
	2000	0.74	0.79	0.70
	2004	0.70	0.77	0.63
All	1998	0.75	0.77	0.60
	1999	0.73	0.76	0.57
	2000	0.68	0.73	0.50
	2004	0.64	0.71	0.44

Note: The poverty figures represent head-count ratios based on the moderate (absolute) poverty line.

V. CONCLUDING OBSERVATIONS

This paper has dealt with an important issue related to the effect of microfinance on poverty, using the PKSF panel household survey data. Setting-up region-specific poverty lines, conventional poverty measures have been presented for the overall panel households as well as for various different groups of households. The estimated poverty measures show that between 1998 and 2004, the headcount ratio for eligible (target) regular programme participants fell by 10 percentage points (from 78.5 to 68.3 per cent) as against of 5 percentage points for eligible households (from 75 to 70 per cent) that never participated in microfinance.

Since the simple analysis of the changes in mean poverty rates cannot isolate the exclusive effect of programme from other noise factors, a panel framework has been used to control for such potential sources of bias as the differences in initial conditions, village level characteristics, and other unobservable household characteristics that could influence the poverty outcome independent of microfinance scheme. The results of the panel regressions extend strong evidence of

positive impact of targeted microfinance by PKSF POs on poverty alleviation. The cumulative household borrowing is found to be significantly and positively influencing the per capita income and stock of assets, while the same is inversely related to income gap ratio, poverty gap ratio and the probability of a household's falling below the poverty line. The estimated effects of microcredit appear to be bigger for the group of eligible participants than those of the non-eligible households. The regression analyses revealed that female borrowing has a greater impact on household economic well-being in terms of rising per capita income, asset build-up and reduced poverty incidence. This is particularly true for the land-poor target (eligible) households.

Based on the estimated income effect of microfinance, a simulation exercise reveals that in the absence of microcredit, the rate of poverty incidence in the PKSF panel could have increased by seven percentage points. If all the eligible non-participant households were brought under the programmes, the head-count ratio for this group would have fallen from the current rate of 70 to 63 per cent.

The findings also provide the evidence that small MFIs have been successful in anti-poverty programmes. Regression analyses show significantly greater impacts of loans from small POs on their borrowers' incomes and assets compared to those of other large and medium sized MFIs. It also appears from the results that relatively small POs may have targeted poorer households. There is however no evidence of medium-sized POs doing better than their large counterparts.

Before concluding this paper, it may be worthwhile to point out that the estimated 10 percentage points decline in poverty incidence over a period of seven years for the PKSF panel households appear to be greater than the national figure of about eight percentage points between 1995-96 and 2004. It is found that the pace of poverty reduction has actually slowed down for the PKSF panel household during 2000-04 compared to the previous two periods of 1998-99 and 2000. When the records for PKSF panel and national poverty incidence are combined, it becomes obvious that the overall economic growth of Bangladesh in the late 1990s, which has been on average 5.5 per cent per annum, has failed to exert any robust effect on the poverty situation. Therefore, there is a need for undertaking a comprehensive assessment of growth-poverty reduction relationship in the country with a view to identifying policy measures that will help make economic growth process more inclusive in nature. Finally, given the evidence provided in this paper, poverty reduction efforts may be strengthened further by supporting the activities of smaller NGOs.

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