Essays on Microcredit Programs and Evaluation of Women's Success

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(Abstract)

Microcredit programs are of great interest to economists and policymakers because of their potential for reducing poverty, particularly among women. The first chapter mainly investigates the effectiveness aspect of microcredit programs. Using program evaluation methods, we find significant improvement in women's economic condition after participating in these programs. This study also corrects for the self-selection bias that might arise due to the fact that women decide on whether to participate in the programs or not.

The second chapter studies the determinants of women's economic performance in microcredit programs. These determinants are in the form of different types of characteristics of women: their own characteristics, such as age or schooling or the characteristics of the household or village they live in. One obstacle to measure the effect of observed characteristics is the problem of omitted variable bias, typically caused by unavailability of data on unobserved ability of individuals. In the absence of suitable instruments, this study finds information about unobserved ability from the marriage market. It is found that incorporating estimates of women's unobserved characteristics significantly changes the estimated effect of women's observed characteristics and substantially removes the omitted variable bias.

Microcredit programs originated from Bangladesh and now three major microcredit programs are operating: Grameen Bank, BRAC and RD-12. The third chapter investigates how these different microcredit programs have been performing relative to each other. Using similar program evaluation technique as in chapter 1, we measure program impact on women's economic welfare for these programs separately. We find that BRAC outperforms Grameen Bank and RD-12 significantly. This result is interesting since it contradicts the popular notion that Grameen Bank is the most successful microcredit program. This study also tries to find the determinants of economic success of women participating in these programs, separately for each program. These results provide more insights into different aspects of microcredit program.

Dedication

I would like to dedicate my work to my late mother who gave it all for us but did not get much in return, to my father who is willing to sacrifice anything for his children's academic success and to my wife who always provided her unconditional support to this cause.

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Chapter 1

Measuring Women's Success in Microcredit Programs: A Comprehensive Program evaluation

1. Introduction

Microcredit programs have attracted much attention from researchers since their inception. These are small-scale credit programs that provide production credit and other services to rural poor. In recent years, governmental and nongovernmental organizations in many low-income countries have introduced credit programs such as these, targeted to the poor. Many of these programs specifically target women on the basis of the view that they are more likely to be credit-constrained than men, have restricted access to the wage labor market, and have inequitable share of power in household decision making. It has been also found that providing credit to women rather than men has a greater impact on different household choice variables, such as, household expenditure, status of children's schooling and health etc [*Pitt and Khandker (1998), Pitt, Khandker, Mckernan, Latif (2001)*].

All of these microcredit programs work exclusively with the poor. Although sequence of delivery and the provision of inputs vary a little from program to program, all programs essentially offer production credit to the landless rural poor (defined as those who own less than half an acre of land) formed into a group, using peer monitoring as a substitute for physical collateral. Loans are given to individual group members, but the whole group becomes ineligible for further loans if any member defaults. The groups meet weekly to make repayments on their loans as well as mandatory contributions to savings and insurance funds. These microcredit programs also provide noncredit services in areas such as consciousness-raising, training for skill development, literacy, bank rules, investment strategies, health, schooling, civil responsibilities, and alteration of the attitude of and toward women.[1]

Among the existing literature on evaluation of microcredit programs, we find several studies analyzing the impact of these programs on different aspects of

[1] For more on micro credit programs in Bangladesh see Khandker (1998)

women's welfare, e.g. reduction in fertility [*Amin, Hill, Li (1995)*, increased empowerment of women in household [*Hashemi, Schuler, Riley (1996)*], having a greater impact on household welfare parameters [*Pitt and Khandker (1998)*] etc. But we did not find any systematic study analyzing the change in economic condition of women after participation in these programs. In this paper, using data from microcredit programs, we analyze how the welfare situation of these women has been affected by microcredit programs. Using program evaluation methods, we find significant improvement in women's economic condition after participating in these programs. For a comprehensive program evaluation, both across time and across group impact of these programs have been measured.

This study also corrects for the self-selection bias that might arise due to the fact that women decide on whether to participate in these programs or not. Previous studies, that attempted to estimate program impact, simply compared outcomes between participating and nonparticipating households. For example, a widely cited study similar in scope to this (Bangladesh Institute of Development Studies 1990), carried out in the 1980s, did not address self-selection into the credit programs studies. To the extent that program participation is self-selective, it is not clear whether measured program effect reflects, in part, unobserved attributes of individuals (such as ability, health and preferences) that affect both the probability they will participate in the programs (and the extent of the participation) and any welfare measure. We show that using conventional instrumental variable technique, this selection bias can be sufficiently removed. This method enables us to find a more accurate measure of program impact of these microcredit programs.

2. The Evolution of Microcredit Programs in Bangladesh

Providing credit is one way of enabling the poor to acquire assets and become productive. Targeted credit programs for the poor were first tried in 1976, when Muhammad Yunus, a Bangladeshi economics professor, introduced an experimental project to test whether the poor were creditworthy and whether credit could be provided without physical collateral. With the help of some Bangladeshi banks, Yunus conducted an innovative experiment emphasizing group delivery of credit and exploring what constituted a manageable group size for effective financial intermediation. The central bank of Bangladesh later facilitated Yunus' work by arranging for funding from the International Fund for Agricultural Development (IFAD). In Yunus' experiment, group collateral was substituted for physical collateral. The group guarantee to repay individual loans became the hallmark of microlending. Using the mechanism, poor people with no physical collateral were able to form groups to gain access to institutional credit. The mechanism also allowed credit to reach the poor, especially poor women.

The central premise of this targeted credit approach is that lack of access to credit is the greatest constraint on the economic advancement of the rural poor. Yunus believes that with appropriate support, the poor can be productively employed in income-generating activities, including processing and manufacturing, transport, storage and marketing of agricultural products, and poultry and livestock raising. After almost seven years of experimentation with a variety of group-based mechanisms, his idea took shape as a bank with its own charter. With the government holding about 90 percent of the shares in paid-up capital, Grameen Bank was established in 1983 to work exclusively with poor, defined as individuals owning less than half an acre of land.

Where Grameen Bank believes that the most immediate need of the poor is credit to create and expand self-employment opportunities, the Bangladesh Rural Advancement committee (BRAC) believes that the poor need skills development and other organizational inputs. BRAC was established in 1972 as a charitable organization to help resettle households displaced during the 1971 Independence War. BRAC soon realized that relief simply maintained the status quo; it was

inadequate to alleviate poverty. BRAC's relief experience helped it understand the causes of rural poverty and develop a framework for poverty alleviation.

BRAC's approach has been to combine lending with the delivery or organizational inputs, such as skills promotion and consciousness-raising (Lovell 1992). It has never viewed credit as a central instrument for poverty alleviation. Rather it believes that economic dependency on exploitative village economic structures is the ultimate cause of persistent poverty. As revealed in many anthropological studies, landholding and command of financial resources are still the major determinants of rural social class. While the wealthiest households dominate the rural society, the rural poor, lacking access to alternative resources and an awareness of their situation, maintain the dominance of each faction by associating themselves with a particular faction for protection and security. As a result, the poor remain poor and become the victims of exploitative forces.

Over time BRAC and Grameen Bank have learned from one another. BRAC has learned that credit must be provided along with skills development training; Grameen Bank has realized that credit alone is not enough, that the poor need social development and organizational inputs to become more disciplined and productive. BRAC continues to provide skills training and other inputs before disbursing credit, however, while Grameen Bank continues to disburse credit before providing social development and organizational inputs.

Following the examples of Grameen Bank and BRAC, the government of Bangladesh introduced a group-based targeted credit approach based on the Comilla model of two-tier cooperatives. The Comilla model rural development was designed and implemented by Akhter Hamid Khan in the 1960s at the Academy for Rural Development in Comilla, Bangladesh. The idea involves organizing farmers into cooperative societies in order to distribute modern inputs, such as high-yielding crop varieties, fertilizer, pesticides, irrigation, and subsidized credit. The organizational approach, which established primary farmers' cooperative societies that were federated into central cooperative societies at the thana (a thana is the administrative center for a number of villages) level, was found to be effective in reaching farmers.

Following Bangladesh's independence in 1971, the government adopted the Comilla model as the basis for the national development. This strategy led to the creation of two-tier cooperative system. The Comilla model was adopted throughout the nation as part of the Integrated Rural Development Program (IRDP). The Bangladesh Rural Development Board (BRDB), a semiautonomous government agency under the Ministry of Local Government, Rural Development and Cooperatives, was established in 1982 to replace the IRDP. Like the IRDP, it was based on two-tier cooperatives, but it employed credit as the main input and included a component that specifically targeted the rural poor. The BRDB experimented with a number of projects to increase income and employment opportunities for the rural poor by setting up a separate system of primary cooperatives. The eligible poor depend on manual labor as their main source of income. These cooperatives provided members with skills development, training in group leadership and management, and access to credit. Saving mobilization was also part of the program. With funds from Canadian International Development Agency, this program was strengthened in 1988 and renamed the Rural Development Project-12 (RD-12).

RD-12 was based on the model of a two-tier cooperative structure with solidarity groups of five to six members, following the credit delivery model of Grameen Bank. This small group-targeted approach was more successful than the large group approach of the BRDB in reaching the poor and recovering loans. Along with the small group delivery approach of Grameen Bank, RD-12 adopted BRAC's skill development approach for promoting productivity of the poor.

3. Literature Review

Microcredit literature is comparatively new but growing rapidly. Initial works mainly looked into the issues regarding the working mechanisms of these microcredit programs. *Stiglitz (1990), Varian (1990), Besley and Coate (1995)* looked into the mechanisms of group-based credit programs especially peer monitoring scheme, repayment incentive and social collateral issues.

Some papers investigated the issue of repayment in the microcredit programs. For example, *Sharma and Zeller (1997)* analyzes the repayment rates of 128 credit groups belonging to three group-based credit programs in Bangladesh: the Association for Social Advancement (ASA), the Bangladesh Rural Advancement Committee (BRAC), and the Rangpur Dinajpur Rural Service (RDRS). This paper concludes that if basic principles of prudential banking are adhered to, repayment rate can be good even in poor and remote communities. The important thing for financial institutions is to tailor services such that it becomes worthwhile for the poor to establish a profitable long-term association. In addition, more freedom to members in the process of group formation is recommended.

Evans, Adams, Mohammed and Norris (1999) examine a targeted microcredit program (BRAC) in Bangladesh to assess it's coverage among the poor, and to identify program and client-related barriers impeding participation. A population survey of over 24,000 households reveals that although three-quarters are eligible for microcredit, less than one-quarter participate. Rates of participation in microcredit are higher among poorer households. Based on a 7% random sample of this population, multivariate analysis identifies lack of female education, small household size and landlessness as risk factors for nonparticipation.

Hollis and Sweetman (1998) provide a historic perspective on the microcredit programs. They discuss six microcredit organizations of 19th century Europe, which are compared to identify what institutional designs were conducive to success and sustainability. Organizations that depended on charitable funding were more fragile and tended to lose their focus more quickly than those that obtained funds from depositors. An ability to adjust interest rates also appears important in sustainability. These authors argue that examining historical microcredit is particularly useful since

it offers an opportunity to explore the characteristics of organizations which were sustained over many decades, a perspective which is rare in modern microcredit banks and programs, most of which are less than 15 years old.

Morduch (1999) examines role of subsidies in Grameen Bank scheme. He argues that focusing on costs and subsidies provides a context with which to view the growing microfinance literature that asserts with limited evidence the ''win–win'' possibility of poverty alleviation with full cost recovery.

Among some recent works, *Amin, Ashok and Topa (2003)* evaluates whether microcredit programs such as the popular Grameen Bank reach the relatively poor and vulnerable in two Bangladeshi villages. It uses a unique panel dataset with monthly consumption and income data for 229 household before they received loans. They find that while microcredit is successful at reaching the poor, it is less successful at reaching the vulnerable. Their results also suggest that microcredit is unsuccessful at reaching the group most prone to destitution, the vulnerable poor. In a related paper, *Sharma and Zeller (1999)* studies factors affecting program placement. Using thana-level data to analyze the geographic placement of three credit programs in Bangladesh, this paper provides evidence that branches tend to be located in poor pockets of relatively well developed areas than in remoter, less developed regions. Client density of established branches does not exhibit such a feature and actually tends to be better in less advantageous locations.

Apart from giving credit, microcredit programs also perform several social capital development activities. *Mckernan (2002)* uses primary data on household participants and nonparticipants in Grameen Bank and two similar microcredit programs to measure the total and noncredit effects of microcredit program participation on productivity. The total effect is measured by estimating a profit equation and the noncredit effect by estimating the profit equation conditional on productive capital. Productive capital and program participation are treated as endogenous variables in the analysis. She finds large positive effects of participation and the noncredit aspects of participation on self-employment profits.

4. Program Evaluation Techniques

Economists and econometricians have been studying statistical methods for program evaluation with non-experimental data for at least 20 years. The major historical impetus for interest among economists was provided by the need to evaluate many of the social programs of the 1960s, particularly those designed to aid the low-income population with educational programs, training programs, and transfer benefits. Early studies by Goldberger (1972) were followed by many others, including those of Ashenfelter (1978) and the studies by Barnow (1987). A major shift in the econometric literature occurred with the introduction of "selectivity bias" methods (Gronau 1974 and Heckman 1974). Among the recent papers, Piehl et el (2003) provide important insights into the recent development of program evaluation measures .

4.1 Identifying Program Impacts with Nonexperimental Data

4.1.1 The Problem

Suppose that we wish to evaluate the effect of a particular intervention (i.e. a treatment) on individual levels of some outcome variable. Let Y be the outcome variable and has the following definitions:

Y_{it}^{*} = level of outcome variable for individual i at time t if he or she has not received the treatment

Y_{it}^{**} = level of outcome variable for the same individual i at time t if he or she has received the treatment at some prior date.

$$Y_{it}^{**} = Y_{it}^{*} + \alpha \tag{1}$$

or

$$\alpha = Y_{it}^{**} - Y_{it}^{*} . \tag{2}$$

The aim of the evaluation is to obtain an estimate of the value of α, the treatment effect. The easiest way to think about what we seek in an estimate of α is to consider individuals who have gone through a program and therefore have received the

treatment, and for whom we later measure their value of Y_{it}^{**}. Ideally, we wish to know the level of Y_{it}^{*} for such individuals – that is, we would like to know what their level of Y would have been had they not gone through the program. If Y_{it}^{*} could be known, the difference between it and Y_{it}^{**} would be a satisfactory estimate of α.

The problem that arises with the above methodology is we do not observe Y_{it}^{*} directly, but only the values of Y_{it}^{*} for nonparticipation of the program. Define a dummy variable for whether an individual has or has not received the treatment:

$d_i = 1$ if individual i has received the treatment
$= 0$ if individual i has not received the treatment.

Then an estimate of α could be obtained by estimating the difference between Y_{it}^{**} and Y_{it}^{*} for those who did and did not go through the program, respectively:

$$\tilde{\alpha} = E(Y_{it}^{**} \mid d_i = 1) - E(Y_{it}^{*} \mid d_i = 0) \qquad (3)$$

where $E(Y_{it}^{**} \mid d_i = 1)$ is the expected, or average, value of Y_{it} of those who have received the treatment and $E(Y_{it}^{*} \mid d_i = 0)$ is the expected, or average, value of Y_{it} for those who have not received the treatment. Unfortunately, this is not what we wish to calculate, for we wish to calculate the difference between the expected value of Y_{it}^{**} for those with $d_i = 1$ and the expected value of Y_{it}^{*} that would have obtained for those with $d_i = 1$ as well – that is, the value of Y that would have been arisen if those who did go through the program had not gone through it. That is we would like to know

$$\hat{\alpha} = E(Y_{it}^{**} \mid d_i = 1) - E(Y_{it}^{*} \mid d_i = 1). \qquad (4)$$

The estimate $\hat{\alpha}$ in (4) is, in fact, the estimate that would be obtained if we had successfully administered a randomized controlled trial for evaluation. For

example, as individuals come in through the door of the program, they would be randomly assigned to treatment status or control status, where the latter would receive none of the services of the program. At some later date we could measure the levels of *Y* for the two groups and calculate (4) to obtain an estimate of the effect of the program.

When will the estimate we are able to calculate, $\tilde{\alpha}$, equal the estimate we would have obtained with a randomized trial, $\hat{\alpha}$? Comparison of (3) and (4) shows that the two will be equal if and only if the following condition is true:

$$E(Y_{it}^{*} \mid d_i = 1) = E(Y_{it}^{*} \mid d_i = 0) \qquad (5)$$

In words, the two estimates of α are equal only if expected value of Y_{it}^{*} for those who did not take the treatment equals the expected value of Y_{it}^{*} that those who did take the treatment would have had, had they not gone through the program.

The heart of the non-experimental evaluation problem is reflected in equation (5), and an understanding of that equation is necessary to understand the selection bias problem when non-experimental data are employed. The equation will fail to hold under many plausible circumstances. For example, if those who decided to join the microcredit programs happened to be concerned with their economic situation and have begun taking different measures to improve their economic condition even before entering the program, they will be quite different from those who did not go through the program. Hence equation (5) will fail to hold because those who go through the program have different levels of Y_{it}^{*}, that is, different levels of economic welfare situation even in the absence of receiving any program services. The estimate of $\tilde{\alpha}$ would be too high relative to $\hat{\alpha}$, for the greater level of economic welfare observed for the treatment group subsequent to receiving services was present even prior to the treatment and is therefore not necessarily a result of the treatment itself. Those who have actually gone through the program are therefore a "self-selected" group out of the pretreatment population, and estimate of is contaminated by selectivity bias because of such self-selection.

The selection bias problem can also be thought as an omitted variable or missing-data problem, in this case the omitted variable being Y_{it}^{*}. In the example just given, it may be that prior practices to improve economic welfare can be an adequate proxy for Y_{it}^{*}, and hence inclusion of that variable will eliminate the bias, but this will not always be the case.

The unavoidability of the potential for selectivity bias arises because the validity of equation (5) cannot be tested as the left-hand side of the equation is inherently unobservable. It is impossible to know what the level of Y_{it}^{*} for those who went through the program would have been had they not gone through it, for that of Y_{it}^{*} is a "counterfactual" that can never be observed. We may know the pretreatment level of Y_{it} for those who later undergo treatment, but this will often not be the same as the Y_{it}^{*} we seek – for the left-hand side of (5), we need to know the level of Y_{it}^{*} for program participants that they would have had at exactly the same time as Y_{it}^{**} is measured, not at some previous time.

4.1.2 Solution

Natural experiment has been widely used to tackle the problem of program evaluation described above. There has been an outburst of work in economics that adopts the language and conceptual framework of randomized experiments. These studies examine outcome measures for observations in treatment groups and comparison groups that are not randomly assigned.

Good natural experiments are studies in which there is a transparent exogenous source of variation in the explanatory variables that determine the treatment assignment. A natural experiment induced by policy changes, government randomization, or other events may allow a researcher to obtain exogenous variation in the main explanatory variables. This occurrence is especially useful in situations in which estimates are ordinarily biased because of endogenous variation due to omitted variables or selection. Such approaches are used to analyze a wide range of issues. The natural-experiment approach emphasizes the general issue of

understanding the sources of variation used to estimate the key parameters. If one cannot experimentally control the variation one is using, one should understand its source. This ideal is evident in past research, but natural experiments certainly give it more emphasis.

An example of the application of natural experiment is provided by studies of the effects of military service on earnings. Work that compares civilian earning by veteran status may be biased if a nonrandom group of individuals serves in the military. In particular, those who enlist may face worse labor-market opportunities than those who do not enlist. Alternatively, military induction may screen out those individuals in worse health. Recent work has overcome this problem by using the variation in veteran's status caused by the Vietnam-era draft lottery or the World War II draft mechanism, which depend on date of birth (Angrist 1990).

How does natural experiment help to solve the problem mentioned above? As already mentioned, we can measure the true program effect by equation (4) only when we can have controlled random experiment. The task of natural experiment is to find exogenous variation so that the entire set-up gets closer to the controlled random experiment.

4.1.3 The Research Designs in Natural Experiments

Three of the main goals of a research design in natural experiment should be (1) finding variation in the key explanatory variables that is exogenous, (2) finding comparison groups that are comparable, and (3) probing the implications of the hypotheses under test. Without the ability to experimentally vary the relevant variables, researchers should seek to find variation that is driven by factors that are clearly identified and understood. One can then make an informed decision about the exogeneity of that variation and rule out other explanations. Being able to rule out obvious sources of endogeneity is not enough, however. The possibility of omitted variables, trends in outcomes, omitted interactions and so forth place a burden on the researcher to examine the compatibility of groups that are being compared. Often other information from additional comparison groups or time can be used to examine comparability. It is also often possible to further probe

hypotheses by refining them and subjecting them to additional test. These ideas need to be kept in mind when analyzing the design of any study. There are a few study designs that have been commonly used in natural experiments. Many other works use slight variants on these designs. We will describe those program designs in greater detail in section 7.

5. Evaluating women's performance: Suitable measures

The main objective of this study is to investigate whether those women who participated in microcredit programs achieved success. Success is measured by increase in welfare. In our analysis, we mainly use the following three measures as indicators of women's economic welfare: non-agricultural assets, food expenditures and non-food expenditures.

For measuring welfare, ideally we would like a survey-based measure that represents the individual welfare measures of economic theory. Particularly useful here is the concept of money metric utility where the indifference curves of individual preference orderings are labeled by the amount of money needed to reach them at some fixed set of prices. In order to avoid the specification of a parametric utility function, money metric utility can be approximated by real income or real expenditure: the two leading candidates for practical welfare measures. However, there are other possibilities, indicators of nutritional status being perhaps the most important, and even if we settle on income or expenditures, there are many other questions that have to be settled before going on to compute the measures.

Whether the welfare measure is income or consumption, it becomes difficult to measure it for a single member in a household. Typically, microcredit programs allow one individual from each household to join and in most cases it is the female members. It is difficult to find evidence of economic success of participants by looking at just household income or expenditure that involves other members. Among the three measures[2] that we proposed above, only non-agricultural assets is individual specific. Both food and non-food expenditures are household specific measures. How can these two measures indicate women's welfare separately from household?

A possible way to identify individual welfare impact might be to look into some specific expenditures and asset accumulation within household. There is an increasingly convincing set of studies in economics and sociology literature, which suggests that the marginal effect of income in the hands of women is different from income in the hands of men. This result implies incomplete income pooling within

[2] For details on these welfare measures please see section 6.

the household and is a refutation of a model of intrahousehold resource allocation that would have us believe that household members maximize a single welfare function, the so-called 'unitary' model of the household (Alderman et al., 1995).

The idea that men and women spend income from own-earnings in different ways is not new. Kumar (1979) document this phenomenon over a wide range of settings and times. Why do men and women tend to spend income differently? Societal and cultural norms may assign women the role of 'gate keepers' in which they ensure that household members' especially children, receive an adequate share of available food. Alternatively, women may prefer to spend more on children's daily need because they spend more time with them. Women may also face different constraints than men. To minimize the competing demands on their time, for example, women may spend more on food because they purchase more expensive calories that take less time to prepare. Finally, women and men may have different income flows and thus different transaction costs. In other words, since women's income tends to come more frequently and in smaller amounts, it may be more readily spent on household daily subsistence needs than lumpier seasonal income, which tends to come to men and is likely to be spent on more expensive items.

Shultz (1990) found that in Thailand, an increase in a woman's unearned income from outside the household will have a larger negative effect on the probability that she joins the labor force than does an equal increase in her husband's unearned outside income. According to Browning et al. (1992), in Canada the shares of the family budget devoted to men's clothing and to women's are positively related to the shares of family income earned respectively by men and women. Using data from a household survey from the Cote d'Ivoire, Hoddinott and Haddad (1995) report that increases in the proportion of cash income accruing to women significantly raise the budget share of food and lower those of alcohol and cigarettes. Thomas (1990) found evidence that in Brazilian families, income of the mother has a much stronger positive effect on fertility and on measures of child health such as calorie intake, weight, height, and survival probability than income of the father.

From the description of existing literature above, following findings are evident: (a) women spend differently than man with an increase in income (b)

women's increase in income manifests mainly on food expenditures and non-food expenditures involving child care and daily needs. If women participate in a microcredit program and achieve sustained increase in their income, then increased spending on the above-mentioned items might reflect that increase in income.

Therefore, these expenditures and assets might be reasonable indicators of women's performance in the microcredit programs. In the following analysis, variables representing these expenditures and assets will be used to measure the performance of participating women. The latter sections would discuss in detail the nature of these performance variables.

6. Survey Design and Data Description

A multi-purpose quasi-experimental household survey was conducted in 87 villages of 29 thanas in rural Bangladesh during the year 1991-92. The survey's major focus was to analyze the credit and other input effects of three major credit programs and was designed to include both target (qualified to participate) and non-target households from both program and non-program (i.e. control) areas.

Out of 29 thanas selected for the study, 24 have at least one of the three credit programs in operation, while 5 thanas have none. That is, the proportion of thanas surveyed under each program coverage is 28 percent, while 16 percent of the 29 thanas do not have any program. The program thanas are distributed among four regions in the following way: 8 thanas in Khulna region, 3 thanas in Chittagong region, 10 thanas in Dhaka region, and 8 thanas in Rajshahi region.[3]

Three villages in each program thana were then randomly selected from a list, supplied by the program's local office, of villages in which the program had been in operation for at least three years. Three villages in each non-program thana were randomly drawn from the village census of the Government of Bangladesh (GOB). For both program and non-program thanas, if a village contained less than 50 and more than 600 households, then it was removed from the list and replaced by another randomly selected village in this size class. Furthermore, if the selected village had between 301 and 600 households, the household census would begun from one randomly selected corner of the village and stopped when some 200 households were covered.

A census was conducted in each village selected for the study. The purpose of the village census was to help identify target (i.e., those qualified to join a program) and non-target households, as well as to identify program participating and non-participating households among the target households in any village. From the

[3] Note that more than one-third of the Chittagong region was devastated by the 1991 cyclone and dropped from sampling. This why few thanas are drawn from the Chittagong region. It is also worth noting that there are several thanas where the three credit programs under study overlap. However, although programs may overlap in a thana, they do not overlap the same individual. Because of program design, the program officials ensure that no individual is a member of two or more programs simultaneously. Technically, therefore, a particular than could not have been drawn twice for two different programs. This did not happen in the actual sample selection, but some of the 24 programs thanas do have more than one credit program in operation.

village census list of households, 20 were drawn from each program and non-program village from both target and non-target households for the in-depth household survey. The distribution of these 20 households by target and non-target groups was 17:3 in each program village and 16:4 in each non-program village. A random sampling technique was used to draw the required sample of 17 target group households from the non-program villages as well as the sample of 3 non-target households from both program and non-program villages.

However a simple random sampling technique could not be applied to draw target households from the program villages; although a good percentage of the target households in program villages did participate in the program, we did not know whether this percentage was above 50 percent. This was significant because the survey design required a sufficient number of program participants among the target households to enable us to analyze the credit or program participation impact on various household or individual outcomes. Instead, a stratified random sampling technique was used to draw households in the ratio of 12:5 (i.e. 12 program participants and 5 non-participants) from the list of target households in the program villages. A total of 1,798 households was drawn for the in-depth household survey, where 1,538 were target households and 260 non-target households. Among the target households, 905 were found to be participating in any of the three credit programs, representing 59 percent of the target households sampled for the study. The actual distribution of program participating and non-participating households in the study villages, according to village census, is 44:66. Therefore, the households were disproportionately drawn for the study and thus the sample ratio needed to be adjusted to make it representative of the actual distribution. Table 1 presents the distribution of these microcredit programs across villages.

This general survey was conducted three times over the crop cycle year 1991-92 to match the three crop season, and information on village-level prices and wages was collected in the same manner. The time interval between the first round and second round is four months and between second round and third round, it is 5 months. Therefore, total time difference between round 1 to round 3 is 9 months.

Below, we provide a brief description of the performance indicator variables that we have discussed in the previous section.

1. Non- agricultural assets

This variable measures the current value of non-agricultural assets (equipment and goods) that the program participants were able to accumulate after joining microcredit programs. This measure is available for each adult member of a household. During the time of survey, each member is asked how much assets she had before joining these programs and how much assets she accumulated after joining. Following are the types of assets included in this category: gold or silver jewelry, household/kitchen utensils, furniture, processing equipment, tools like spade, hammer etc.

2. Food expenditures

This measures the value of normal daily food consumption in a household in the last one year.

3. Total non-food expenditures

This measures the value of expenditures incurred by households on non-food items in the last four months from the time of survey. In the data, expenditures on different categories are mentioned. For this paper's purpose, only those expenditures that are supposed to be more influenced by increased income of women (as suggested in the previous section), have been included. These expenditures mainly include expenditures on childcare, home improvement, medicine, fuel, book/stationary.

Table 1. Distribution of villages by credit program and group type

	BRAC	BRDB	GB	None	Total
Female only	7	3	12	0	22
Male only	0	9	1	0	10
Female and male	17	12	11	0	40
No program	0	0	0	15	15
Total	24	24	24	15	87

Note: Sample size is 87 villages, 1775 households, and 9215 individuals

7. Program Designs and Results

7.1 The one group design

We begin with this design because it is often used as a method of preliminary analysis and because many other methods are logical extensions of this approach. In psychology, this approach has been called the one group pretest-posttest design. In economics, this approach is often called differences, based on the most common statistic calculated with such data. This approach is not very likely to lead to valid inferences, but it may be appropriate in some situations. It is also not appropriate for measuring microcredit program effect but we include it because it lays the foundation for later analysis. Most of the more complicated designs are used to overcome some difficulty or deficiency with this simple design or to determine if the inferences from it are valid.

The one group before and after design is motivated by the equation

$$y_{it} = \alpha + \beta d_t + \varepsilon_{it}, \qquad \text{(a)}$$

where y_{it} is the outcome of interest for unit i in period t, $t = 0,1$, and $i = 1,\ldots\ldots, N_t$, d_t is a dummy variable for the treatment group being in different time periods , that is, $d_t = 1$ if $t = 1$ and 0 otherwise - and β is the true causal effect of the treatment on the outcome for this group. The treatment group is usually defined (at least in part) by the variation in another variable such as the level of the minimum wage or the workers' compensation benefit. Examples of outcomes include employment in the minimum-wage studies or time out of work in the workers' compensation studies. In microcredit programs studies, the treatment group is defined by those who participated in the program. The outcome variable would be any welfare measure, let it be non-agricultural asset accumulation, food or non-food expenditures as described in section 6.

The key identifying assumption of this model is that, in the absence of the treatment, β would be 0; that is, there would be no difference in the means of treatment group in different time periods in the absence of the treatments. This condition is typically written as $E(\varepsilon_i \mid d_t) = 0;$ that is, the conditional mean of the error term does not depend on the value of the treatment dummy. If this condition

holds, an unbiased estimate of β can be obtained as

$$\hat{\beta}_d = \Delta\bar{y} = \bar{y}_1 - \bar{y}_0$$

where the bar indicates an average over the individual units and the subscript on y denotes the time period. Under typical assumptions, $\hat{\beta}_d$ would also be consistent as the number of units in each group goes to infinity. β Can also be obtained by directly estimating the parameters of the regression equation mentioned above, using data from the two time periods. Now replicating the above procedure on our data, for those who participated, the mean value of their non-agricultural assets before participation is Tk 2422.392 and after participation it is Tk. 1576.865. Therefore,

$$\hat{\beta}_d = \Delta\bar{y} = 2422.392 - 1576.865 = 845.527$$

and the program effect for the participating women is an increase in non-agricultural assets by Tk 845.527.

Now running the regression in equation (a) we find the following estimates:

$$y_{it} = 1573.77 + 845.53 d_t + \varepsilon_{it}$$

We find that the coefficient of d_t is exactly the same amount found in the value of $\hat{\beta}_d$, as expected from the above analysis.

The use of the one group before and after design requires very special circumstances. One needs strong evidence that the two groups would have been comparable over time in the absence of treatment. Basically, we are assuming there would be no time effect. This is a very strong assumption for the microcredit program participants or in general for most of the treatment groups. It might be very plausible that even in the absence of any program participation, we might have observed increase in wealth just because over the years we tend to expect that asset

accumulation would increase. In that case the effect of program participation would be seriously biased.

7.2 The Before and After Design With an Untreated Comparison Group

Often data will be available for the time period before and after the treatment for a group that does not receive the treatment but experiences some or all of the other influences that affect the treatment group. When such a group is present, the design in psychology has been called the untreated control group design with pretest and posttest. In economics the approach is identified with the most common statistical technique used in this situation, difference in differences (DID).

When one has a comparison group over the same time period as the before and after groups, often the underlying model of the outcome variable is of the form:

$$y_{it}^{j} = \alpha + \alpha_1 d_t + \alpha^1 d^j + \beta d_t^j + \varepsilon_{it}^{j}, \qquad (6)$$

where the outcome y is now also indexed by j for the group, j=0,1(where 0 and 1 represents control and treatment group respectively), and d_t = 1 if t = 1 and 0 otherwise, d^j = 1 if j = 1 and 0 otherwise, and d_t^j = 1 if t = 1 and j = 1 and 0 otherwise. The key idea behind this approach is that α_1 summarizes the way that both group j = 0 and group j = 1 are influenced by time. There may be a time-invariant differences in overall means between the groups j = 0 and group j =1, but this aspect is captured by α^1.

Finally, d_t^j is a dummy variable for being in the treatment group after it receives the treatment, and β is the true causal effect of the treatment on the outcome for this group. Again the key identifying assumption is that β would be 0 in absence of the treatment, of $E(\varepsilon_{it}^{j} \mid d_t^j) = 0$. In this case, an unbiased estimate of β can be obtained by DID as

$$\hat{\beta}_{dd} = \Delta\bar{y}_0^1 - \Delta\bar{y}_0^0$$

$$= (\bar{y}_1^1 - \bar{y}_0^1) - (\bar{y}_1^0 - \bar{y}_0^0) \qquad (7)$$

where again a bar indicates an average over *i,* the subscript denotes the time period, and the superscript denotes the group.

The research design is the essence of two often cited studies in the program evaluation literature. Card and Krueger (1994) examined the effects of an increase in the New Jersey state minimum wage on employment. Their sample consists of fast-food restaurant from four chains in New Jersey before (t = 0) and after (t = 1) the increase in the minimum wage. In addition, they examined employment at a sample of similar restaurants in eastern Pennsylvania over the same time period. This sample from Pennsylvania provides a group (j = 0) that is plausibly subject to the same changes over time as the group in New Jersey, except that Pennsylvania did not change the minimum wage. Meyer (1994) examined the effects of two large workers' compensation benefit increases on the length of claims. They also relied on a untreated comparison group, as well as before and after groups. The untreated comparison group is those individuals within a state who were not subject to the increases in workers' compensation benefits because they had average or low earnings. These comparisons workers were likely to be subject of any other changes in program administration or insurers' claim-monitoring procedures.

Again, β can be estimated directly by applying ordinary least squares to Equation (6). This method would reproduce $\hat{\beta}_{dd}$ the same way it did for the one group design. Table 2, 3 and 4 respectively shows the mean values of total non-agricultural assets, non-food expenditures and food expenditures for participants and non-participants in the targeted category for two different time periods. For non-agricultural assets, we have the data for before participation period. For food expenditures and non-food expenditures, in the absence of before participation data, round 1 is used as the base period. For all three measures round 3 has been used as the after participation period. Table 2, 3 and 4 reveals that for all three measures of program evaluation, there is substantial program impact for each category. Non-agricultural assets increased by Tk 800.96 in program effect measure which is more

than 50 percent increase for the participants. Food and non-food expenditures increased by Tk 6.22 and Tk 367.61 which is 16 and 33 percent increase respective for the participants from round 1 to round 3, that is within 9 months period. [4]

Table 5 reproduces the same program impact by the regression formulation. Without using the regression formulation we cannot conveniently say whether the program impact is significant or not. We find that the value of program effect coefficient is exactly same as we measured by the DID estimate. Moreover, these regression results show that these program effect coefficients are highly significant even at 1 percent level of significance.[5]

[4] All these program effect estimates are measured in 1990 constant prices

[5] Even though, these estimates are highly significant, but they might be biased due to different characteristics are not controlled for yet. It also does not correct for the endogeneity of participation decision. Section 7.4 tackles these issues.

Table 2. Mean Value of Non-agricultural Assets (in Taka)

	Observations	Before Participation	Round 3
Participants	412	1576.865	2422.392
Non-participants	315	1668.721	1713.288

$\hat{\beta}_{dd}$ = (2422.392-1576.865)-(1713.288-1668.721) = 800.96

Table 3. Mean Value of Daily Food Expenditures in a Family (in Taka)

	Observations	Round 1	Round 3
Participants	203	38.273	42.579
Non-participants	152	36.228	34.235

$\hat{\beta}_{dd}$ = (42.579-38.273)-(34.235-36.228) = 6.229

Table 4. Mean Value of Non-food expenditures in Last Four Months (in Taka)

	Observations	Round 1	Round 3
Participants	203	803.210	1122.392
Non-participants	152	861.721	913.288

$\hat{\beta}_{dd}$ = (1122.392-803.210)-(913.288-861.721) = 267.612

Table 5. Estimates for different program evaluation measures

	Non-agricultural assets	Food Expenditures	Non-food Expenditures
Time (d_t)	110.539	1.238	231.89
	(0.37)	(0.95)	(0.563)
Group (d^j)	1141.646	7.031	934.14
	(4.46)	(5.89)	(7.89)
Program effect (d_t^j)	800.96	6.229	267.612
	(4.56)	(2.567)	(6.231)
Constant	2387.21	48.713	13.13
	(11.52)	(53.73)	(13.75)

Note: Figures in parentheses indicate t-ratio

7.3 Program impact without a time dimension

As we have seen above, we have got data for before and after situation in the case of non-agricultural assets but for food and non-food expenditures the time span is only 9 months between round 1 and round 3. Even though we have observed substantial program impact within that time period, ideally we would like to have a greater time span. But due to data limitation, we are restricted to shorter time span. In this situation, an alternative program evaluation technique might be more appropriate.

In this alternative approach, the variables in Equation (6) can be relabeled without changing the underlying approach. The index t does not need to indicate time. Rather, it only needs to indicate one group that was subject to a treatment and another group that was not. For example, Madrian (1994) examined the effects of insurance coverage on the probability of moving between jobs. The hypothesis is that those with both current coverage and a greater demand for insurance (due to lack of coverage through a spouse or greater demand for health care due to pregnancy or large family size) should be less likely to move. Let $t = 0$ for someone with a low demand for insurance, and $t = 1$ for someone with a high demand. Similarly, let $j = 0$ for an uncovered worker, and $j = 1$ for a person currently covered. The treatment effect is the interaction of being currently covered and having a greater demand for future insurance ($t = 1, j = 1$).

We take the similar approach to find program impact in microcdredit programs. While discussing survey design and data, we have seen there are two broad categories of households in the data: program villages and non-program villages. The households in these villages are again divided in two categories which are targeted and non-targeted. The program impact can be measured by comparing these two types of households in program and non-program villages. Here we let $t = 0$ for someone in program villages, and $t = 1$ for someone in non-program village. Similarly, let $j = 0$ for a person who is targeted and $j = 1$ for a person who is not targeted. The DID estimator in that case would be in the following form:

$$\delta = (\overline{Y}_{Targeted} - \overline{Y}_{Non-Targeted})_{program} - (\overline{Y}_{Targeted} - \overline{Y}_{Non-Targeted})_{non-program} \qquad (8)$$

δ is the Average Treatment Effect (ATE), that is the average effect of the Micro-credit programs on the targeted people. Now the problem is, not all of the targeted people participated in the programs. Among the targeted individuals, some chose to participate and some did not. Assuming that the proportion of targeted people who participated is p, then δ can be written as the

$\delta = p\,\delta + (1-p)\,\delta$

As 1- p portion of the persons did not participate in the program, the relevant program effect would be identified by only $p\delta$. Therefore, the actual program effect is capture by $\boldsymbol{p\delta}$.

Now the question is how δ can be a valid ATE on the treatment group. The reasoning would be the same as we have used in the previous section. We can reason that when we measure the difference $(\overline{Y}_{T\,\mathrm{arg}\,eted} - \overline{Y}_{Non-T\,\mathrm{arg}\,eted})_{program}$ we are differencing out the effect of common characteristics of targeted and non-targeted individuals in the program villages that influence the outcome. What is left is the program effect (δ) and the effect of difference in the uncommon characteristics of targeted and non-targeted observations (u_t - u_{nt}).

$$(\overline{Y}_{T\mathrm{arg}eted} - \overline{Y}_{Non-T\mathrm{arg}eted})_{program} = \delta + (u_t - u_{nt}) \qquad (9)$$

Now the term $(\overline{Y}_{T\mathrm{arg}eted} - \overline{Y}_{Non-T\mathrm{arg}eted})_{non-progra}$ differences out the effect of common characteristics of the targeted and non-targeted persons in the non-program villages. Only thing that is left is the effect of differences between the uncommon characteristics of targeted and non-targeted persons ($(u_t - u_{nt})$.

$$(\overline{Y}_{T\mathrm{arg}eted} - \overline{Y}_{Non-T\mathrm{arg}eted})_{non-program} = (u_t - u_{nt}) \qquad (10)$$

Now (10) - (9) yields,

$$(\bar{Y}_{Targeted} - \bar{Y}_{Non\text{-}Targeted})_{program} - (\bar{Y}_{Targeted} - \bar{Y}_{Non\text{-}Targeted})_{non\text{-}program}$$
$$= \delta + (u_t - u_{nt}) - (u_t - u_{nt}) = \delta$$

Table 6, 7 and 8 present results for the program effect without time dimension. Even in this setup, we observe substantial program effect for each category of evaluation measures. Table 9 compares these two scenarios: program effect between two time periods and program effect without time dimension. We note that observed effect in the case without time dimension is greater than the effect between two time periods except for the non-agricultural assets. The effect on food expenditures and non-food expenditures is almost a 100 percent increase and around 35 percent increase respectively but the impact on non-agricultural assets is marginal. One plausible explanation might be when we measure across groups, that program impact is larger because the data is not restricted between 9 months of time frame as in the case for food and non-food expenditures. The impact on non-agricultural assets does not change much because this is the only measure where we are able to use before participation information.

Table 6. Program effect without a time dimension (Non-agricultural Assets)

	Program	Non-program
Targeted	622.81	1181.21
	(1538)	(312)
Non-targeted	2870.621	4792.482
	(260)	(53)

Note.- Figure in parentheses indicate number of observations.

Program Effect = (0.59)[(622.81-2870.621)- (1181.21-4792.482)]

= 804.442

Table 7. Program effect without a time dimension (Food Expenditures)

	Program	Non-program
Targeted	37.13	41.79
	(1538)	(312)
Non-targeted	39.173	64.31
	(260)	(53)

Note.- Figure in parentheses indicate number of observations.

Program Effect = (0.59)[(37.13-39.173)- (41.79 - 64.31)]

= 12.03

Table 8. Program effect without a time dimension (Non-Food Expenditures)

	Program	Non-program
Targeted	512.46	401.67
	(1538)	(312)
Non-targeted	604.29	1092.77
	(260)	(153)

Note.- Figure in parentheses indicate number of observations.

Program Effect = (0.59)[(512.46 - 604.29)- (401.67- 1092.77)]

= 353.56

Table 9. Comparison between Effects: Across Time and Across Group

Welfare Measures	Program effect across time	Program effect across group
Non-agricultural Assets	800.96	804.442
Food-expenditures	6.229	12.03
Non-food expenditures	267.612	353.56

7.4 Controls for Different types of Characteristics

The results that we have presented in section 7.2 or 7.3 are without controlling for different characteristics, e.g. individual, household or village characteristics. It is possible that the program impact that we have measured so far is biased as we do not control for these characteristics. Incorporating these characteristics provides a simple way to adjust for observable differences between the observations in different groups. Using this formulation may also improve the efficiency of the estimate of program impact by reducing the residual variance.

To account for these characteristics, we choose before and after program participation framework[6]. By adding these additional variables, the program impact equation takes the following form:

$$y_{it}^{j} = \alpha + \alpha_1 d_t + \alpha^1 d^j + \beta d_t^j + \beta_1 I + \beta_2 X + \beta_3 Z + \varepsilon$$

I = individual characteristics

X = household characteristics

Z = village characteristics

Table 10 presents the regression results for above equation. The welfare index that we use in this analysis is non-agricultural assets. We choose this variable because this is the only individual specific measure that we have here and it is also consistent between different formulations we have used so far. We find that the participation coefficient (β) is insignificant even at 10 percent level of significance.

First we have to check whether there is any misspecification problem[7] with the statistical model above. The results for the misspecification tests are provided in Table 1 in Appendix A. We observe no serious departure from the major assumptions. Therefore we have to look into other sources of this problem.

[6] We choose this framework because "without time dimension framework" is difficult to estimate and we would not hope to learn anything more than the framework we use here.

[7] For details see Spanos (1999).

Table 10. Effect of Participation on Women's Non-Agricultural Assets

Explanatory Variables	***Estimates (participation exogenous)***
Program effect (β)	731.198 (0.62)
Age	-1117.03 (-3.74)
Education	71.01 (2.17)
No spouse present	-2147.24 (-5.9)
Education of household head	3.370 (0.72)
Sex of household head	27.775 (1.1)
Age of household head	55.899 (1.86)
Maximum education of female members	449.512 (3.47)
Maximum education of male members	491.969 (2.29)
Has any primary schooling?	-99.575 (-0.5)
Has any rural health center?	264.794 (2.02)
Has any family planning clinic?	-187.374 (-2.6)
Has any Dai/Midwife available?	316.061 (5.59)
Price of coarse grain rice	-17.022 (-1.0)
Price of wheat flour	434.233 (2.07)
Price of Potato	-176.387 (-3.0)
Average female wage	20.791 (1.51)
Average male age	-20.842 (-2.1)
Closest bank distance	10.336 (0.48)
Does the village have electricity?	373.653 (3.32)
Time Effect (α_1)	160.39 (0.56)
Participation Effect (α^1)	960.32 (7.361)
Constant	2654.816 (2.07)

Note.- Figure in parentheses indicates t-ratio.

One possible explanation might be participation decision is endogenous which might make β and ε correlated. This problem is intrinsically related to the self-selection bias mentioned earlier. This problem arises because the same unobserved characteristics (captured in ε) that affect asset accumulation might also affect the participation decision. For example, one of the unobserved characteristics might be the ability to work hard. It should affect how much asset the person accumulates. It should also affect whether the person would join a program where hard work is needed. This problem is intrinsically related to the issue of self-selection of these members. The members decide whether they would join the program or not and that makes the participation decision endogenous.

The usual way to tackle the endogeneity of explanatory variable is to find an instrument for it. The essence of instrumental variable technique is to find a variable which is correlated with the endogenous variable (for which we are looking for an instrument) and likely to be uncorrelated with the error term. A suitable candidate for an instrument for participation decision might be the "distance to the nearest program office" variable. This variable measures the distance (in Kilometer) to the nearest program office from where the households get loans. It might affect the participation decision as the transportation in the village is primitive and most of the people walk. These microcredit program requires weekly group meetings in their program branch offices to assess performance and to provide training[8]. Therefore if the program office is situated a little far, it might discourage her to get more involved in the credit programs. But the distance should be uncorrelated with her unobserved characteristics.

This instrumental variable technique is inherently related to natural experiment process we described earlier. Natural experiment tries to provide exogenous variation in an endogenous explanatory variable. By applying above instrumental variable method, we are exactly following the process of natural experiment. We are trying to relate endogenous participation decision to a variable which is exogenous to the model. It is also similar to the controlled experiment we talked about. Participants are being offered the program membership. All of them are

[8] For details, see chapter 3.

receiving treatment or controlled status in a random manner based on their distance to the nearest program office.

Now to qualify "distance" as an instrument for participation, we have to show that it is significantly correlated with participation decision. We estimated a probit model of microcredit participation. Probit model can be derived from an underlying latent variable model that satisfies the classical linear model assumptions. Let y^* be an unobserved, or latent variable, determined by

$$y^* = \beta_0 + \tilde{x}\tilde{\beta} + e, y = 1[y^* > 0]$$

where y is a binary variable. Let us assume y^* is the ability to work hard. Therefore the model basically implies that if ability to work hard is positive, individuals would participate in microcredit programs and we would have y = 1, otherwise y = 0. We assume that *e* is independent of $\tilde{x}$ and that *e* has the standard normal distribution. From the above equation, we can derive the response probability for *y*:

$$P(y = 1/x) = P(y^* > 0/x) = P[e > -(\beta_0 + \tilde{x}\tilde{\beta})/x]$$

$$= 1 - G[-(\beta_0 + \tilde{x}\tilde{\beta})] = G(\beta_0 + \tilde{x}\tilde{\beta})$$

where *G* denote the cdf of a random variable which is normally distributed. Our aim is to find how the variable "distance" which is denoted by one of the variables in vector $\tilde{x}$, for example x_j, affects the response probability $P(y = 1/x)$, the probability to join the microcredit programs. If x_j is (roughly) continuous, then

$$\Delta\hat{P}(y = 1/x) \approx [g(\beta_0 + \tilde{x}\tilde{\beta})\hat{\beta}_j]\Delta x_j$$

for "small" changes in x_j. Since $g(\beta_0 + \tilde{x}\tilde{\beta})$ depends on $\tilde{x}$, we must compute it at interesting values of *x*. Often the sample averages of the x_j are plugged in to get $g(\beta_0 + \bar{x}\tilde{\beta})$.

Table 11 gives the Probit estimates for the above functional form. Main importance of this table lies in the fact that it shows that the "distance" variable is significantly related to participation decision. The co-efficient of distance variable is significant even at 1 percent level of significance. Using these estimates and method described above we can find how marginal change in distances affect participation.

Table 11. Factors affecting participation decision (Probit estimates)

Explanatory variable	Estimates
Distance to the nearest program office	- 0.321 (4.72)
Age	0.328 (2.77)
Education	-3.936 (-0.4)
No spouse present	0.088 (3.55)
Education of household head	0.152 (1.20)
Sex of household head	-0.134 (-2.98)
Age of household head	0.222 (0.36)
Maximum education of female members	0.063 (0.07)
Maximum education of male members	1.153 (1.53)
Has any primary schooling?	2.627 (3.62)
Has any rural health center?	-0.596 (-2.3)
Has any family planning clinic?	-0.412 (-1.3)
Has any Dai/Midwife available?	0.204 (2.27)
Price of coarse grain rice	-1.847 (-2.0)
Price of wheat flour	1.3 (2.97)
Price of Potato	0.025 (0.42)
Average female wage	1.696 (1.39)
Average male age	0.122 (1.41)
Closest bank distance	0.60 (1.58)
Does the village have electricity?	31.33575 (0.57)
Time Effect (α_1)	132.345 (1.642)
Participation Effect (α^1)	97.31 (0.780)
Constant	2134.78 (12.67)

Note.- Figure in parentheses indicates t-ratio.

We find that if the distance increases from 1 km to 2 km, the probability of participation gets .224 lower; if the distance increases from 4 km to 5 km, the probability of participation gets .342 lower.

There is a probability that the characteristics of villages, where program offices are actually situated, might influence the performance of women - if those villages are different from the villages where program participants live. But our data shows that there is no village which has a program office and does not have any program participants residing in. Therefore, those characteristics of villages where program office are situated are already controlled for in our study.

Above results suggest that "distance to the nearest program office" is a suitable instrument for participation. Table 12 shows how the use of this instrument alters the results provided by original regression. We find that the measured program effect stands at 640.77 and the effect is now highly significant. But compared to the measures that we derived in previous sections, this effect is lower. This implies that earlier results were considerably overestimated which is not surprising as those results did not include any controls for different types of characteristics.

Table 12. Effect of Participation on Women's Non-Agricultural Assets (Distance to the nearest program office = Instrumental Variable)

Explanatory variables	Estimates
Program effect (β)	640.77
	(2.53)
Age	-2699.6
	(-5.3)
Education	95.277
	(1.81)
No spouse present	-2873.27
	(-4.8)
Education of household head	-10.006
	(-1.0)
Sex of household head	6.519
	(0.16)
Age of household head	60.792
	(1.45)
Maximum education of female members	514.787
	(2.56)
Maximum education of male members	876.822
	(2.79)
Has any primary schooling?	-305.17
	(-1.1)
Has any rural health center?	217.657
	(0.89)
Has any family planning clinic?	-199.332
	(-1.6)
Has any Dai/Midwife available?	545.315
	(5.68)
Price of coarse grain rice	-30.527
	(-1.0)
Price of wheat flour	516.884
	(1.56)
Price of Potato	-134.919
	(-1.1)
Average female wage	53.356
	(2.31)
No female wage dummy	1456.511
	(2.74)
Average male age	-37.679
	(-1.95)
Closest bank distance	39.156
	(1.25)
Does the village have electricity?	616.602
	(3.43)
Time Effect (α_1)	142.345
	(0.692)
Participation Effect (α^1)	743.31
	(1.280)
Constant	1666.136
	(0.54)

Note.- Figure in parentheses indicates t-ratio.

7.5 Summary and Conclusion

In this chapter we have analyzed different program evaluation technique applied to measure the program impact of microcredit programs. Three major indicators have been used: non-agricultural assets, food expenditures and non-food expenditures. Taking measures such as before and after participation situation in the case of non-agricultural assets, and from round 1 to round 3 for food and non-food expenditures, we have found significant program impact on each of the three measures. But for food and non-food expenditures we could only use the time span of 9 months between round 1 and round 2 which might not be sufficient. That is why we resorted to finding the program impact without time dimension. This approach resulted in the same program impact for non-agricultural assets which is not surprising because only non-agricultural assets incorporated the before participation information. But for food and non-food expenditures, we find a substantial increase in program impact which might have resulted from the freedom of time limitation.

But the across time or group comparison does not include any controls for different types of characteristics. As a result, there is a good possibility that these results are positively biased.

Another danger lies in the endogeneity of participation decision. The fact that members decides to join makes the participation decision endogenous. We use instrumental variable technique to solve this problem. We find the measure, "distance to nearest program office" qualifies as a good instrument for participation decision. Using this instrument, we find significant program impact even after controlling for individual, household or village characteristics. The program effect is now smaller which proves that our earlier estimation was indeed positively biased.

This study shows that microcredit programs are an effective policy instrument for reducing poverty especially for the women. The novel thing about these results is that it specifically shows significant improvement in women's welfare which is the major objective of all of these microcredit programs.

Now having shown that these microcredit programs are indeed useful in increasing welfare for women, the next chapter analyzes the determinants of their success. It helps us to understand what the most important factors for these women

to be successful in microcredit programs are and how they affect the mechanism of these programs.

Chapter 2

Assessing Performance of Participating Women in Microcredit programs

1. Introduction

Even though overwhelming majority of participants in microcredit programs are women (over 80 percent), there has not been any comprehensive study that investigates their determinants of economic performance. These determinants can be in the form of different type of characteristics of women: their own characteristics (age, schooling etc) or the characteristics of the household or village they live in. This chapter looks into this issue using data on the same three group-based credit programs (Grameen Bank, Bangladesh Rural Advancement Committee (BRAC), and Bangladesh Rural Development Board's (BRDB) Rural Development RD-12 program) that we have discussed in chapter 1.

Apart from investigating the important factors that affect women's performance in the microcredit programs, we also try to find accurate estimates of these determinants using an unconventional technique. A typical problem to estimate the impact of schooling and similar type of variable is that these variables are influenced by unobserved ability of individuals, which results in biased estimates (commonly known as omitted variable bias). Usually in the literature, this problem is tackled by finding suitable instruments, i.e. by applying the conventional instrumental variable technique. But finding suitable instruments are often difficult due to data unavailability and even when data are available, instruments are often questionable.

In this study, a different method has been employed to overcome this problem. We try to derive the information regarding unobserved ability from the marriage market involving women who participates in microcredit programs. Overwhelming majority of the women who participated in these microcredit programs are married (only 2% are unmarried) and we argue that their marriage

history helps to find information regarding their unobserved ability or characteristics.[9]

In marriage market, unobserved characteristics are as important as observed ones in selecting future spouse. Those unobserved characteristics are more important for women than men. Men's eligibility is more or less exposed by their earning capability or amount of household wealth they accumulated. On the other hand, woman's participation in wage market or attainment of schooling is very limited in a typical South Asian village for the conservative nature of the society. The data we have indicates only 3.2 percent of married women participates in wage market. Therefore, women's beauty, intelligence or skill at household works, which are all unobservable, might become important factors in finding suitable matches. We argue that this matching process between potential husband and wife helps to reveal the information regarding women's unobserved characteristics.

This study shows that inclusion of unobserved characteristics from marriage market significantly alters the magnitude of observed characteristics' impact on women's economic success. Tests of endogeneity also reveal the absence of endogeneity after incorporating estimates of unobserved characteristics. This study also shows that these unobserved characteristics play an important role in the economic performance of these women. Formally it shows that the characteristics which helped these women to get a better quality husband in the marriage market also helped them performing better in the credit market.

The results of this paper have important implications for microcredit programs. Having an idea about significant characteristics of women might help in re-evaluating current recruiting procedure of member. They might want to see whether existing procedure encourages participation of women with higher level of these significant characteristics. It might also help to identify what measures they should take to enhance women's performance in these credit programs.

[9] Here "observed" or "unobserved" term is used from the viewpoint of the researcher. The researcher might have data regarding schooling, marital age etc but it is highly unlikely that there would data available for intelligence, beauty and others.

2. Marriage Market and Mating Function

2.1 Background

Many social scientists have considered how an individual selects a mate based on a set of the prospective mate's characteristics, such as age, education, and physical attractiveness. Evidence from these studies suggests that people want a mate with traits similar to their own (similar age, similar education, and even similar weight). The main exception applies to labor-market traits such as earnings or hours. Theories regarding the sexual division of labor suggest that members of a couple will exhibit a specialization of these traits (Becker 1974). Becker (1974, 1981, 1991) modeled the process of selecting a mate as similar to the process of selecting a consumer good designed to increase a person's level of happiness or utility. An individual maximizes his or her utility by selecting a mate based on the set of characteristics that the prospective mate possesses. According to Becker (1981), higher-quality men and women marry each other rather than selecting lower-quality mates when these qualities are complements: a superior woman raises the productivity of a superior man and vice versa. The mating of likes or unlikes is optimal as traits are complements or substitutes, because superior persons reinforce each other when traits are complements and offset each other when traits are substitutes.

Becker's work on marriage left a huge trail of literature. Extensive empirical work has been done investigating the evidence of assortative mating. One characteristic that researchers have studied extensively is age among couples. Hayes (1995) found that within opposite-sex unions, men seek younger women and women seek slightly older men. In contrast, Jaffe and Chacon-Puignau (1995) showed that regardless of their sexual orientation, people prefer partners of an age similar to their own.

Klawitter (1995) sampled couples from the 1990 census, finding evidence of positive assortative mating for age, race, and education across types of couples. With regard to education, Mare (1991) found that homogamy (a similarity between a matching of spouses' characteristics) has increased from the 1930s through the 1980s. Other researchers have found evidence of positive assortative mating among married couples for earnings (Nakosteen and Zimmer 2001), physical attractiveness (Stevens,

Owens and Schaefer 1990). South (1991) found that men value the youthfulness and physical attractiveness of their potential marriage partners more than women do.

It is obvious by now that literature on matching generally provides substantial evidence of positive assortative mating on a variety of attributes and limited evidence of negative assortative mating. Most of these studies used correlation coefficient for their analysis. But simple correlations do not reveal the whole story, as other variables are not controlled in that setting. Suppose we go with the theory that man usually seeks for younger women. But he might settle for a slightly older woman if he finds her other attributes more attractive, e.g. she might have above average education.

The marriage pattern in which spouses' characteristics are dissimilar but in which low values on one characteristic are offset by high values on another characteristic can be explained by "exchange theory" (Edwards 1969). Exchange theory focuses on the interpersonal relationships involved in the marriage choice process and on the resources – both assets and liabilities of potential partners. A major assumption is that potential spouses are rational and goal-oriented individuals attempting to maximize the gain (or utility) in mate selection while minimizing any costs. One outcome is an equilibrium in which spouses tend to be matched evenly on important characteristics, resulting in high levels of homogamy. Nonetheless, the prevalence of homogamy is reduced by the ability of potential spouses to trade or exchange equivalent but different resources in the marriage market .

In accordance with this exchange theory, to formulate a relationship between the characteristics of husband and wife, ideal way would be to set up a regression equation where husband/wife's characteristics are determined by his/her spouse. The main point here is this: to find evidence of assortative mating it is not sufficient to regress corresponding characteristics of male and female participants in the marriage market. The other variables that affect the process of choosing mate should be also included to control for other influences. In marriage market literature, this relationship between spouse characteristics is termed as mating function. An example of this mating function specification can be presented in the following form [Rosenzweig and Boulier (1984)]:

$$H^{ijl} = \beta_0^k + \beta_1^k T_E^i + \beta_2^k T_S^i + \beta_3^k \alpha^i + \beta_4^k D^l + \beta_5^k R^K + \beta_6^k J^K + \beta_7^k J^l + \varepsilon_1^{ki} \qquad (1)$$

k = male or female; l = male or female;

where H^{ijl} is the human capital of the spouse j of individual i, T_E^i and T_S^i are i's schooling attainment and marital search time, α^i represents other traits of i that attract a higher-quality mate (marital attractiveness), J^K and J^l are variables representing sex-specific labor-market conditions, D and R are features of the marriage market reflecting the dispersion of potential mates and the ratio of potential mates to competitors, and ε_i is the random error term. The marital literature suggests that β_1, β_2, $\beta_5 > 0$ and $\beta_4 < 0$ while $\beta_3 > 0$ by definition.

The above equation may be generalized to include as a right-hand-side variable any transfers, conditional on the marriage of i and j, provided to j by the family of individual i (dowry if i is female; bride price if i is male). In addition, if individual i's parental background, for given observed characteristics of i, affects marital offers, then variables describing i's family would be included in the mating function.

2.2 A simple marriage market model

This subsection deals with a simple model of marriage market. This model predicts the same sort of relationship between spouse characteristics as in the mating function mentioned above. This model is useful in the sense that it provides a theoretical basis for the mating function. Rao and Deolalikar (1998) presents the following model that empirically explores the extent of assortative mating and influence of personal and family traits in determining pecuniary exchanges between families at the time of marriage. The marriage in rural Bangladesh is largely an alliance between two families and the wife household typically undertakes a search for a husband. Both individual traits (such as beauty, intelligence and schooling) and family background (such as wealth, father's occupation and caste) are given consideration in the search for a 'perfect' husband. In the large majority of marriages, a dowry is negotiated and

paid by the wife's household to the husband's household, the value of which depends upon the traits of the husband, the bride, and their respective households.

To model the demand for husband traits, it is assumed the wife household's utility function is defined over the traits of the potential husband and his parental household:

$$U = U(\Omega_h, H_h, X), \qquad U' > 0, U'' < 0 \qquad (2a)$$

where the subscript *h* refers to the husband, and

Ω = vector of individual traits
H = vector of parental household traits
X = consumption of a composite good (having a price of unity)

The wife household is assumed to maximize the utility function (2a), subject to a budget constraint that includes the dowry payments made to the husband household, viz.:

$$X + D(\Omega_h, H_h, \Omega\ , H) = Y \qquad (2b)$$

$$\partial D / \partial \Omega_h > 0, \quad \partial D / \partial H_h > 0, \quad \partial D / \partial \Omega < 0, \quad \partial D / \partial H < 0,$$

where,
Y = exogenous (non dowry-related) income of the wife's household,
D = dowry given by the wife household, and

Solution of the first order conditions and the budget constraint for all the endogenous variables yields the wife household's reduced-form demand for husband and his household's traits:

$$\Omega_h = \Omega_h(\Omega, H, Y), \qquad (3a)$$

$$H_h = H_h(\Omega, H, Y), \qquad (3b)$$

Equation (3a) is a general functional form of the mating function specified in equation (1). These mating functions [equation 3(a) or equation (1)] can be used to uncover the unobserved characteristics of participating women in the microcredit programs. It will be argued that residuals from these mating functions can be used as a proxy for the unobserved characteristics of women. Section 3 will examine this procedure in detail where econometric specifications will be discussed.

3. Econometric Specification

3.1. Mating function

This section starts with an econometric specification of the mating function described in the previous section (equation 3a). In linear form the mating function for the husband can be written as the function of observed and unobserved characteristics of his wife (and her household):

$$C_H = \alpha + \beta_1 SC_W + \beta_2 MA_w + \beta_3 HH + \mu + \varepsilon \qquad (4)$$

C_H	=	A vector of Husband's Characteristics (e.g. his Schooling, amount of assets)
SC_w	=	Wife's Schooling
MA_w	=	Wife's Marital Age
HH	=	Characteristics of bride's parents (father's education, occupation etc)
μ	=	a vector of dimensions of wife's unobserved characteristics, including attributes or endowments such as attractiveness, intelligence or skills at household works
ε	=	A vector of i.i.d. disturbance terms with zero means

Following two variables have been chosen to represent husband's desirable characteristics as a potential spouse in the marriage market. One is in the form of human capital (schooling), and the other is in the form of physical capital (accumulated asset). Consequently, equation (4) represents a bivariate linear regression model.

Among the explanatory variables, first let us consider the case of observed characteristics of wife. We have already seen in section 2 that marriage market theories imply positive assortative mating in complementary characteristics among the matches. As education is considered to be a complementary good (educated spouses reinforces each other's capabilities), one would expect wife's schooling is positively related with husband's schooling.

Younger wife's are in general preferable for various reasons, e.g., they are more attractive, more fecund etc. Therefore, husband with higher quality should be matched with younger wife and the older wives might be left with low quality husband i.e., husband with less schooling or less assets. But there is a conflicting marriage market theory about the existence of pay-offs to search in the market (Keeley 1977). It argues that the postponement of marriage results in a better spouse. According to this theory, it can be predicted that the higher the marital age, the higher is the possibility of getting a husband with better quality. Hence, there is an ambiguity regarding the sign of the coefficient of MA_W (β_2).

Wife's parental household might have some impact on the determination husband's characteristics. In above specification, wife's father's education and profession have been included. If father's education implies how wealthy he is, then it might be an important determinant of husband's characteristics. It can be expected wealthy father can afford higher quality husband for his daughter by offering higher pay-off to groom or groom's family (e.g. offering higher dowry). In the same manner father's occupation may affect the quality of husband's characteristics.

3.2. Specification of women's performance equation

In Section 4 of Chapter 1, we have seen certain types of expenditures and assets would be reasonable indicators of women's performance in the microcredit programs. We used those variables to measure the performance of participating women. To find the determinants of women's success, we use the same variables as performance indicators.

Now the question is what the factors that might influence these performance indicators are. Women's own characteristics like age, education might be important. Household characteristics are also important e.g. household head having higher education might have more facilatatory impact on women's performance. Similarly, village characteristics like the presence of electricity and improved sanitation might influence women's performance positively. In the light of this discussion, following reduced form equation can be proposed to evaluate women's performance:

$$P = \delta_0 + \delta_1 Sc + \delta_2 Age + \delta_3 Cr + \delta_4 Lm + \delta_5 HH + \delta_6 Vill + \delta_7 \hat{\xi} + \varepsilon_2 \quad (5)$$

where

P	=	Performance indicators (Total accumulated asset, food and non-food expenditures)
Sc	=	amount of schooling
Age	=	Age of women participating
Cr	=	Amount of credit accumulated
Lm	=	Length of program participation
HH	=	Vector of household characteristics
$Vill$	=	Vector of village characteristics
$\hat{\xi}$	=	Estimated residuals from mating function

Among the vector of explanatory variables, $\hat{\xi}$ are representing the unobserved characteristics of the women - derived from the residuals of mating function in equation (4). Except *Cr* and *Lm,* all other explanatory variables are representing individual, household or village characteristics. Inclusion of *Cr* and *Lm* is important because the amount of credit received by women and the length of participation should affect their performance. The critical point of this equation is that unobserved characteristics of the woman are expected to have important effects on her performance in the microcredit programs.

The econometric issue that arises is regarding the validity of using residuals from marriage market equations as the dimensions of women's unobserved characteristics. The residuals from the marriage market equation, which is the difference between the actual level of husband's characteristics and their expected levels, approximates dimension's of women's unobserved characteristics with a random error component that is unforeseen by the marriage market participants ($\zeta = C_H - \hat{C}_H = \mu + \varepsilon$). Regressing variables that represent women's performance on this calculated residual of the marriage market equations estimate the impact of women's unobserved characteristics on these variables. But since the calculated residual measures the unobserved characteristics with error, the estimate is biased

toward zero.[10] Standard text book argument is as follows: the actual vectors of unobserved effect is μ. But instead of observing μ, we observe $\xi = \mu + \varepsilon$. Then it can be shown that

$$p \lim \hat{\delta}_7 = \delta_7 [\frac{1}{1 + \sigma_\varepsilon^2 / \sigma_\mu^2}]$$

where σ_ε^2 and σ_μ^2 are variance of ε and μ, respectively, and $p \lim \hat{\delta}_7$ means the probability limit of δ_7. Since the term inside the brackets is expected to be less than 1, the above expression shows that even if the sample size increases indefinitely, $\hat{\delta}_7$ will not converge to δ_7. Actually if δ_7 is assumed positive, $\hat{\delta}_7$ will be underestimated, that is, it would be biased toward zero.

Though biased, it can be shown that these residuals are consistent representation of unobserved characteristics of individuals and households. The residuals in equation (4), ε are white noise errors by Gauss-Markov OLS assumption. Since $\xi = \mu + \varepsilon$ from equation (4) and the elements of ε with zero mean, $P \lim \xi = P \lim \mu$, therefore ξ is a consistent representation of μ.[11]

The use of unobserved characteristics in equation (5) is expected to remove the omitted variable bias that would have been present otherwise. It has been already mentioned that the schooling variable is supposed to be correlated with the error because of unobserved ability. The same problem arises with the accumulated credit variable. The amount of credit a woman can accumulate depends on how productive she is with the credit and productivity in part depends on unobserved characteristics. In other words, credit might also be an endogenous variable. Endogeneity of the credit and schooling variable might not arise when we use equation (5). In that specification, unobserved effects are controlled for and therefore, there exists little chance of correlation between credit and error (a test for endogeneity of these variables would be provided in the next section). But, we also need the specification

[10] Rosenszweig and Schultz (1983) made a similar argument in estimating health technology equation.

[11] See Behrman, Birdshall and Deolalikar (1995) for a similar case where they derived man's unobserved characteristics from the residuals in wife's characteristics equations.

in equation (4) as one of the goals of our analysis is to investigate the impact of incorporating unobserved characteristics on the performance equations. Therefore, it is necessary to compare estimates with or without incorporating the unobserved characteristics.

Before going onto describing results, one issue needs to be mentioned regarding dependent variables. Husband's total asset in mating function and all performance indicator variables are measured in log terms. This is purely a specification issue as diagnostic tests for underlying assumptions of statistical model revealed that log form of dependent variables helps to satisfy the those assumptions. These tests are described in greater detail in the next section.

4. Results

Table 1 describes independent variables used in the analysis. The sample of individuals between year 15-64 is middle aged: mean age is around 35 years. The educational level is very low, averaging merely one year. The highest education of the household head is 1.7 years of schooling. On the average a participant has been in the program for more than 4 years. Around 11 percent of household does not have any spouse present in the household. The explanatory variables also include availability of rural health center (10 percent) and family planning center (18 percent). They also include the village-level prices of major commodities and the wages of male and female labor. Few women participate in the wage labor market (about 19 percent of the villages have no active wage labor market for women); the female wage is about 40 percent of the male wage. The distance of a finished road from a village is on the average 11 kilometer. Around half of the villages have access to electricity. Table 2 describes the dependent variables used in the marriage market analysis.

Table 3 presents estimates of the determinants of husband's characteristics in the mating function in equation (4). It presents estimates for the equations of husband's schooling and total assets accumulated. These estimates can be interpreted in the following manner.

First, wife's schooling is significantly and positively related to her husband's schooling and total assets. Assortative mating on schooling is strong, with one year increase in wife's schooling, husband's schooling increases by about 0.63 year[12]. For every additional year of wife's schooling, there also is a significant increase (12.5 percent increase) in husband's total asset. As husband's assets and wife's schooling can also be considered complementary goods, this result can count as another example of positive assortative mating between marital partners.

As for the marital age of wives, there seems to be significant relation between wife's age at marriage and husband's schooling. The significant positive coefficient implies that women marrying at higher age get husbands with higher schooling. This

[12] In some analysis, tobit estimation is employed when schooling variable is a dependent variable and significant amount of individual report no schooling. But here, for husband's schooling, only six individual report no schooling among 877 observations. Therefore, conventional OLS estimation is used.

happens probably because women postpone their marriage to get higher schooling and then also choose husband with more schooling [Rosenzweig and Boulier (1984)].

The characteristics of wife's parental household seem to be important too. Father's education is significantly related to both husband's schooling and accumulated assets. Higher educated father might pay more attention to improve child quality by providing more education. Father's education also seems to be significantly related to husband's asset. It is also evident that father's occupation affects the education his daughter's husband. If father owns a large business, it increases the husband's education by almost two years. Father's occupation does not seem to have any impact on husband's assets.

Table 1. Means and standard deviations of Independent variables

Independent Variable	Mean	Standard Deviation
Schooling of Woman aged 15 and above (years)	0.898	1.864
Age	34.741	10.173
Length of participation (in Months)	52.422	21.617
Accumulated credit from microcredit programs (Taka)	12314.580	9370.727
Distance to parental household (in Kilometer)	11.586	38.477
No. of Children	4.24	19.87
Spouse not present in the household	0.112	0.316
Highest grade completed by Household Head	1.702	2.780
Percentage of Adult female present in the household	0.526	0.150
Availability of rural health center	0.092	0.289
Availability of family planning center	0.183	0.387
Distance to finished road	2.118	3.002
Price of rice	10.488	1.097
Price of flour	9.110	1.087
Price of hen egg	2.443	1.704
Price of Salt	6.301	0.855
Average female wage	17.448	8.625
Average male wage	36.195	8.815
Availability of electricity	0.492	0.500

Note – Sample size is 87 villages, 1775 households, and 9215 individuals

Table 2 . Description of dependent variables in Mating Equation

Dependent variable	*No of observations*	*Mean*	*Standard Deviation*
Husband's Schooling (Years)	877	5.48	17892.3
Husband's total assets (Taka)	1633	72001.04	3.125

Table 3. Estimates of Husband's Schooling and Total Assets

	Husband's Schooling (OLS)		Log of Total Assets (OLS)	
	Estimates	t-ratio	Estimates	t-ratio
Intercept	0.678	0.61	9.658	16.8
Wife's Schooling	0.638	10.46	0.126	3.49
Wife's Age at First Marriage	0.14	1.95	0.011	0.30
Father's Education	0.161	4.35	0.066	3.20
Whether wife's father is in				
Agriculture	-0.892	-0.775	-0.578	-0.023
small business	0.702	1.36	0.471	0.67
Big business	1.930	2.983	0.890	0.342
Others	0.923	1.03	1.85	0.00

Table 4 reports the estimates of women's main three performance indicators: non-agricultural assets, non-food expenditures and food expenditures. For each category, there are two types of estimates. Column (1) is OLS and column (2) is also OLS but after incorporating unobserved characteristics represented by the residuals obtained from mating function equations.

Not surprisingly, both estimates (Column 1 and 2) of schooling are showing that another year increase in schooling increases women's performance measured by non-agricultural assets. In column (2) estimates, another year of schooling increases non-agricultural assets by around 45 percent. Interestingly estimates coming out of column (2) are much larger than the one in column (1) (almost seven times higher. For non-food and food expenditures, the effect of schooling is not that strong).

Among other explanatory variables, e.g. in the case of age, only column (2) is showing negative impact of aging process on women's performance: around 3 percent decrease in assets if women get older by a year. Other estimates show insignificant result. It might indicate that younger women are more successful in the micro credit programs in terms of asset accumulation and that is not surprising as these are more or less labor-intensive programs. For food and non-food expenditures, on the other hand, it shows positive effect. Though number of children has been accounted for, these increased expenditures might reflect the increasing need of grown up children.

The duration of being member in the programs has positive and significant effect on women's performance only in column (2) estimates of non-agricultural assets. Other significant estimates are not strong enough, though some of those estimates are showing negative effects. For accumulated credit, an increase in one thousand taka loan, increases accumulated assets by 7.5 percents in column (2) which is double the amount estimated by OLS in column 1 (3.1 percent). Food and non-food expenditures show smaller impacts. Distance to parents household does not seem to have any significant impact on women's performance. Hence, staying near or far away from parents' household does not seem to affect married women's performance.

Table 4. Determinants of women's performance

Independent variables	Log of Non-agricultural assets (OLS)		Log of Non-food expenditure (OLS)		Log of Food expenditure (OLS)	
	Estimates (1)	Estimates (2)	Estimates (1)	Estimates (2)	Estimates (1)	Estimate (2)
Intercept	3.258 (6.96)	9.563 (10.33)	5.385 (16.38)	4.944 (8.38)	2.660 (15.17)	2.661 (11.08)
Schooling (years)	0.067 (4.26)	0.440 (3.92)	0.038 (3.33)	0.041 (1.94)	0.013 (2.09)	0.015 (1.71)
Age (years)	0.005 (1.73)	-0.029 (-3.03)	0.003 (1.79)	0.011 (2.46)	0.007 (6.75)	0.015 (8.31)
How long member (Months)	-0.007 (-4.12)	-0.017 (-3.23)	0.003 (3.01)	-0.003 (-1.64)	-0.002 (-3.7)	-0.004 (-4.59)
Accumulated credit	0.031 (7.42)	0.075 (6.58)	0.024 (6.96)	0.014 (2.36)	0.011 (5.71)	0.006 (2.34)
Distance to Parents' household	-0.001 (-1.44)	0.002 (0.52)	-0.001 (-1.12)	0.003 (1.22)	0.000 (-0.58)	0.000 (0.37)
Member of RD-12	-0.301 (-3.27)	-0.302 (-1.42)	0.100 (1.55)	0.101 (0.91)	0.078 (2.26)	0.061 (1.36)
Member of BRAC	0.437 (5.81)	0.704 (3.59)	0.084 (1.44)	0.153 (1.47)	0.070 (2.27)	0.100 (2.36)
Round 2 Dummy	0.265 (3.81)	0.083 (0.64)	-0.077 (-1.57)	-0.106 (-1.32)	0.072 (2.76)	0.077 (2.35)
Round 3 Dummy	0.251 (3.1)	0.280 (1.71)	-0.736 (-12.85)	-0.902 (-9.41)	0.020 (0.67)	-0.123 (-3.17)
Household Characteristics						
No spouse present	0.618 (7.23)	0.422 (3.22)	-0.214 (-3.19)	-	-0.220 (-6.14)	-
No. of Children	-0.239 (-0.93)	0.296 (4.348)	0.000 (0.000)	-0.101 (0.91)	0.000 (0.000)	0.067 (4.26)
Highest education for household head	0.086 (8.23)	-	0.023 (3.07)	0.001 (0.05)	0.005 (1.25)	0.002 (0.48)
Percentage adult female present in the household	-0.306 (-1.8)	-.334 (-3.75)	-0.773 (-5.81)	-0.048 (-0.15)	-0.736 (-10.39)	-0.281 (-2.18)
Village Characteristics						
Any Rural health center?	0.169 (1.83)	0.941 (4.25)	-0.459 (-5.66)	-0.267 (-2.26)	-0.120 (-2.76)	-0.300 (-6.26)

Family planning center?	-0.254 (-2.92)	-1.639 (-7.89)	0.183 (2.65)	0.547 (5.85)	0.113 (3.08)	0.257 (6.77)
Distance to finished road	0.089 (9.06)	-0.227 (-6.05)	-0.009 (-1.34)	0.050 (3.41)	0.005 (1.25)	0.010 (1.7)
Price of Rice	-0.119 (-3.54)	0.056 (0.87)	0.055 (2.23)	-0.029 (-0.72)	0.023 (1.72)	0.023 (1.38)
Price of Flour	0.350 (11.08)	-0.010 (-1.47)	0.074 (3.27)	0.178 (4.54)	0.051 (4.22)	0.047 (2.97)
Price of egg	-0.044 (-3.19)	-	-0.041 (-3.23)	-0.050 (-2.54)	-0.010 (-1.48)	0.009 (1.08)
Price of salt	-0.097 (-2.84)	-	-0.113 (-4.59)	-0.128 (-3.07)	0.027 (2.09)	0.000 (-0.02)
Average female wage	-0.008 (-2.22)	-	0.002 (0.97)	0.004 (1)	-0.004 (-3.49)	-0.003 (-1.6)
Average male wage	0.023 (6.64)	0.520 (4.28)	0.008 (3.13)	0.005 (1.04)	0.003 (2.14)	-0.003 (-1.9)
electricity	0.424 (7.06)	-	0.295 (6.67)	0.370 (4.55)	0.131 (5.56)	0.136 (4.12)
Residual from Husband's schooling equation	-	0.520 (4.28)	-	-	-	-
Residuals from husband's asset equation	-	0.390 (5.1)	-	0.180 (5.29)	-	0.076 (5.48)

Notes: 1. Figures in Parentheses are t-ratios.
2. "-" implies estimates are not available.

The membership dummies to three programs give some important results. To compare between these three programs, I have chosen Grameen Bank as the base. In column (2), assets estimates show that, compared to Grameen Bank members, BRAC members on the average accumulate 70 percent more assets and spend 15 percent and 10 percent more on non-food and food expenditures respectively. This result is surprising in the sense Grameen bank is widely considered the most recognized and effective microcredit program but with this evidence that idea is being contradicted and shows BRAC members are outperforming Grameen members. On the other hand, compared to Grameen Bank member, RD-12 members accumulate 30 percent less assets.

Also included are the round dummies to account for the three rounds of surveys performed to collect the data. These rounds of surveys mainly takes into account the seasonalities influenced by crop cycles. In the case of asset accumulation, there seem to be no significant impact when unobservable effects are taken into account but there are drastic reductions in both food and non-food expenditures in round 2 and round 3 compared to round 1. This is not surprising because round 2 and round 3 are leaner seasons compared to round 1, when household income depending heavily on crop cycles suffers more.

Among household characteristics, households where husband is not present, women performs better. In terms of asset accumulation, women with no spouse present accumulate 42 percent more assets than those women who have spouse present in their households. This is probably because women get more freedom in the decision making process that they would not have got with their husband present and thus become more productive. This result is important because it shows microcredit programs help even those women who are solely dependent upon themselves.

Among other household characteristics, the household head's education seems to have significant impact on women's performance. Additional year of household head's schooling increases asset accumulation by seven percent, whereas impact on food and non-food expenditures is minor. On the other hand, an increase in the percentage of adult female in household seems to be negatively affecting

women's performance. The reason might be, most of the times when other female is present, she is in the form of either mother-in-law or another wife. Socio-culturally, wife does not have good relationship with them (Rajnathan and Kumar 1992) due to several conflicts of interest and probably this affects productivity.

Among the village characteristics, presence of a rural health center considerably increases women's performance, which is not surprising as better health definitely increases productivity of work force in general. Interesting thing is the magnitude of increase. Women on the average accumulate 94 percent more assets than those women who does not have any rural health center present in their village. It also probably helps women to reduce their expenditure on food and non-food items. Hence the reduction in these categories might imply the external benefit of better health environment rather than diminished performance. The higher the distance to finished road, the lower the asset accumulation, which is not surprising as transportation is very important and it raises the production cost. And it also raises food and non-food expenditure as price of the products usually rise with transportation cost. Most of the prices (price for rice, egg etc) show positive relation with food and non-food expenditures for obvious reason. Wage of female does not have any significant impact as access to labor market for the female participants are very limited. As only very limited number of villages have access to electricity, having electricity is a great advantage and it is being reflected on their performance. Asset accumulation increases by almost 42 percent when electricity is present, non-food and food expenditure rises by 37 and 13 percent respectively. With the presence of electricity, it gives women the opportunity to use advance technology in their production and thus become more productive.

The crucial aspect of these estimates is the impact of unobservable characteristics. The residual from husband's schooling equation implies that, one unit increase in the unobservable characteristics which allows the wife's to get a husband with schooling level one year higher, also helps her to accumulate 52 percent more assets after joining the micro credit programs[13]. In the same manner,

[13] Since this is a vector unobserved variables, the units can be selected so that the coefficients are equal to one

the residual from husband's asset equation implies that, one unit increase in the unobservable characteristics which allows the wife to get a husband with one percent more assets, also helps her to accumulate 52 percent more assets after joining the microcredit programs. It has been already mentioned that we have to be cautious about these results for being biased due to the presence of measurement error associated with these unobservable characteristics. Even then, the highly statistical significance of these measures and their positive impact on all three measures of performance indicators underscores the importance of unobservable characteristics in the microcredit programs.

In Appendix B, figure 1 and 2 plots the residuals from the husband's schooling and assets equation against women's accumulated non-agricultural assets. Those two figures clearly shows positive relation between these residuals and women's asset accumulations. It implies that women accumulate more assets if they have more of those unobserved characteristics that helped them get a better husband in the marriage market. Figure 4 and 6 shows the same positive relationship between the residuals from the husband's asset equation and food and non-food expenditures. On the other hand, figure 3 and 5 shows no clear relationship between the residuals from the schooling equation and food and non-food expenditures. It can be inferred that those unobserved characteristics that helped women to attain a husband with higher schooling in the marriage market did not help them perform better in microcredit programs. Probably that is the reason why residuals from schooling equation drop out in the regression involving food and non-food expenditure. Therefore, estimates for these residuals are unavailable in Table (4).

4.3 Specification Tests

Table C1 and C2 in Appendix C provide some specification tests for both marriage market equations and women's performance equations. These equations have underlying statistical assumptions, which have to be satisfied before any inference can be drawn.[14] For testing the normality assumption both Skewness-Kurtosis (D'Agostino and Balanger 1990) and Swilk (Shapiro and Wilk 1965) test have been

[14] For details see Spanos (1986, 1999).

employed. For testing linearity and homoskedasticity, RESET type tests have been employed. In the case of testing linearity, Ramsey Reset test (Ramsey 1969) and for testing homoskedasticity Cook-Weisberg test (Cook and Weisberg 1983) has been used. None of the p-values shows any serious departures from these assumptions.

Now to test for the presence of endogeneity after incorporating the residuals in estimation in estimates (2), Hausman test for endogeneity is employed (Hausman 1978). As already mentioned, the variables that are prone to be endogenous are schooling and accumulated credit. For each suspected endogenous variable, we obtain the reduced form residuals. Then, we test join significance of these residuals in the structural equation, using an F test. In Table 6, these Hausman tests reveal that for estimate (1) for all three performance indicator variable, there is a strong presence of endogeneity – high value of F-statistic implying we can reject the null hypothesis of no endogeneity. On the other hand, for estimates (2), these tests reveal very moderate presence of endogeneity. It would be fair to say that estimated residuals from the marriage market equations sufficiently capture unobserved characteristics of women.

Table 5. Hausman Test for Endogeneity

	Log of Non-agricultural assets	Log of Non-food expenditure	Log of Food expenditure
Estimates (1)	3.912	2.946	5.132
Estimates (2)	1.123	0.923	1.760

5. Concluding Remarks

The main objective in this paper was to determine the important factors that contribute to women's economic success in microcredit programs. Main focus was on finding accurate estimates of women's economic performance by controlling for the unobserved ability of these women.

The information about women's unobserved characteristics has been derived from marriage market interaction. It was argued that residuals from the mating function (where husband's characteristics are determined by wife's observed and unobserved characteristics) provide a consistent representation of wife's unobserved characteristics. These residuals from the marriage market are used in the wife's performance indicator equation along with her observed characteristics.

Observed characteristics such as schooling, age, duration of membership, different program membership and others were found to have significant impact on the accumulated asset. Some of these results have important implications for microcredit programs.

The finding that women's accumulated assets increase by more than ninety percent with the presence of a rural health center is significant for non-credit service of these microcredit programs. Also important is the evidence that women's asset accumulation declines with increase in the percentage of adult women present in the household. It has been already mentioned, for socio-cultural reason, women might not perform well while other women are present in the household who are not participants. This evidence might encourage policy makers to include more than one female member from households where other adult female members are present.

One of the surprising results is the finding that BRAC members are outperforming Grameen Bank member in all three measures of economic performance. The next chapter looks at the mechanisms of these different credit programs individually which might give more insight into understanding important aspects of microcredit programs.

It has been also found that unobserved characteristics (represented by the residuals from marriage market) have significant effect on these women's performance and the presence of them sometimes significantly changes the

magnitude of the effect and sometimes even the direction of the change. Therefore, assessing women's performance only on the basis of observed characteristics might lead to erroneous conclusion. We gain a better understanding of women's performance in the microcredit programs by combining information from both marriage market and microcredit programs.

The finding that unobserved characteristics are important might also validate the group-based nature of these credit programs where members are aware of these unobserved characteristics of each other and try to form a group with members who have the higher quality of these characteristics.

It has been also found that impact of participating in the credit programs as measured by the accumulated credit is considerably less compared to other variables. The effect of credit is about seven percent increase in assets accumulation whereas it has been found that schooling, some household and village characteristics and importantly unobserved effects have caused well over 40 percent increase in assets. This might imply that the credit programs gives the women a outlet to generate income but while they are in the program, other characteristics are more important than merely the amount of credit they have access to.

Chapter 3

Different Microcredit Programs in Bangladesh: A comparative Study

1. Introduction

Microcredit programs, having made their mark in providing credit and other development services to the poor in a non-traditional way, are able to make significant changes in a rural economy. This chapter attempts to compare the impact of these programs on the economic welfare of women. We focus mainly on the operational structure of the same three microcredit programs that was discussed in previous two chapters, namely Grameen Bank, Bangladesh Rural Advancement Committee (BRAC), and Bangladesh Rural Development Board's (BRDB) RD-12 project.

In Bangladesh, there are more than 750 organizations that are working in rural areas to provide credit and non-credit services to target population – largely women from landless households (World Bank, 1996). Grameen Bank and Bangladesh Rural Advancement Committee (BRAC) are two programs well known all over the world. Grameen Bank achieved its fame because of its innovative group-based lending program specifically designed for the poor who are otherwise excluded from formal financial institutions. BRAC, on the other hand, is known for its informal primary education and innovative health program designed also for the poor. BRAC also has micro-credit program targeted at the poor; but, unlike the Grameen Bank, BRAC's emphasis is more on human capital development such as functional literacy, skill-promoting training, awareness, and so on, than on credit. Both programs provide financial services to their members, including savings mobilization. Unlike Grameen Bank, however, BRAC is not a bank and cannot mobilize savings from non-members. By December 2003, Grameen Bank had mobilized more than three million members, of which 95 percent were women. In the same year, BRAC also mobilized more than 3 million members, of whom 88 percent were women. By December 2003, Grameen Bank disbursed US $4.1 billion,

while BRAC disbursed US $294 million. The loan recovery rate for both programs has been consistently more than 90 percent. Also by 2003, the savings mobilized by Grameen Bank were US $227 million compared with US$85.93 million of BRAC.

Given the success of group-based lending, the government of Bangladesh introduced group-based lending schemes in its various programs aimed at promoting rural development. One of the well known replications within the government bureaucracy is the RD-12 project run by the Bangladesh Rural Development Board (BRDB). The BRDB is the successor of the well known integrated rural development program (BRDP) of the 1960s, which gained popularity because of its two-tier co-operative system that served as a vehicle for the delivery of the modern inputs such as high-yielding seeds, fertilizer, and credit. However, the co-operatives failed to recover loans offered to co-operative members. Evidence suggests that the co-operatives were dominated by rural elite who directed most of the government-provided assistance to their own advantage [Khan, 1971]. Recognizing the limitations of the co-operative structure in helping farmers and other groups, the government introduced a microcredit program (the RD-12 project) within its two-tier co-operative structure. Similar to Grameen Bank and BRAC, the RD-12 project is group-based, targeted at the landless farmers, and mobilizes men and women into two separate groups called societies in BRDB terminology. It follows the credit delivery schemes of Grameen Bank, and also adopted BRAC's training programs. The BRDB's RD-12 program appeared to be a successful replication of the group-based microcredit programs. This program started in December 1988 and by 2003 it had mobilized 1.5 million members of whom 70 percent were women, and disbursed US$ 225 million, and its loan recovery rate has also been consistently over 90 percent. The savings mobilized by RD-12 from its members was US$75 million.

This chapter investigates how these different microcredit programs have been performing compared to each other. Using similar program evaluation technique as in chapter 1 and 2, we measure program impact of women's economic welfare for these programs separately. We find that BRAC outperforms Grameen Bank and RD-12 significantly. This result is interesting since Grameen Bank is known to be the most successful microcredit program. This study also tries to find the determinant of

economic success of the women participating in these programs- separately for each program. These results would provide more insights into understanding different aspects of microcredit programs, contribution in reducing poverty.

2. The Group Approach to Targeted Credit

All of the microcredit programs under study have separate programs for men and women, in accordance with the socio cultural norm of Bangladesh (Table 1). Membership is strictly limited to people who own less than half acre of land, are not members of the same household as another program member, have similar economic resources, and live in the same village. Experience shows that the spatial and social cohesiveness developed among individuals of the same gender, residing in the same village, and having similar economic backgrounds are important factors in the smooth functioning of these groups.

The five-member group is the central unit of Grameen Bank. BRAC uses village organizations that comprise 50-60 people from the target population. The village organizations are the central pillar of BRAC. But because the village organizations are difficult to manage, at least for credit delivery and repayment, BRAC introduced solidarity groups of five to seven people within the village organizations to monitor group performance. The village organizations, not the solidarity groups, are the principal functionaries, however. RD-12 follows a structure very similar to that of BRAC. Women join the Mahila (women's) Bittaheen (landless) Samabay (Co-operative) society (MBSS); men join the Bittaheen Samabaya Society (BSS). These societies, consisting of 50-60 members, are federated into that bittaheen central cooperative societies. RD-12 has found that the small group approach works better than the large group approach in monitoring group performance in loan utilization and repayment.

In all three programs, groups hold weekly meetings in the presence of a group organizer to review the group's performance and deposit their weekly savings of Tk 1 -Tk 2. They also learn, practice, and discuss the rules of the program and other group activities. Weekly loan installments are also repaid at these meetings. Each group elects a leader, who is responsible for the discipline of the group members. All members have the chance to lead their groups. The leader of the group initiates loan proposals at the monthly center or village organization meeting. A community leader is elected to manage the centers, village organizations, or cooperative societies

and is responsible for reviewing loan applications, monitoring loans, and performing other noneconomic service.

Table 1. Features of Three Microcredit programs

Program feature	Grameen Bank	BRAC	RD-12
Membership criteria	Maximum landholding of half an acre of land. Only one member allowed per household.	Maximum landholding of half an acre of land; at least one household member must work for wages. One household member may earn daily wages. Since 1992 one member allowed per thousand.	Maximum landholding of half an acre of land; at least one household member must work for wages. More than one member allowed per household.
Group Features	Five members form a group. Five to eight groups constitute a center. Separate groups for men and women. Weekly meetings of groups.	30-40 members form village organizations.Village organizations are divided into solidarity groups for men and women. Each men's group has a counterpart women's group. Weekly meeting of solidarity groups.	15-35 members from primary cooperatives. Primary cooperatives are divided into solidarity groups 4-5 members. Separate cooperative for men and women. Separate groups for men and women. Weekly meetings of cooperatives.
Savings Mobilization	Tk 1 per week. 5 percent of each loan (nonrefundable) goes to group fund. 0.5 percent of each loan used for group insurance.	Tk 2 per week. 4 percent of each loan	Tk 2 per week. 5 percent of each loan goes to group fund. Mandatory purchase of cooperative share of Tk 10 per member per year.
Credit delivery mechanism	No collateral but group liability. 50-week installment of loan. Interest at the end of loan cycle. 20 percent interest for general loan, 8 percent for housing loan. Maximum loan Tk 10,000.	No collateral but group liability. 50-week installment of loan. Interest at the end of loan cycle. 20 percent interest rate of production loans. Maximum loan Tk 10,000.	No collateral but primary cooperative liability. 50-week installment of loan. Interest at the end of loan cycle. 16 percent interest rate for production loans
Social development	Training duration 15-30 days. Review of code of conduct at center meetings. Minimal skills-based training.	Training duration 3-6 months. Review of code of conduct at village organization meetings. Substantial skill-based training.	Training duration 3-6 months. Review of code of conduct at primary cooperative meetings. Substantial skills based training.

3. Provision of Noncredit Services by Microcredit programs

A blend of credit and noncredit services is the hallmark of microcredit institutions, with the mix varying form institution to institution. Grameen Bank relies heavily on credit, while BRAC has an elaborate noncredit component. Program designs evolve over time and are conditioned by the philosophy of the program.

BRAC began with the idea that economic dependency on exploitative forces was source of poverty in rural areas. It thus began to mobilize the poor and instruct them through consciousness-raising training about these exploitative forces. In this process the poor also tried to learn how to access public resources distributed by the government. Literacy and health programs were also provided. BRAC soon found that its training was inadequate to improve the conditions of the poor who did not own productive means, such as land or capital. It found that credit is need to make the poor productive through self-employment. In order to receive credit for BRAC, however, the poor must go through rigorous training for at least six months.

Grameen Bank differs in its approach. It believes that the poor need training only on how to bank with an institution such as Grameen Bank. Since they are familiar with an informal activity, such as processing, transportation, or poultry raising, they can begin a productive activity immediately once they have access to credit. Hence Grameen Bank provides credit soon after its members are familiar with bank formalities. During this training period, group members are instructed in other areas, such as kitchen gardening, health care, nutrition, productivity and housing. Grameen Bank distributes seeds and seedings to members and supplies low-cost housing materials to borrowers, and encourages members to open nursery schools at centers for preschool children (so that preschool children are taken care of while mothers attend Grameen Bank meetings). Training in social and health issues is also a part of regular programs.

BRAC and RD-12 offer similar training in social and health issues. BRAC also has developed a functional education program for its many illiterate members and a nonformal primary education (NFPE) program directed at school-age children who are out of school or have never attended school primarily for economic reasons. The objective of the NFPE is to help these children achieve basic literacy, numeracy,

and social awareness. Older children complete this course in one and a half years and then become eligible to enroll in class six of formal middle school. Younger children complete this course in three years and follow the same path. BRAC employs the teachers of the NFPE school and provides books and learning materials; parents of BRAC members help run the school. Because of the success of NFPE program, BRAC has helped a World Bank – funded general education project incorporate this idea nationwide. BRAC has developed similar innovative primary health care programs.

What makes BRAC and RD-12 distinct from Grameen Bank is their skills development training programs. Grameen Bank believes that skills development is not necessary for the poor to become productively self-employed; only the provision of credit is necessary. In contrast, BRAC assumes that while credit-only programs help the poor to become self-employed and generate cash income, the poor would benefit even more if they could use more modern methods and skills. This has led BRAC to invest staff time and other resources in developing training materials that improve productivity in key economic sectors, including poultry, livestock, sericulture, fisheries, and agriculture (irrigation and use of high-yielding seed varieties). BRAC's efforts have helped break the sectoral bottlenecks for improved productivity and have increased the income and employment of members. They have also helped spread technology to other members of the community.

Similar sector-specific training programs have been launched by RD-12. RD-12 follows the BRAC approach in providing skills training in key economic sectors. Members of primary cooperative societies are trained to undertake profitable and productive income-generating activities and to use credit and other external resources available for socio-economic development. The objective of skills-based training is to provide members with practical training directly related to their current or proposed income-generating activities. Training is provided in livestock and poultry raising, fisheries, processing, and repair and servicing of agricultural tools and equipment.

4. Participation among Target Households

Less than half (45 percent) of all eligible households participated in microcredit programs (figure 3.1). The participation rates were 44 percent in Grameen Bank villages, 52 percent in BRAC villages, and 33 percent in RD-12 villages.

Women represented 76 percent of program participants in Grameen Bank villages, 73 percent in BRAC villages, 44 percent in RD-12 villages, and 67 percent in all program villages. The dropout rate among participating households was 9 percent in Grameen Bank villages, 8 percent in BRAC villages, and less than 1 percent in RD-12 villages. Net program participation among target households was 40 percent for Grameen Bank, 48 percent for BRAC, and 33 percent for RD-12.

The average length of program participation for current members was 3.7 years for all programs, 4.3 years for Grameen Bank, 3.8 years for BRAC, and 2.8 years for RD-12 (figure 3.2). Thus Grameen Bank members on average had more program exposure than members of other programs. Among participants who dropped out , the average length of program participation was 3.4 years, and it was higher for Grameen Bank and BRAC (3.5 years) than for RD-12 (2 years).

Participating households must meet the eligibility criterion (namely owning no more than half an acre of land). Household surveyed were asked about the extent of their landholding before they joined a program. The eligibility criterion was met by 79 percent of households in Grameen Bank villages, 83 percent in BRAC villages, and 85 percent in RD-12 villages. These findings suggest that these microcredit programs enforce their eligibility criteria tightly.

Among participants who met the eligibility criterion, a larger proportion came from landless households (owning no operational holdings) than from landed households (owning no more than half an acre of land). Landless households represented 55 percent of Grameen Participants, 65 percent of BRAC participants, and 58 percent of RD-12 participants . This suggests that BRAC is better at targeting the ultra poor than Grameen Bank or RD-12.

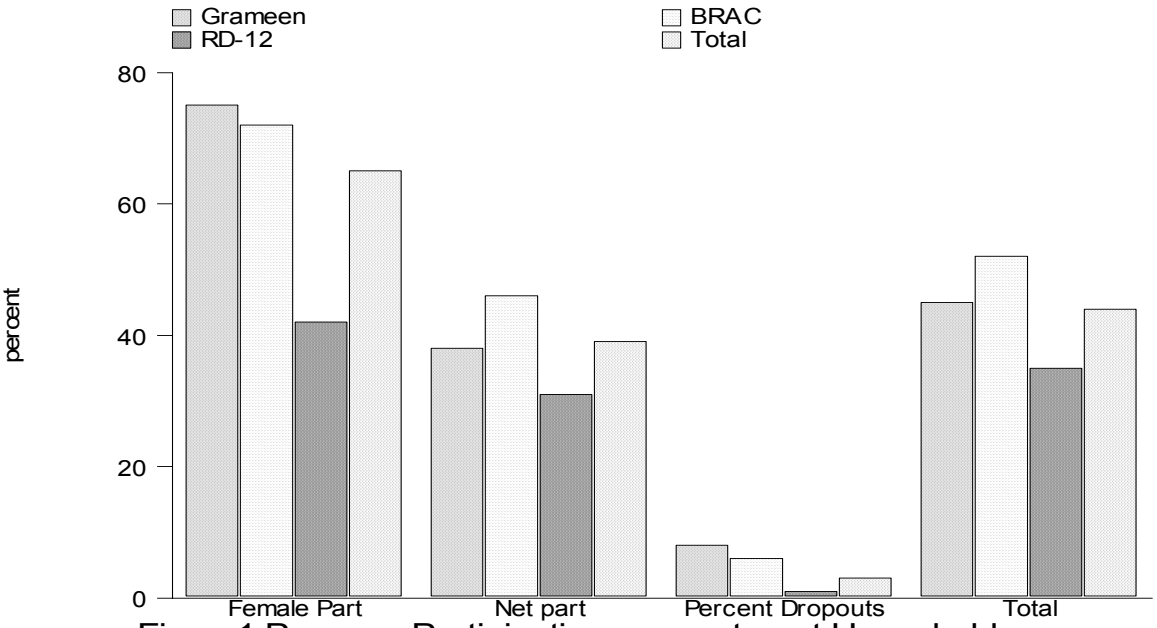

Figure1:Program Participation among target Households

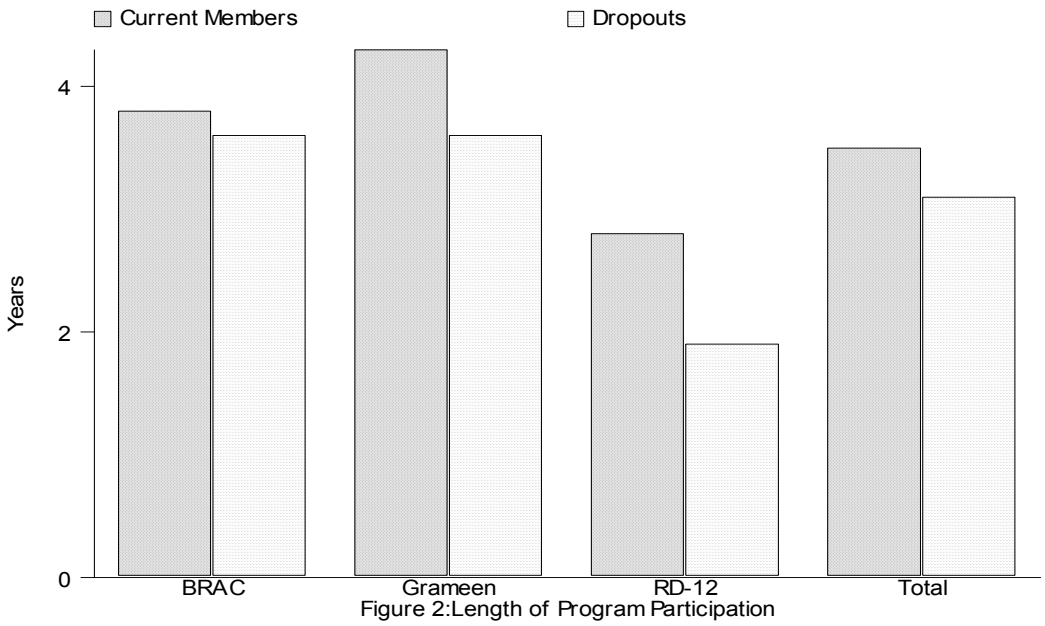

Figure 2:Length of Program Participation

5. Results of Program Effect comparison

Table 2, 3 and 4 summarizes program effect of different microcredit programs. BRAC shows superior performance for almost all the measures. This program impact measures uses the same program impact technique used in the previous chapters. The participation impact has been instrumented by the distance variable and all the individual, household and village characteristics have been also controlled for[15]. One very surprising result comes out of this whole exercise. The program impact measure for BRAC is consistently greater than Grameen Bank and RD-12 for all the three measures. BRAC members accumulated 14 percent more non-agricultural assets than Grameen Bank members and 24 percent more than the RD-12 members; BRAC members spend 12 percent more on food expenditures than Grameen Bank Members and 30 percent more than RD-12 members; BRAC members spend 9 percent more on non-food expenditures than Grameen Bank members and 17 percent more than RD-12 members.

This result is surprising because Grameen Bank is the pioneer of microcredit movement and considered the premium microcredit institution not in the Bangladesh only, also through out the world. But what we see here is that BRAC has outperformed Grameen Bank in every measure we used in this paper. The main reason might be that while Grameen Bank has innovated the unique micro lending system, they did not emphasize much on other aspects of human capital development. They mainly emphasize that poor are mainly constrained by credit and all they need is capital to move them towards prosperity. On the other hand BRAC's emphasis is more on human capital development such as functional literacy, skill-promoting training, awareness, and so on, than on credit. Our evidence shows that this approach is more effective than Grameen Bank's approach. BRAC's approach might make each member more productive with the skill they achieve under their program. Now when we analyze in the following analysis, the contribution of each factors as we have done in the previous chapters we might get a better understanding why BRAC is more successful than other groups.

[15] But the tables do not include those characteristics to focus on the main result.

Table 2. Estimates for different program evaluation measures (Non-agricultural Assets)

	Non-agricultural assets (BRAC)	Non-agricultural assets (Grameen Bank)	Non-agricultural assets (RD-12)
Time (d_t)	87.934	104.791	126.32
	(0.79)	(7.91)	(1.26)
Group (d^j)	953.230	1027.765	1281.31
	(1.86)	(1.97)	(3.26)
Program effect	703.69	679.13	565.16
(d_t^j)	(2.23)	(3.36)	(3.36)
Constant	387.21	1285.130	1852.12
	(1.52)	(8.36)	(13.52)

Table 3: Estimates for different program evaluation measures (Food Expenditures)

	Food Expenditures (BRAC)	Food Expenditures (Grameen Bank)	Food Expenditures (RD-12)
Time (d_t)	0.338	0.868	3.83
	(0.59)	(1.55)	(3.59)
Group (d^j)	3.071	6.037	5.130
	(4.91)	(0.89)	(0.72)
Program effect	8.923	5.139	7.921
(d_t^j)	(.567)	(2.95)	(6.980)
Constant	51.317	82.245	77.311
	(23.37)	(23.71)	(53.73)

Table 4 : Estimates for different program evaluation measures (Non-Food Expenditures)

	Non-food Expenditures	Non-food Expenditures	Non-food Expenditures
Time (d_t)	227.17	212.91	132.980
	(1.36)	(2.387)	(2.963)
Group (d^j)	887.26	906.26	864.41
	(2.15)	(2.59)	(5.78)
Program effect	497.71	313.630	301.223
(d_t^j)	(1.231)	(4.67)	(1.774)
Constant	37.13	12.09	12.08
	(9.57)	(6.76)	(16.05)

Table 5 reports the estimates of women's main three performance indicators: non-agricultural assets, non-food expenditures and food expenditures. For each category of performance indicators, we estimate the effect of their determinants separately for BRAC, Grameen Bank and RD-12. We observe that BRAC is almost outperforming Grameen Bank almost every factors that affect their performance. Most of the factors are much more productive in BRAC than in Grameen Bank or RD-12. Now let us take a closer look at some of the important factors.

Another year of schooling brings about 12, 7 and 6 percent increase in non-agricultural assets, non-food and food expenditures respectively for BRAC participants compared to only 8, 3 and 5 percent increase for Grameen Bank participants. In the same way, we find that another thousand Taka of credit is more productive for BRAC participants than Grameen Bank participants. Most of the other characteristics are also showing the same trend. For example, the presence of electricity which is shown to have significant factor in the previous chapter also indicates here that electricity itself is much more productive in BRAC villages than in Grameen villages.

More interestingly, even the unobserved characteristics are found to be more effective for the BRAC participants than any other participants which includes Grameen Bank participants also.

These are the evidence for the strong BRAC institution, incorporating non-credit services which prepares members to be well-equipped with the abilities to perform well. It shows that skills development training is very important and that is the probably the reason why BRAC shows superior performance than Grameen Bank in every respect.

Table 5. Comparing determinants of women's performance

Independent variables	Log of Non-agricultural assets (OLS)			Log of Non-food expenditure (OLS)			Log of Food expenditure (OLS)		
	Estimates (BRAC)	Estimates (GB)	Estimates (RD-12)	Estimates (BRAC)	Estimates (GB)	Estimates (RD-12)	Estimates (BRAC)	Estimates (GB)	Estimates (RD-12)
Intercept	2.955 (3.36)	3.159 (4.70)	6.319 (5.46)	6.162 (13.6)	3.445 (11.77)	7.438 (12.96)	2.551 (11.64)	2.186 (12.79)	2.863 (10.0)
Schooling	0.091 (3.13)	0.124 (5.75)	0.000 (0.01)	0.025 (1.54)	0.073 (7.99)	0.027 (1.62)	0.006 (0.78)	0.020 (3.79)	0.015 (1.83)
Age (years)	0.013 (2.79)	0.008 (1.86)	0.010 (1.17)	0.003 (1.17)	0.006 (3.27)	-0.003 (-0.85)	0.006 (5.65)	0.012 (12.37)	0.003 (1.65)
How long member (Months)	-0.006 (-2.54)	-0.002 (-0.8)	-0.006 (-0.8)	-0.002 (-1.91)	-0.004 (-3.31)	-0.004 (-2.01)	-0.002 (-2.93)	0.001 (1.47)	-0.006 (-5.99)
Accumulated credit	0.016 (1.35)	0.030 (5.74)	0.082 (2.84)	0.031 (5.55)	0.019 (7.67)	0.019 (1.66)	0.019 (7.16)	0.002 (1.47)	0.022 (3.88)
Distance to Parents' household	-0.005 (-3.28)	0.000 (0.64)	-0.004 (-1.4)	0.001 (0.61)	-0.001 (-1.65)	0.000 (-0.42)	0.000 (-0.36)	0.000 (-0.53)	0.000 (-0.58)
Round 2 Dummy	0.536 (4.06)	0.074 (0.84)	0.094 (0.50)	-0.042 (-0.58)	-0.097 (-2.47)	-0.123 (-1.58)	0.105 (3.02)	0.106 (4.63)	0.069 (1.77)
Round 3 Dummy	0.582 (3.80)	-0.068 (-0.63)	-0.085 (-0.4)	-1.010 (-12.66)	-0.480 (-10.34)	-0.684 (-7.12)	0.057 (1.48)	-0.013 (-0.47)	0.046 (0.97)
Household Characteristics									
No spouse present	0.793 (4.87)	0.487 (4.83)	0.378 (1.45)	-0.252 (-2.97)	-0.288 (-5.45)	-0.316 (-2.71)	-0.301 (-7.31)	-0.201 (-6.52)	0.009 (0.15)

Highest education for household head	0.039 (2.03)	0.125 (9.76)	0.004 (0.13)	0.018 (1.77)	0.032 (5.63)	0.012 (0.88)	0.009 (1.78)	0.001 (0.44)	-0.001 (-0.1)
Percentage adult female present in the household	-1.604 (-5.4)	0.569 (2.75)	-1.115 (-2.3)	-0.752 (-4.69)	-0.542 (-5.03)	-0.603 (-2.35)	-0.696 (-8.98)	-0.695 (-11.03)	-0.417 (-3.27)
Village Characteristics									
Any Rural health center?		-0.310 (-2.77)	1.341 (4.70)		-0.414 (-7.1)	-0.820 (-5.41)		-0.148 (-4.35)	-0.003 (-0.04)
Family planning center?	-0.876 (-2.47)	0.119 (1.33)	-5.282 (-8.7)	-0.496 (-2.14)	0.160 (4.48)	1.210 (4.25)	-0.521 (-4.65)	0.098 (4.72)	0.500 (3.54)
Distance to finished road	0.142 (8.73)	0.069 (4.98)	0.134 (3.17)	-0.023 (-2.51)	-0.005 (-0.84)	-0.004 (-0.37)	0.013 (3.02)	-0.010 (-2.58)	-0.006 (-0.99)
Price of Rice	0.010 (0.14)	-0.189 (-4.0)	-0.229 (-2.4)	0.034 (0.98)	0.160 (7.46)	0.021 (0.49)	0.058 (3.44)	0.005 (0.37)	0.073 (3.50)
Price of egg	0.220 (1.87)	-0.027 (-2.08)	0.026 (0.33)	0.112 (1.71)	-0.060 (-8.42)	-0.030 (-0.67)	0.094 (2.98)	-0.024 (-5.91)	0.014 (0.65)
Price of salt	-0.065 (-0.92)	0.005 (0.12)	-0.341 (-4.2)	-0.141 (-3.9)	-0.033 (-1.52)	-0.242 (-6.5)	0.034 (1.92)	-0.013 (-1.01)	0.020 (1.06)
Average female wage	-0.020 (-3.02)	0.011 (2.52)	0.001 (0.12)	0.004 (1.25)	-0.001 (-0.64)	0.008 (1.75)	-0.003 (-1.95)	-0.007 (-6.06)	-0.007 (-3.3)
Average male wage	0.008 (1.01)	0.031 (7.19)	-0.006 (-0.6)	-0.006 (-1.48)	0.012 (6.26)	-0.003 (-0.65)	0.001 (0.63)	0.000 (-0.37)	0.008 (3.25)
Electricity	0.524 (4.97)	0.315 (3.85)	0.488 (1.91)	0.339 (5.62)	0.349 (9.46)	0.107 (1.14)	0.133 (4.54)	0.181 (8.40)	0.125 (2.69)
Residual from Husband's schooling equation	0.372 (6.13)	0.09 (2.21)	0.27 (0.07)	-	-	-	0.087 (0.97)	0.176 (8.91)	0.061 (3.32)
Residuals from husband's asset equation	0.195 (0.720)	0.00 (1.62)	0.76 (0.00)	-	-	-	0.342 (6.79)	0.06 (0.00)	0.125 (0.132)

Note. – Figures in Parentheses are t-ratio

6. Concluding Remarks

This article attempted to compare the impact of three microcredit programs on the economic welfare of women. We focused on mainly three most important microcredit programs in Bangladesh, namely Grameen Bank, Bangladesh Rural Advancement Committee (BRAC), and Bangladesh Rural Development Board's (BRDB) RD-12 project.

Using similar program evaluation technique as in the above paper, we measured program impact of women's economic welfare for these programs separately. We find that BRAC outperforms Grameen Bank and RD-12 significantly in all the three welfare measure that we have used. This result is interesting since Grameen Bank is known to be the premier microcredit programs. This study also tries to find the determinant of economic success of the women participating in these programs- separately for each program. These results provide more insights why BRAC is more successful than other two microcredit programs. We find that all the important factors of production are more productive in BRAC than in other programs. This finding helped us to conclude that the emphasis of BRAC on human capital development and skill training has resulted in their superior performance compared to other microcredit programs operating in Bangladesh.

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Appendix A

Table 1 : Misspecification Tests for Participation equation

Misspecification Tests	
	P-value
Normality Tests	
(a) Skewness-Kurtosis	0.732
Skewness	0.291
Kurtosis	0.445
(b) Shapiro-Wilk	0.413
RESET Test for Linearity	0.572
Cook-Weisberg Test for Homoskedasticity	0.77

Appendix B : Plots of residuals and Women's performance

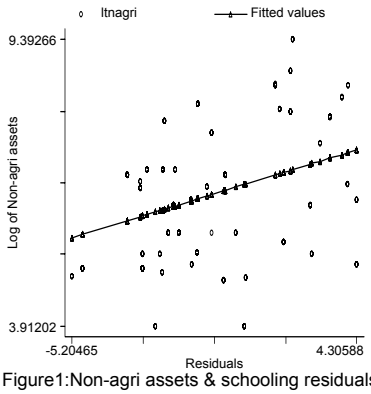

Figure1:Non-agri assets & schooling residuals

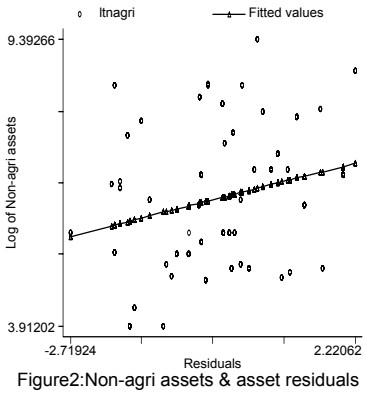

Figure2:Non-agri assets & asset residuals

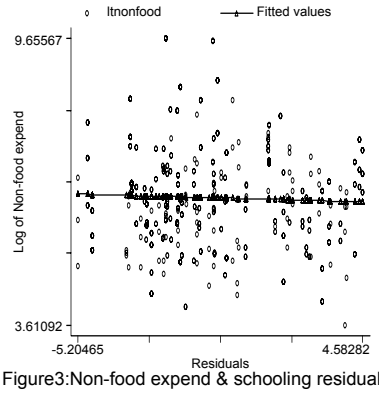

Figure3:Non-food expend & schooling residuals

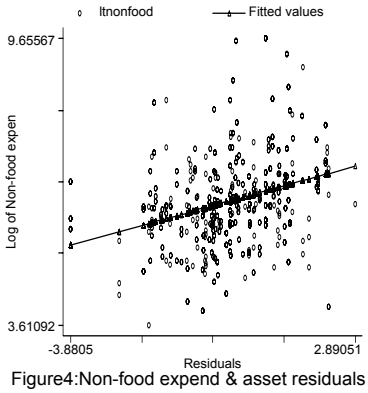

Figure4:Non-food expend & asset residuals

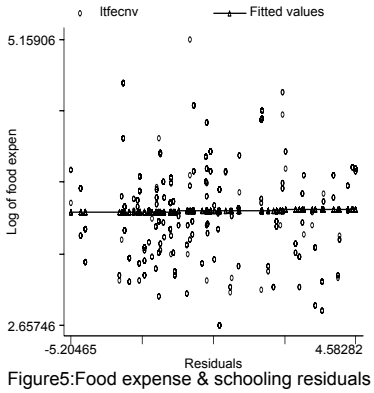

Figure5:Food expense & schooling residuals

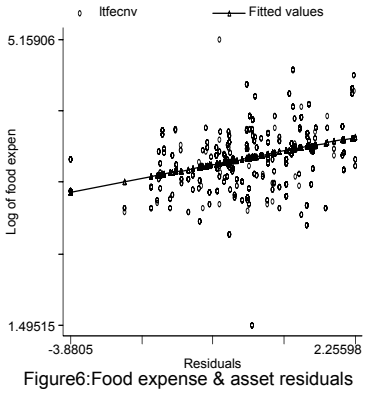

Figure6:Food expense & asset residuals

Appendix C

Table C1 : Misspecification Tests for Marriage Market equations

	Husband's Schooling equation	Husband's Asset equation
	P-value	P-value
Normality Tests		
(a) Skewness-Kurtosis	0.992	0.183
Skewness	0.991	0.180
Kurtosis	0.995	0.158
(b) Shapiro-Wilk	0.999	0.359
RESET Test for Linearity	0.078	0.048
Cook-Weisberg Test for Homoskedasticity	0.221	0.1080

Table C2 : Misspecification Tests for Women's Performance equations

	Non-agricultural assets	Non-Food Expenditures	Food Expenditures
	P-value	P-value	P-value
Normality Tests			
(a) Skewness-Kurtosis	0.292	0.381	0.312
Skewness	0.761	0.118	0.669
Kurtosis	0.125	0.851	0.925
(b) Shapiro-Wilk	0.298	0.953	0.123
RESET Test for Linearity	0.273	0.248	0.981
Cook-Weisberg Test for Homoskedasticity	0.122	0.108	0.528

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