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Household and Intrahousehold Impact of the Grameen Bank and Similar Targeted Credit Programs in Bangladesh

Mark M. Pitt
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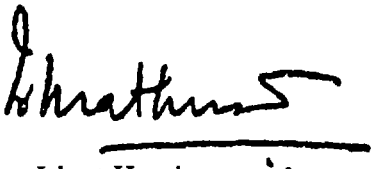
FOREWORD

Providing credit to the rural poor and developing viable credit institutions within the broader objectives of poverty alleviation is a well established development policy, but there are few good studies of effects and sustainability. The research project RPO 676-59 "Credit Programs for the Poor: Household and Intrahousehold Impacts and Program Sustainability" was designed with appropriate research methods to examine these important issues. Bangladesh was selected as a suitable location to apply such methods because it has a number of targeted programs with varying designs, including the Grameen Bank, the BRAC and the BRDB's RD-12 operated by the government and non-government organizations.

One objective of this research was to develop a methodology to estimate the costs and benefits of group-based credit programs. It included the identification of program effects on household and individual outcomes as well as the analysis of the participation of women in these credit programs and the ensuing effects on household and intrahousehold outcomes by gender.

Another objective was to analyze the financial and economic efficiency of the credit programs, which depend on resource-intensive group formation and monitoring. While peer monitoring reduces the transaction costs of lending to the poor, group formation and monitoring is costly and group members may not be able to bear the full costs of a program. The aim was to estimate the cost structures of the programs and examine how the programs operate and whether and under what conditions such group-based credit programs are sustainable.

This paper is one of several papers produced as a research output under this research project. It estimates the influence of borrowing by both men and women for each of three programs (GB, BRDB, BRAC) under the study on a variety of household and intrahousehold outcomes. These outcomes include the school enrollment of boys and girls, the labor supply of women and men, the asset holdings of women, recent fertility and contraceptive use, consumption, and the anthropometric status of children. Estimates show that credit is a significant determinant of manyof these outcomes. However, credit provided to women was found more likely to influence these behaviors than credit provided to men. In short, targeted credit to women has a significant effect on the well-being of poor household and the effect is greater when women are the program participants.



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ABSTRACT

Group-based lending programs for the poor have become a focus of attention in the development community over the last several years. To date, there has been no comprehensive investigation of their impact on household behavior that has been sufficiently attentive to issues of endogeneity and self-selection. Perhaps one reason for this is the absence of any data generated from social experiments associated with these credit programs, and from the difficulty in finding valid instrumental variables (exclusion restrictions) to deal with the endogeneity bias in non-experimental data.

This paper surmounts these issues by treating the choice of participating in credit programs in a sample of Bangladeshi households and villages as corresponding to a "quasi-experiment" conditional on all observed (in the data) and unobserved village characteristics. It uses the same approach to help identify the separate effects of lending to female and male household members, making use of the fact that credit groups are single-sex and groups for both sexes are not available in all villages. The data were collected in a special survey carried out in 87 rural Bangladeshi villages during 1991-92. A comparison of our econometric method with more naive approaches clearly indicates the importance of our attentiveness to endogeneity in evaluating these credit programs.

The paper provides separate estimates of the influence of borrowing by both men and women for each of three credit programs (the Grameen Bank, the Bangladesh Rural Advancement Committee (BRAC), and the Bangladesh Rural Development Board's RD-12 program (BRDB) on a variety of household and individual outcomes. These outcomes include the school enrollment of boys and girls, the labor supply of women and men, the asset holdings of women, recent fertility and contraceptive use, consumption, and the anthropometric status of children. We find that credit is a significant determinant of many of these outcomes. Furthermore, credit provided to women was more likely to influence these behaviors than credit provided to men, and had the greatest impact on variables associated with women's power and independence. In short, program credit has a significant effect on the well-being of poor households in Bangladesh and this effect is greater when women are the program participants.

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1. Introduction

This paper evaluates the effects of three group-based credit programs (the Grameen Bank, the Bangladesh Rural Advancement Committee (BRAC), and the Bangladesh Rural Development Board's (BRDB) Rural Development RD-12 program) on measures of household welfare and on the intrahousehold distribution of resources. These programs are the major small-scale credit programs in Bangladesh that provide credit and other services to the poor, who are otherwise excluded from formal credit institutions because they lack material collateral. While the BRAC is an NGO, the BRDB's RD-12 is a government project, and the Grameen Bank is a rural bank with only about 10 percent of equity owned by the government (the rural poor owning the remainder), all three programs work exclusively with and for the rural poor. Although the sequence of delivery and the provision of inputs vary from program to program, all three programs essentially offer credit to the poor (defined as those who own less than 50 decimals of land, the poor are henceforth referred to as "target" households) with group collateral where group responsibility and loan repayment are tied to lending.[1]

Unlike formal financial institutions, these targeted programs mobilize the poor into groups, give them training, ask them to regularly save a small amount of money, and help them identify a source of employment for generating income. The self-employment activity is, of course, selected by the individual member, but with group approval. The group's incentive to monitor the behavior of individual members is its collective future ability to borrow.

Although some have identified an inadequate credit supply as a constraint on production, and hence channeling credit to the rural poor for productive purposes has been emphasized in many developing countries, including Bangladesh, formal financial institutions have hardly succeeded in reaching the poor.[2]

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[1] The landholding ceiling of not more than 50 decimals is the general criterion of participation for all three programs. However, for the Grameen Bank, household assets (both land and non-land) must not exceed the value of an acre of land in areas of its operation. The BRAC and BRDB emphasize that in addition to the ownership of less than 50 decimals of land, at least one family member of the participating households should be selling labor to the local wage market prior to program participation.

[2] Several types of credit institutions (such as commercial banks, specialized agricultural credit agencies, rural banks, cooperatives and government-supported projects) have been widely used to deliver rural credit. Because of deliberate policy and for other reasons the interest rates were held below the market-clearing rates and credit was thus rationed. Evaluations have found that the rich rural elite have been the principal beneficiaries of these credit

This is partly because of the formal institutions' stringent asset-based collateral requirements and partly because of inherent weaknesses in program design.[3] Although informal credit markets operate in rural areas, moneylenders usually charge very high rates of interest (for varying reasons), preventing the rural poor from making any sustained gains in income through productive investments. Affordable credit for productive activities would lead, if the effects are sustainable, to improvements in income, welfare and asset positions. Among the poor, this may have a significantly greater impact on women than men, since in many societies the former are burdened by socio-cultural as well as financial constraints.[4]

The failure of formal institutions to reach the rural poor led to the evolution of credit cooperatives and lending groups as alternative vehicles of rural financial intermediation. Both group-based organizations and credit cooperatives were seen as ways of reaching those who did not otherwise have access to the formal financial system. The risk of default and transaction costs were also expected to decrease as these groups incorporated some form of joint liability and monitoring (for theoretical issues, see Varian, 1990; Stiglitz, 1990). In practice, there have been problems with credit cooperatives and group lending in India, Egypt, Venezuela, Kenya and Lesotho, but examples from Cameroon, Malawi, South Korea, Malaysia, and Bangladesh highlight their successes.

The small-scale credit programs, such as the Grameen Bank, BRAC and BRDB RD-12 of Bangladesh, seem to have promoted targeted credit as a means of enabling the poor to break out of the

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programs and, thus, the major portion of the credit did not reach the intended beneficiaries -- the poorest rural households (World Bank 1975).

[3] Inadequate emphasis is placed on the mobilization of rural savings, which has weakened the formal sector institutions. Also, the role of interest rates in stimulating rural financial markets is ignored in program design (Adams and Von Pischke 1984). Since credit is sometimes seen as a process of intermediation (rather than as an input for production), the critical issue is improving this intermediation process through market forces. This involves reducing the costs of intermediation, increasing the dependability of the lender, providing appropriate services to the borrower and enhancing savings mobilization. However, viewed from the framework of imperfect information, financial intermediation does not resolve the problems of screening, incentives and enforcement in the rural credit market (Hoff and Stiglitz 1990). Nor does it ensure that important groups, such as the landless or poor women, gain access to credit. It follows that providing credit and other financial services, especially to the poor and women, requires innovative program design.

[4] By expanding opportunities for women (relative to men) to undertake productive income-earning activities that affect their status, the welfare of their families may be positively and more than proportionately affected. This is, of course, a testable proposition that will be addressed in this paper. For discussion on the plight of poor women in rural Bangladesh, see World Bank, 1989.

vicious cycle of low capital, low productivity, low income, low savings, and consequent low capital. The Grameen Bank, for example, provides credit to members in self-selected groups of five persons, who are collectively responsible for each member's repayment. Members are required to make weekly repayments and minimum weekly savings as well as mandatory contributions to group savings and insurance funds (for details, see Hossain, 1988; Khandker and others, 1994a; Wahid, 1992). Loan recovery rates have been consistently above 90 percent. By the end of 1993, this program had served 1.8 million borrowers of whom 94 percent were women, disbursing the equivalent of $311 million and mobilizing $218 million in savings and deposits (Khandker and others, 1994a).

Program evaluations suggest that the Grameen Bank's success rests with its creation of a market niche and its outreach to poor rural women (Khandker and others, 1994a; Von Pischke, 1991; Yaron, 1992). Although the committed leadership of founder Professor Muhammad Yunus and the availability of foreign subsidized funds and grants were instrumental in its inception and institutional development, the Grameen Bank has institutionalized a highly decentralized management structure with the potential capacity to operate on market-based resources and without the continued leadership of Professor Yunus. Over time the Grameen Bank has reduced its reliance on foreign funds for on-lending: the foreign proportion of total funding was 58 percent in 1993 compared to 98 percent in 1987 (Khandker and others, 1994a). About 54 percent of the Grameen Bank's 1,040 branches recorded profits in 1993.

Similar analyses of the BRAC and the BRDB's RD-12 program suggest that although there is scope for improving cost efficiency, these targeted credit programs have the potential to become viable, given their program design, leadership, and institutional development (Khandker and Khalily, 1994; Khandker and others, 1994b). However, the long-run sustainability of these programs depends to a large extent on the viability of the borrowers that they serve. Since these programs are organizations for the poor and their objective is to alleviate poverty, they cannot sustain their operations unless the accrued benefits to the poor from program participation are sustainable. As such, the critical issues are what these programs have accomplished and for whom, whether their impacts are quantifiable and sustainable and, if so, what policy implications may result.

Participation in a targeted credit program such as the Grameen Bank is self-selective; an individual member of a target household is free to choose whether to participate. The decision to participate is based on her/his expected costs and benefits from program participation. Although membership is free, program participation is costly, since group formation, training, and other group activities are time consuming and involve opportunity costs of time spent in group-based activities. But program participation (joining the group) provides access to institutional credit and other organizational inputs that are often inaccessible to many rural households.

Once a household decides to participate, it is important to identify the effects of program participation on household and individual outcomes, such as assets, consumption, employment, time allocation and investment in children. This is cruicial in order to quantify whether a credit program achieves its stated goal of reducing poverty. The fragmented literature on credit programs suggests that participants do benefit from the programs, as reflected in higher income and employment among participants (e.g., Hossain, 1988; Wahid, 1993; Amin and others, 1994). However, there are serious weaknesses in the methodologies used in the pre-existing literature to study the impact of credit programs on household outcomes. More rigorous research is needed to fully identify and quantify this impact.

A related task is to analyze women's participation in these credit programs and measure the impact on the productivities of women and men and any induced effects on household and intrahousehold consumption and investment. As noted earlier, the major beneficiaries of these group-based credit programs are women who, independently of their husbands, earn cash income from investments made as a result of their access to credit and related inputs. In Bangladeshi society, where the mobility of women is restricted and they are traditionally not allowed to participate in income-earning activities outside the home, direct access to credit and other inputs can significantly influence women's cash earnings. This raises two important questions: (i) Does increased personal income enhance women's influence in household decision-making, and, if so, what are the results on intrahousehold resource allocation? (ii) Do the induced effects of credit programs differ by the gender of the program participants?

The third aspect of household and intrahousehold impacts of credit programs is to distinguish credit effects from non-credit effects. Programs such as the Grameen Bank and the BRAC also provide non-credit

services to the poor, such as consciousness-raising and skill development training. Such social intermediation is often seen as a complement to financial intermediation for the poor. Since program participation thus provides access to both financial and non-financial services, their relative importance cannot be discerned by examining the total impact of program participation. For policy purposes it is necessary to document the relative importance of these financial and non-financial services in the household or individual behavioral outcomes, in particular to ascertain whether non-financial services are a major factor limiting effective poverty alleviation.[5]

Very few studies have attempted to identify the causal effects of program participation, let alone credit versus non-credit effects or gender effects of credit and non-credit services or program participation.[6] The studies that attempted to evaluate program impact did so by comparing the outcomes between participating and non-participating households. To the extent that program participation is self-selective, it is not clear whether measured program effects reflect, in part, unobserved attributes of households that affect both the probability they will participate in the programs (and the extent of that participation) and the relevant household outcomes (schooling of children, fertility, asset accumulation). These unobserved factors include such things as unmeasured ability, health and preferences. Moreover, because of the fungibility of credit, it is very difficult to identify the independent effect of credit on household and individual outcomes.

Unlike other studies, this one takes into account the endogeneity of program participation and the amount borrowed while assessing their impacts on household and individual behavioral outcomes. The study uses a quasi-experimental survey design to solve the identification problem plaguing earlier attempts to document the program or credit effects. The survey design covers one group of households with the choice to enter a credit program that may alter their behavior and a "control" group which is not given that choice but still allows monitoring of their behavior. Similarly, the identification of program or credit

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[5] This is also important for the program design and placement. Since the major cost of such a program is the administrative cost (see Khandker and others, 1994a) necessary for group mobilization and training, it is imperative to know what the contribution of the non-financial services of the Grameen Bank and similar programs is for the poor.

[6] Evaluation of programs such as the Grameen Bank is extensive in Hossain (1988). There are other studies such as the one carried out by the BIDS (1990) that have also looked at the program effects on a set of household-level outcomes.

impact by gender is done based on the comparison between a group of each gender which has a choice to participate and a group which does not have that choice.

However, analyzing the program impacts by comparing program-participating households or individuals with control groups may be erroneous because of the possibility that program placement is endogenous. Thus, it will not be clear whether the measured program impact is due to the credit program itself or due to unobservable village characteristics that influence program placement. To avoid such problems, we will use a village-level fixed-effects method to estimate the impact of targeted credit programs on various household and individual outcomes, including differential effects within the household attributable to the gender of the borrower, identified through a quasi-experimental survey design.

The remaining portion of the paper is organized as follows. Section 2 discusses a household model framework to motivate the specification of conditional demand equations that provide estimates of the impact of credit program participation by gender on a set of household- and individual-level outcomes. Section 3 presents the quasi-experimental survey design of household and community surveys that were conducted in Bangladesh during 1991-92 and presents the descriptive statistics of major variables identified for model estimation. Section 4 presents the results of the determinants of program participation and credit and the impact by gender on household- and individual-level outcomes. The concluding section summarizes the results and provides policy conclusions.

2. Evaluating program impact: a framework

To motivate the evaluation of the effects of group-based credit program participation on household behavior and intrahousehold resource allocation, consider a simple model that generates an efficiency argument for targeted credit for the rural poor. Assume that households of size n, consisting of two working age adults (the male head and his wife) plus n-2 dependents, maximize a lifetime utility function containing time-specific utility functions of the form

$$U_t = U(Q_1 \ldots Q_n, \dot{H}_1 \ldots H_n, l_1 \ldots l_n) \qquad (1)$$

where Q_i is a set of market goods consumed by household member i, the set of non-market household-produced goods allocated to member i is H_i, and l_i is leisure time consumed by household member i. As a generalization of (1), each of the two adult household members, denoted by f and m, wishes to maximizes his (if m) or her (if f) own utility u_{it}

$$u_{it} = u_i(Q_1 \ldots Q_n, H_1 \ldots H_n, l_1 \ldots l_n),\ i = f, m \qquad (2)$$

where household social welfare is some function of the individual utility functions $U_{it}=U(u_{ft}, u_{mt})$, a simple form of which is

$$U_{it} = \lambda u_{ft} + (1-\lambda) u_{mt}, \quad 0 \le \lambda \le 1 \qquad (3)$$

in which λ is the weight given to women's preferences in the household's social welfare function. The parameter λ can be thought of as representing the bargaining power of female household members relative to males in determining the intrahousehold allocation of resources. When λ=0, female preferences are given no weight and the household's social welfare function is identically that of the males.[7]

The household-produced goods H include "household care" activities such as food preparation, child care, and the gathering of fuel.[8]

$$H = H(L_{mh}, L_{fh}, G; F) \qquad (4)$$

where L_{mh} and L_{fh} are time devoted to the production of H by males and females, respectively, G is a vector of market goods used as inputs in the production of H, and F is a vector of technology parameters that affect efficiency in H good production.

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[7] The reader is referred to McElroy (1990), McElroy and Horney (1981), and Manser and Brown (1989) for a formal exposition of game theoretic approaches to household decision making.

[8] Some of these household goods, such as food preparation and child care, cannot be stored for consumption in later periods.

Due to socio-cultural factors, relatively few poor women work in the wage labor market. The reservation wage for market work is, therefore, relatively high.[9] In addition to this preference effect on female wage employment, workers typically must commit to a full day's employment even in the spot labor market.[10] If men's time (or that of other household members) is a poor substitute for women's time, and if important *H*-good outputs, such as child care and food preparation, must be "produced" daily (cannot be stored), then working a full day may entail foregoing the production and consumption of highly valued *H*-goods. Thus, the non-storability and time-intensity of production of household goods *H*, the indivisibility of time allocation in the wage labor market, and high reservation wages due to cultural impediments to wage employment outside the home all result in most women being engaged in the production of household goods *H* in every period to the exclusion of employment in market activities. These effects are magnified if λ is small and male preferences tend to favor certain kinds of *H*-goods produced on women's time.

However, there are also economic activities that produce goods for market sale that are not culturally frowned upon. These activities, producing what we refer to as *Z*-goods, permit part-day labor and do not require that production occur away from the home. Although many of these production activities can be operated at low levels of capital intensity, for many *Z*-goods a minimum level of capital is necessary. This minimum is often the result of the indivisibility of capital items. For example, dairy farming requires no less than one cow, and hand-powered looms have a minimum size. For other activities, such as paddy husking, where the indivisibility of physical capital is not an issue, transaction costs (or the high costs of information) place a floor on the minimal level of operations. In many societies these indivisibilities may be inconsequential, but among the rural poor of many developing countries, including Bangladesh, household income and wealth is so low that the costs of initiating production at minimal economic levels are quite high.

[9] Poverty alleviation programs, such as the Rural Works Programs, which target households by drawing them into (in-kind) wage labor have a comparatively small direct effect on the time allocation and productivity of women.

[10] In addition, transportation and other transaction costs in labor markets may be so high as to make part-day labor unremunerative.

Formally, we represent the production function for the Z-goods as:

$$Z = Z(K, L_{mz}, L_{fz}, A; J) \tag{5}$$

where L_{mz} and L_{fz} are labor time of head and wife devoted to the production of Z, K is capital in Z production, A is a vector of variable inputs, and J is a vector of technology parameters that affect efficiency in Z-good production (information). Positive production requires a minimal level of capital K, $K \geq K_{min}$. The production function (5) can be operated at a non-zero level when L_{mz} or L_{fz} are zero, but not when both are zero. For example, in the case of milk production, although at least one cow is required, any person's labor can be used to obtain the milk. In other cases, K_{min} may represent the minimal information required to produce and market home production.

Households maximize lifetime utility subject to a budget constraint that requires that the present discounted value of expenditure on goods and leisure equal the present value of all wealth, defined as assets plus the discounted present value of the time endowments, and the two production function equations (4) and (5). Household ability to borrow has significant influence on the time path of household consumption. Households having very low levels of initial assets as collateral may not be able to borrow to achieve the minimum capital requirements necessary to operate the Z-good activity. At very low levels of income and consumption, reducing current consumption to accumulate assets for this purpose may not be optimal because it may seriously threaten health (and production efficiency) and life expectancy, as shown in Gersovitz (1983). As a result, for many households, the Z-good activity is never carried out (and $L_{fz} = 0$) and women who do not work in the wage labor market devote all their time to production of the non-market good H and to leisure.

This simple model, which has some of the features of the "two-gap" models of aid and development, demonstrates the role of a credit program.[11] For the very poor, access to credit may alter the

[11] In the two-gap model, the effect of foreign aid on the rate of growth of output is high as long as imported capital requirements exceed labor availability. The two-gap model requires that domestic capital cannot substitute for imported capital, and that labor cannot be substituted for imported capital in production. Without sufficient capital, labor is unemployable. In the household model described here, labor is also unemployed, or rather underemployed, for lack of a minimum level of capital in the production of the Z-good. As in the two-gap model, this result requires

optimal time allocation for women from home production of H to market production of Z. Conceivably, if household consumption is at or near minimal levels necessary for survival, so that saving is almost infinitely costly, even a small quantity of credit for the purchase of K_{min} can have a large impact on household welfare by shifting women's time from the production of H, which may have a low shadow value to the household, to high marginal product Z-good production. In addition, program participation may alter the technology parameters, F and J, by providing information and training, which may affect efficiency in H- or Z-good production and, hence, income and consumption.

It is straightforward to allow for heterogeneity in preferences (including λ) and in human capital endowments (including ability) in the model. The introduction of a rural credit program into a poor village economy composed of heterogeneous households may induce some households to participate and borrow to finance K_{min}. Since Z-goods can be produced with part-time and flexible labor and can take place at home where an H-good, such as child care, can be jointly produced, women who undertake Z-good production will allocate time for it by reducing time in one or both other activities (H-good production and leisure). Some households, in which the marginal utility of H-good production is high (perhaps because λ is small), or in which wage labor opportunities are superior, may choose not to participate in a credit program.

The production of H-goods may rise or fall in households that initiate program borrowing in order to start Z-good production. The direction of change in H-good production depends on the size of the income effects, the substitutability of market inputs G with time inputs, and the degree to which a unit of (women's) time can jointly produce the Z-good and the H-good. Program participation may also affect household allocations by altering the value of λ, the weight given women's preferences in the household's social welfare function. The value of λ may increase with the greater bargaining power of women, resulting from having additional resources under their control through targeted credit and training and from the "consciousness raising" acquired from group participation (such as the Grameen Bank's Sixteen Decisions).

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the non-substitutability of other factors (including labor) for capital in the production of Z over some range of the production technology.

The empirical model

From the model presented above, the reduced-form determinants of credit program participation include the prices of market time, the price of the purchased market good Q, the prices of the market inputs into H-good production including the cost of averting a birth and other determinants of fertility, the prices of variable inputs into Z-good production, the price of the capital good, age and education levels of the borrower and spouse, access to transfers from non-resident relatives, and village-level characteristics (V).[12]

Whether or not poor households, particularly the women, are credit-constrained is a complex issue. Rashid and Townsend (1993) present an excellent review of this issue in the context of targeted group-based lending. They suggest that risk, private information, communications and enforcement difficulties may result in inefficient consumption and production outcomes. There is substantial evidence of the limited participation of women in the formal credit market due to lack of collateral and education, the health risks and intermittency of employment associated with childbirth, and cultural barriers. Rashid and Townsend note that the evidence does not in itself imply that outcomes are inefficient if, for example, women have access to other sources of finance such as transfers or if male household members obtain funds for female household members.

This paper does not test whether credit constraints are binding for women but whether or not access to group-based lending programs alters allocations and whether or not there is a difference if a man or a woman is the participant. It is important to note that the problem of "credit rationing" here is essentially different than that of, say, a farmer who needs to borrow to finance farm inputs (Feder and others 1988). If a farmer is credit-constrained in any season he cannot use inputs at the profit maximizing level during that season (e.g., Feder and others 1988). In the case of group-based lending to the landless, the time path of credit allocated to a member is part of the dynamic optimization problem of a group, and the level of credit provided each individual in the group is tailored to fund a new self-employment project of certain size.

[12] The terms of the loan may affect loan demand, but those effects are not statistically identifiable since all Grameen Bank or other credit program loans carry the same terms. Local credit market conditions, including the informal lending market, and the availability of relatives able to transfer funds, will affect the individual demand for credit.

Moreover, the cost of credit includes not only the interest rate, but also the timing of repayment and the penalties associated with default. Group-based credit is packaged with both responsibilities (meeting attendance, forced saving, shared default risk) and benefits (training, insurance, consciousness-raising). If there was no monitoring of the use of borrowed funds and no group responsibility and decision-making in the lending program, individuals would likely want to borrow much more than they actually do in order to capture the premiums associated with the soft terms of the loan. In some sense, the monitoring of credit use makes all program participants "credit constrained." Whatever the case, all participating households are presumed to be in the same credit demand regime given the practical impossibility of any other treatment.

Estimation strategy

A primary focus of this paper is to estimate the impact of credit programs on various household outcomes such as household consumption, time allocation, asset accumulation, contraceptive use, and investments in children. We propose to estimate the conditional demand equation for each outcome to be investigated, conditioned on the household's program participation as measured by the quantity of credit borrowed.[13]

Consider the reduced form equation (6) for the level of participation in one of the credit programs (C_{ij}), where level of participation will be taken to be the value of program credit

$$C_{ij} = X_{ij}\beta_c + V_j\gamma_c + Z_{ij}\pi + \varepsilon^c_{ij} \qquad (6)$$

where X_{ij} is a vector of household characteristics (e.g., age and education of household head), V_{ij} is a vector of village characteristics (e.g. prices and community infrastructure), Z_{ij} is a set of household or village

[13] The quantity of credit is, of course, only one measure of the flow of services associated with participation in any one of the group-based lending programs. As the introductory section has made clear, they are much more than just lending institutions. Nevertheless, the quantity of credit is the most obvious and well measured of the services provided. In work in progress, we are attempting to discern the importance of the non-credit services provided group members by estimating conditional demand equations for the same set of outcomes investigated in this paper by conditioning on a variety of measures of non-credit services provided. Since we do not control for these other services in this paper, the estimated credit effects reported below should be interpreted to (imperfectly) include the effects of all aspects of program participation.

characteristics distinct from the X's and V's in that they affect C_{ij} but not other household behaviors conditional on C_{ij} (see below), β_c,γ_c, and π are unknown parameters, and ε_{ij}^{c} is a random error having three components

$$\varepsilon_{ij}^{c} = \mu_j + \eta_{ij} + e_{ij}^{c} \tag{7}$$

where μ_j is an unobserved village-specific effect, η_{ij} is an unobserved household-specific effect, and ε_{ij}^{c} is a non-systematic error uncorrelated with the other error components or the regressors.

The conditional demand for household outcome Y_{ij} conditional on the level of program participation C_{ij} is

$$Y_{ij} = X_{ij}\beta_y + V_j\gamma_y + C_{ij}\delta + \varepsilon_{ij}^{y} \tag{8}$$

where β_c,γ_c, and δ are unknown parameters and ε_{ij}^{y} is comprised of

$$\varepsilon_{ij}^{y} = (\alpha\mu_j + \mu_j^{y}) + (\theta\eta_{ij} + \eta_{ij}^{y}) + e_{ij}^{y} \tag{9}$$

where α and θ are parameters (corresponding to correlation coefficients), μ_i^{y} and η_{ij}^{y} are additional village- and household-specific errors uncorrelated with μ_j and η_{ij}, respectively, and ε_i^{y} is a non-systematic error uncorrelated with other error components or with the regressors. If $\alpha\neq0$ or $\theta\neq0$ the errors ε_{ij}^{y} and ε_{ij}^{c} are correlated. Econometric estimation that does not take this correlation into account will yield biased estimates of the parameters of equation (8) due to the endogeneity of credit program participation C_{ij}.

Why might credit program participation be endogenous?

The endogeneity of credit program participation (represented here by the amount of credit borrowed from the targeted credit program) in the household outcome (Y_{ij}) equations may arise from common village-specific unobservable variables, the μ_j, and from common household-specific unobservables, the η_{ij}. We note the following sources:

1) ***Non-random placement of credit programs.*** It is unlikely that credit programs are randomly allocated across the villages of Bangladesh. Indeed, program officials note that they often place programs in poorer and more flood-prone areas, as well as areas in which villagers have requested program services. Recently, Pitt, Rosenzweig and Gibbons (1993) have shown that treating the timing and placement of programs as random can lead to serious mismeasurement of program effectiveness in Indonesia. Comparison of the two sets of villages as in a treatment/control framework would lead to a downward bias in the estimated effect of the program on household income and wealth (and other outcomes associated with income and wealth) and could even erroneously suggest that credit programs reduced income and wealth if the positive effect of the credit program on the difference between "treatment" and "control" villages did not exceed the negative effect that induced the non-random placement.

2) ***Unmeasured village attributes affect both program credit demand and household outcomes Y_{ij}.*** Even if credit programs are randomly placed by the agencies involved, village attributes that are not well measured in the data may affect both the demand for program credit and the household outcomes of interest. These attributes (the μ's) include prices, infrastructure, village attitudes and the nature of the environment including climate and propensity to natural disaster. For example, the proximity of villages to urban markets or transport may influence the demand for credit to undertake small-scale activities but may also affect household behavior through altering attitudes and access to urban amenities.

3) ***Unmeasured household attributes affect both credit demand and household outcomes Y_{ij}.*** These attributes (the η's) include endowments of innate health, ability, and fecundity, as well as preference heterogeneity. Consider the possibility that households are heterogeneous with respect to the relative treatment of males and females. It seems possible that households that are more egalitarian in their

treatment of the sexes are also more likely to have female household members participate in credit programs and are also more likely to provide more resources to females than otherwise identical but less egalitarian households. Ignoring this heterogeneity would wrongly attribute a more egalitarian intra-household resource distribution to the credit program, where it is actually due to the more "egalitarian" preferences of self-selected households themselves.

Econometric approach

The standard approach to the problem of estimating equations with endogenous regressors, such as equation (8), is to use instrumental variables. In the model set out above, the exogenous regressors Z_{ij} in equation (6) are the identifying instruments. Unfortunately, it is difficult to find any regressors Z_{ij} that can justifiably be used as identifying instrumental variables. The exogenous regressors Z_{ij} must satisfy two conditions: (i) they must affect the decision to participate in a credit program (that is, $\pi \neq 0$), and (ii) they must not affect the household outcomes of interest Y_{ij} conditional on program participation. An approach motivated by demand theory is to use the price of the endogenous variable, conditioned upon as an identifying instrument. The most obvious measure of the "price of credit program participation" is the interest rate charged, but this is ruled out here since it does not vary across the sample.[14,15]

Using either interest rates or measures of the cost of information as identifying instruments fails for another reason. If households are responsible for repaying the loans made in the name of individual members and jointly make the credit decisions of individual household members, and there is a single price for credit to all members of a household, then gender- or individual-specific allocations of credit to multiple-person households suffer from the classic problem of more goods than prices. An individual-

[14] Even if interest rates varied across the sample, it is likely that some of this variation reflects unmeasured household attributes unknown to us but known to the lender and likely to be part of the ε_{ij}^{y} error term, and hence be an invalid instrument.

[15] Another measure of the "price of credit program participation" is some proxy for the information costs associated with learning about these credit programs. To some extent, this depends on the qualities of the credit program organizers and staff. Our survey collected information on the educational background, experience, age and gender of credit program organizers and other staff. There was a substantial number of missing values in these data and these measured attributes tended to vary little across the sample. In any case, the validity of these variables requires that the credit programs allocate program organizers randomly across villages, which is uncertain.

specific price of credit (informational or otherwise) to the female adults of a household is likely to be related to the borrowing behavior of male adults and unobserved household attributes.

Village fixed-effects estimation, which treats the village-specific error μ_i as a parameter to be estimated, eliminates the endogeneity caused by unmeasured village attributes including non-random program placement. However, fixed-effects estimation raises issues of consistency and computational difficulty. Measured program credit is a limited dependent variable since not all eligible households participate in the credit programs. Some relevant household outcomes -- such as schooling of children, labor supply, and assets -- are also limited dependent variables. As is well known, fixed effects estimation in this case generally yields inconsistent parameter estimates without large numbers of observations on each fixed effects unit. Heckman (1981) provides Monte Carlo evidence that with 8 or more observations per fixed effects unit, the inconsistency problem becomes relatively minor. The average number of target households per village in this study is 20.2. There are 87 village units in the data, 72 with credit programs, and joint estimation of credit use by gender (see below) with each household outcome (such as schooling or labor supply) implies that nearly 200 fixed-effects parameters need to be jointly estimated.

Even with village fixed effects, the endogeneity problem still remains if $\theta \neq 0$; that is, if there are common household-specific unobservables affecting credit demand and household outcomes. Lacking identifying instruments Z_{ij} (exclusion restrictions), another approach is required for identification. Realizing this, the sample survey was constructed so as to provide identification through a quasi-experimental design.

To understand the nature of this quasi-experimental design, consider the classic program evaluation problem with non-experimental data. Individuals can elect to receive a treatment offered in their village (or neighborhood). The difference between the outcome (Y_{ij}) of individuals who chose to receive the treatment and the outcome of those who chose not to is not a valid estimate of the treatment's effect if individuals self-select themselves into the treatment group. Lacking any Z_{ij} (or panel data on individuals before and after treatment availability), one method of identifying the effect of the treatment is based upon (presumed) knowledge of the error distribution. This is the standard sample selection framework of Heckman (1976) and Lee (1976). If the errors are assumed to be normally distributed, as is common, the treatment effect is

implicit in the deviations from normality within the sample of treatment participants (Moffitt 1991). The nonlinearity of the presumed distribution is crucial. If both the treatment and the outcome are measured as binary indicators, identification of the treatment effect is generally not possible even with the specification of an error distribution.

Now consider a "natural experiment" in which the treatment is not available in every village and this availability is not correlated with observables affecting the outcome Y_{ij}; that is, treatment availability is randomly placed across villages. In this case, the presence or absence of treatment choice is a legitimate identifying variable, requiring samples of individuals from villages with treatment choice as well as villages without it (Moffitt 1991). What if the availability of treatment were correlated with village-specific unobserved attributes? Then, net of these unobserved attributes, one could identify the parameters of all the observed exogenous household and individual regressors by fixed-effects estimation with the subsample drawn from non-treatment villages only. For example, in equation (8), C_{ij} is identically zero for all households in non-program villages, so that village fixed effects estimation of (8) on that subsample yields consistent parameter estimates of β_y. The credit-effect parameter δ and the parameters γ_y are not identifiable from any part of the sample, since they are "captured" by the village fixed effects.

The parameters of interest, δ, the effect of participation in a credit program on the outcome Y_{ij}, can be identified if the sample includes households in villages with treatment choice (*program villages*) that are excluded from making a treatment choice by random assignment or some exogenous rule, which would be the exclusion of households owning more than 0.5 acres of land from any of the three credit programs. Data on the behavior of households exogenously denied program choice in this way is sufficient to identify the credit program effect. Thus, rather than relying solely on nonlinearity arising from the specification of an error distribution to identify the program effect δ, another piece of identifying information is available. A comparison of the outcome Y_{ij} between households with program choice and those without it, conditioning on all village effects and observed household and individual attributes, is an estimate of the program's effect on that outcome.

To illustrate these ideas more formally, consider a binary treatment (I_c=1 if treatment chosen, 0 otherwise) and a binary outcome (I_y=1 if outcome is true, 0 otherwise). This is the most difficult model to identify in that nonlinearity is insufficient to identify the credit effect parameter δ. The model is

$$c^* = X_c\gamma + \varepsilon_c \tag{10}$$

$$I_c = 1 \text{ if } c^* > 0, \quad I_c = 0 \text{ otherwise}$$

$$y^* = X_y\beta + \delta I_c + \varepsilon_y \tag{11}$$

$$I_y = 1 \text{ if } y^* > 0, \quad I_y = 0 \text{ otherwise}$$

where c^* and y^* are latent variables associated with, respectively, treatment choice and the outcome, X_c and X_y are vectors of regressors, γ, β and δ are parameters to be estimated, and ε_c and ε_y are errors distributed as bivariate normal with unit variances and correlation coefficient ρ. The parameter δ represents the treatment effect. The log-likelihood function for this model is

$$\log L(\gamma, \beta, \delta, \rho) = \sum \log \Theta_2(X_c\gamma d_c, (X_y\beta + \delta I_c) d_y, \rho d_c d_y \tag{12}$$

where θ_2 is the bivariate standard normal distribution, and $d_c = 2*I_c - 1$ and $d_y = 2*I_y - 1$. If ε_c and ε_y are not independent ($\rho \neq 0$) and X_y includes all the variables in X_c, the parameters in equation (11) are not identified (Maddala 1983, page 122-123). That is, lacking exclusion restrictions, if the choice into the treatment group is selective, identification of the treatment effect on a binary outcome is not possible with a sample of self-selected individuals. Consider the addition of a subsample of individuals for whom treatment is (exogenously) not available. The log-likelihood becomes

$$\log L(\gamma, \beta, \delta, \rho) = \sum_{choice} \log \Theta_2(X_c\gamma d_c, (X_y\beta + \delta I_c)d_y, \rho d_c d_y)$$

$$+ \sum_{no\,choice} \log \Theta(X_y\beta d_y) \tag{13}$$

where θ is the univariate standard normal distribution, and "choice" and "no choice" represent those individuals in the sample who have a treatment choice and those for whom no treatment is available. All of the parameters of the model are identifiable even if the errors are not independent and exclusion restrictions do not exist. If program placement is random, all of the households in the second part (*no choice*) of the likelihood could come from villages without programs. Identification of the credit program effect is then essentially a comparison of outcomes across villages conditioned on village and household/individual observables.

If program placement is not random only with respect to village effects, then we can control for village effects by adding a village-specific intercept μ_k to the vector of regressors. Distinguishing between households with no choice because they reside in a non-program village and households residing in a program village that do not have choice because of the application of an exogenous rule, the likelihood can be written as:

$$\log L(\gamma, \beta, \delta, \mu, \rho) = \sum_{choice} \log \theta_2((\mu + X_c\gamma)d_c, (\mu_k + X_y\beta + \delta I_c)d_y, \rho d_c d_y)$$

$$+ \sum_{\substack{no\,choice \\ program \\ village}} \log \theta((\mu_k + X_y\beta)d_y) + \sum_{\substack{no\,choice \\ non-program \\ village}} \log \theta((\mu_m + X_y\beta)d_y) \tag{14}$$

where μ_k are the village-specific intercepts for program villages and μ_m are village-specific intercepts for non-program villages. It is the ability to estimate the marginal probability $\theta(\mu_k + X_y\beta)d_y)$ of the outcome directly from a subsample of households that makes this identification possible.[16]

[16] Implicit in this setup is the assumption that the effect of the treatment (δ) is the same for all individuals, an assumption which is common in the program evaluation literature (Moffitt 1991). Furthermore, the model is not

Underlying identification in this model is the assumption that land ownership is exogenous in this population. Although it is clearly non-standard to use program eligibility criteria for purposes of identification in most instances of program evaluation, we think its use is well justified here. Unlike the evaluation of job training programs, health/nutrition interventions, and many other types of programs, where lack of job skills, lack of health, or insufficiency in some other behavior are both criteria for eligibility and the behaviors the programs directly act upon, land ownership is used as the primary eligibility criteria for these credit programs only to proxy for unreliable indicators of income, consumption or total asset wealth. Land ownership is simple to quantify, understood within the community and unlikely to change in the medium-term.

Market turnover of land is well known to be low in South Asia, and the absence of an active land market is the rationale given for the treatment of land ownership as an exogenous regressor in almost all the empirical work on household behavior in South Asia.[17] A number of theories have been set forth to explain the infrequency of land sales. Binswanger and Rosenzweig (1986) analyzed the set of material and behavioral factors which are important determinants of production relations in land-scarce settings, and concluded that land sales would be few and limited mainly to distress sales, particularly where national credit markets are underdeveloped. Rosenzweig and Wolpin (1985) set out an overlapping generations model incorporating returns on specific experience which uses low land turnover as an implication and, using data from the Additional Rural Incomes Survey of the National Council of Applied Economic Research (NCAER) of India, found a very low incidence of land sales.

Even if land ownership is exogenous for the purposes of this analysis, it is necessary that the "landless" and the "landed" can be pooled in the estimation of reduced form equations (6). To enhance the validity of this assumption, we restrict the set of non-target households used in the estimation to those with

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nonparametrically identified. That is, if the linear indices $X_c\gamma$ and $(X_y\beta+\delta I_c)$ were replaced by nonparametric functions of the X's and I_c, the model is not identified.

[17] For example, in a classic paper in the field, Rosenzweig (1980) tested the implications of neoclassical theory for the labor market and other behaviors of farm households in India by splitting the sample on the basis of land ownership, treating the sample separation criterion as non-selective.

less than 5 acres of owned land. In addition, we include the quantity of land owned as one of the regressors in the vector X_{ij}, and include a dummy variable indicating the target/non-target status of the household.

Identification of the impact of gender-specific credit

A principal objective of this research is not just to determine whether credit programs for the rural poor affect household behavior in important ways, but whether the sex of the program participant matters. For that reason, the reduced form credit equation is disaggregated by gender

$$C_{ijf} = X_{ij}\beta_{cf} + V_f\gamma_{cf} + \varepsilon^{c}_{ijf} \tag{15}$$

$$C_{ijm} = X_{ij}\beta_{cm} + V_f\gamma_{cm} + \varepsilon^{c}_{ijm} \tag{16}$$

where the additional subscripts f and m refer to females and males respectively. The conditional household outcome equation not only allows for separate female and male credit effects, but also for different effects for each of the three credit programs

$$Y_{ij} = X_{ij}\beta_y + V_f\gamma_y + \sum_k C_{ijf}D_{ijk}\delta_{fk} + \sum_k C_{ijm}D_{ijk}\delta_{mk} + \varepsilon^{y}_{ij} \tag{17}$$

where D_k is a dummy value such that D_k=1 if the individual participates in credit program k and D_k=0 otherwise (k=BRDB, BRAC, and Grameen), C_{ijf} is the credit participation of females in household i of village j, C_{ijm} is similarly defined for males, and the δ's are program-specific parameters specific to each sex.

Introducing gender-specific credit is not a trivial generalization of the econometric model. First, it is likely that the errors ε^{c}_{ijf} are correlated with the errors ε^{c}_{ijm}; that is, there are common unobservables influencing the credit program behavior of both women and men in the household. Second, additional identification restrictions are required when there are both male and female credit programs with possibly

different effects on behavior. The first issue is computational; bivariate probability distributions need to be evaluated when estimating equations (15) and (16). Furthermore, if Y_{ij} is a limited dependent variable and limited information maximum likelihood methods are applied to the full system given by (15), (16) and (17), trivariate probability distributions need to be evaluated.

The second issue, that of identification, is handled by an extension of the quasi-experimental setup described above. All of these group-based credit programs have single-sex groups. It was established above that identification could be achieved, even if program placement was non-random, by including in the estimation sample observations for households that are in villages with credit programs but are unable to join because they possess more than the threshold quantity of land, considered an exogenous rule. Similarly, identification of gender-specific credit is achieved by a quasi-experimental survey design that includes some households from villages with only female credit groups, so that even males in landless households are denied the choice of joining a credit program, and some households from villages with only male credit groups, so that even landless females are denied program choice. In particular, of the 87 villages in the sample, 15 had no credit program, 40 had credit groups for both females and males, 22 had female-only groups and 10 had male-only groups. Table 2.1 provides the details by type of credit program. Since each village had only one type of credit program available, there is no need to model which program members of a household join -- the BRDB, BRAC or Grameen.[18]

While the likelihood given by (14) illustrates the general principle and method used in estimating the effect of credit programs on behavior in Bangladesh, the actual likelihoods maximized are substantially more complex for the following reasons:

1) The likelihood for binary and tobit outcome variables involve trivariate and bivariate normal distribution functions because two credit equations ((15 and (16)) are being estimated simultaneously with the outcome equation. In addition, some of the outcomes are continuous (such as child anthropometry and expenditure) or tobit (such as labor supply). In each case, estimation was done by limited information maximum

[18] A small number of individuals belonged to credit programs that met in other villages. For example, there were some women who belonged to Grameen Bank groups even though there was no Grameen Bank group in their village. These participation decisions were treated as exogenous in the analysis.

likelihood. For the tobit case, our method is a substantial generalization of the LIML likelihoods presented in Smith and Blundell (1986) and Rivers and Vuong (1988) for limited dependent variables because the endogenous right-hand-side variables are also tobits.

2) Observations on Y_{ij} are sometimes for multiple members of the same household, as in child anthropometry and schooling where more than one child per household appears in the sample, or observations on the same individual in different seasons, as in labor supply. Thus, it is unlikely that the errors are independently and identically distributed. Unobserved household attributes that affect one child's schooling or nutrition are likely to also affect the schooling and nutrition of that child's sibling. Not accounting for this lack of independence will yield biased estimates of the parameter covariance matrix (t-ratios). Our approach is to use an asymptotic bootstrap estimator of the covariance matrix, essentially White's (1980) heteroskedasticity-consistent covariance matrix estimator in which the outer-product of the derivatives of the log densities (commonly known as the Berndt-Hall-Hall-Hausman or BHHH estimator) is defined so that the log density contains the full set of observations for any household or household member. The log densities thus defined are independently and identically distributed and the resulting parameter covariance matrix is consistent.

3) The sample design is choice-based (see Section 3.1 below). In particular, program participants are over-sampled. The use of choice-based sampling somewhat complicates the econometrics but allows researchers to get the most statistical efficiency per dollar spent on data collection. Lancaster and Imbens (1991) have demonstrated the large efficiency gains to be obtained from a well-designed choice-based sampling strategy and Lancaster (1992) has reviewed methods for estimation with choice-based samples. Not correcting for the choice-based nature of the sample would lead to biased parameter estimates. The Weighted Exogenous Sampling Maximum Likelihood (WESML) methods of Coslett (1981) were grafted onto the limited information maximum likelihood (LIML) methods described above in the estimation of both parameters and the parameter covariance matrix. To remind the reader of these crucial aspects of the maximum likelihood approach taken in this paper, the method is referred to as WESML-LIML-FE, which stands for Weighted Exogenous Sampling Maximum Likelihood - Limited Information Maximum Likelihood - Fixed Effects.

3. Survey design

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.

The sample consists of 29 thanas (subdistricts) randomly drawn from 391 thanas in Bangladesh. Out of the 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.[19]

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 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 it was dropped 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 (see below) was 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

[19] Note that more than one-third of the Chittagong region was devastated by the 1991 cyclone and dropped from sampling. This is 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 thana could have been drawn twice for two different programs. This did not happen in the actual sample selection, but some of the 24 program thanas do have more than one credit program in operation.

identify program participating and non-participating households among the target households in any village. From the 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 and 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.[20] 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 the 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 village distribution.

In addition to the general household survey (that collected household- and individual-level information on income, employment, education, health, consumption, borrowing, savings, etc.) and a

[20] The sample size and its ratio between participating and non-participating households are different in five program thanas (2 for the Grameen Bank, 2 for the BRAC and 1 for the BRDB) which were also selected for nutrition surveys. In each nutrition study thana the number of the target households drawn was higher than 17, although the number of non-target households drawn remained the same (i.e., 3). Thus, in the Grameen Bank and BRAC nutrition thana 20 target households were drawn from the target households where the ratio between participating and non-participating households was 16:4. By contrast, for the BRDB nutrition thana 25 target households were drawn for in-depth study at a ratio of 18:7 between participating and non-participating households.

nutrition sub-survey (that collected individual dietary intake, weight, and height), a village survey questionnaire was also administered. Note that the general household survey was conducted three times over the crop cycle year 1991-92 to match the three crop seasons, and information on village-level prices and wages was collected in the same manner. On the other hand, the nutrition survey was conducted twice over the same year to collect dietary intake information during the peak (December to February) and slack (July to September) seasons in terms of food availability. In addition, data were also collected on village-level infrastructures that tend not to vary seasonally.

Data description

Table 3.1 presents the weighted mean and standard deviations of all exogenous variables used in the regression. Because the samples drawn are not representative of the village population, the means of the variables are adjusted by appropriate weights based on the actual and sample distribution of the households covered in the study villages.

The sample of individuals aged between 15-64 is quite young, since the mean age is only 23 years. Approximately half of the sample is female. The educational level is very low, averaging only 1.4 years. About 61 percent qualify to join one of the credit programs under study. Those who have joined a credit program have, on average, 3.7 years of membership.

The number of potential transferees of the households who own more than 50 decimals of land provides an alternative source of credit. As the table suggests, the average number of such relatives (for example, parents, sons, daughters, brothers, sisters, uncles and aunts) of the household head and his/her spouse is less than 1. Approximately 11 percent of target households are BRAC members, while 6 percent belong to the BRDB and 8 percent to the Grameen Bank. The average household landholding size is only 30 decimals. About 13 percent of households do not have a spouse present; however, 95 percent are headed by men. The average education of the household head is 1.9 years of schooling, the average age is 41 years. The average highest educational level among the adult females in each household is 1.6 years, and the average highest educational level among adult males in each household is 3.1 years. Only 3.5 percent of the households have no adult male, while an even smaller 1.7 percent have no adult female.

About 95 percent of participants in all three programs borrow. The average (cumulative) amount borrowed since November 1986 is greater for female than for male borrowers of the BRAC and GB, although it is higher for male than for female borrowers of the BRDB.[21] However, the amount borrowed by females from the GB is the largest among the loans received by men or women from any program. Women's credit from the GB is about 8 times larger than that from the BRDB and 3 times larger than that from the BRAC. Women's credit from the GB is also 3 times larger than men's credit from the GB. Since loans from all three programs are annual, the higher loan amounts for female or male borrowers of the GB may represent the longer program participation of GB borrowers relative to borrowers from other programs.

The explanatory variables also include availability of a primary school (68 percent of households reported having a primary school in their village), rural health center (30 percent), family planning center (10 percent), and Dai/midwife (67 percent). They also include the village-level prices of major commodities and the wages of male and female labor. Although 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. Even if one assumes that participation in any of these targeted credit programs involves foregone wage income, it appears that women have a lower opportunity cost than men in joining the Grameen Bank or another program. Although the availability of a commercial bank in the area does not ensure a large number of targeted households' borrowing from a formal financial institution, its presence may nevertheless increase the availability of credit. The average distance from a study village to a commercial bank is about 3.5 km.

Table 3.2 presents some household- and individual-level outcomes that are of particular interest in this paper and disaggregated by various groups -- participants and non-participants of program areas, target households of non-program areas, and aggregates for all households of all areas. There are differences in behavioral outcomes between participating and non-participating households, between men and women and between boys and girls. For example, contraceptive use among married women aged 14-50 is 42 percent for program participants, 37 percent for non-participants in program areas, and 36 percent among target

[21] Credit is deflated by regional cost-of-living indices to constant Taka.

households in non-program areas. About 68 percent of women had a child in the 3 years prior to the survey among participants, 70 percent among non-participants, and 72 percent among the target households in non-program villages.

School enrollment among children aged 5-17 is 54 percent for girls and 57 percent for boys among participants, 43 percent for girls and 41 percent for boys among non-participants, and 54 percent for girls and 48 percent for boys among the target households of non-program villages. The hours worked per month by women for cash-earning activities are 40 for participants, 38 for non-participants and 44 for target households in non-program villages. By contrast, the hours worked by men are 202 among participants and non-participants in program areas and 195 among target households in non-program areas. More interestingly, the non-land assets owned by women are higher among participants (Tk. 2,267) than among non-participants (1,145) and much higher than among target households in non-program areas (Tk. 585). Our objective is to analyze whether program participation has benefited the poor, especially women and children.

4. Results

In this section we present and interpret the results of estimating conditional demand equations of the form given by equation (16) for a wide variety of behaviors. All of the parameter estimates are WESML-LIML-FE (Weighted Exogenous Sampling Maximum Likelihood-Limited Information Maximum Likelihood-Fixed Effects) estimates using the quasi-experimental identification restrictions set out in Section 2 above (Appendix B, Tables B1-B8 provides WESML-LIML-FE estimates for different outcomes). We also present two "naive" estimates which do not treat credit program placement or participation as endogenous (Appendix A, Tables A1-A15). One set of naive estimates treats the choice-based sampling nature of the survey appropriately and uses WESML methods, while the other does not. The latter is actually more consistent with the maintained hypothesis of the naive model that choice -- credit program participation -- is exogenous, and thus fully consistent estimates are obtained by ignoring varying sampling proportions.[22] Since village fixed effects are not accounted for in the naive estimates, a set of

[22] Furthermore, neither naive model deals with the possible nonindependence of the errors. This is not atypical of much of the applied literature in this area. If the exogeneity assumption is valid, ignoring nonindependence

village characteristics, consisting of 5 measures of village infrastructure, 6 goods prices and two wage rates, are included as regressors (see Table 3.1.), as is common in this type of cross-sectional analysis.

In a separate table (Table 4.1), we present WESML-LIML-FE estimates side-by-side with WESML-LIML estimates. If program placement is random, the WESML-LIML estimates are efficient and WESML-LIML-FE estimates are consistent but inefficient. If program placement is non-random, the WESML-LIML estimates are inconsistent. Hausman-like tests of the consistency of the WESML-LIML models were attempted, but the covariance matrix of the differences in the parameter vectors were not positive definite in every case tried. This problem is not uncommon in estimation problems of this kind. The test statistic computed is:

$$(\beta_{FE} - \beta)(\Sigma_{FE} - \Sigma)^{-1}(\beta_{FE} - \beta) \qquad (18)$$

where β_{FE} and β (Σ_{FE} and Σ) refer to the WESML-LIML-FE and WESML-LIML parameter (covariance) vectors (matrices) respectively. Typically, the problem is that one or more of the diagonal elements of the covariance matrix ($\Sigma_{FE} - \Sigma$) is very close to zero, and sometimes negative. Essentially, the implication is that the test statistic is infinitely large, and the null hypothesis that the fixed-effects and non-fixed-effects parameter vectors are the same is thus rejected. This implies that credit programs are not placed randomly across the villages of Bangladesh.

The results of Table 4.1 will be addressed as we discuss individual outcomes. Presenting fixed-effects and non-fixed-effects estimates side-by-side but separately is intended to allow the interested reader to eyeball the parameters and their t-ratios, to subjectively judge the importance of the difference between these methods.

One important drawback of estimating program impacts from data on two cohorts (those from villages with and without programs available) in which cohort assignment is non-random, meaning

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provides consistent parameter estimates but inconsistent estimates of the parameter covariance matrix (the t-statistics).

deliberate program placement, is the possible misinterpretation of the village fixed effects. The discussion so far has treated the village effects as time-invariant attributes. However, it is possible that credit programs can alter village attitudes and other village characteristics, perhaps through *demonstration effects*, and thus can alter the attitudes of non-participants as well as participants. The full behavioral effect of the program must then include the effect of any such village "externalities" and not just the direct effect on credit participants.

As an example, consider the limiting case in which program placement is in fact random but program activities, particularly those aimed at altering attitudes, successfully alter the views of non-participants on the value of contraception and limiting family size. In this case, unobserved village contraception propensities would be correlated with program placement, but the causation would not go from village unobserved effects to program placement, but from program placement to village unobserved effects. In this scenario, programs are not placed in villages because of their relative attitudes on contraception, but rather program placement affects the attitudes of non-participants in villages. Unfortunately, the only way these external effects can be measured is to collect data on villages before and after program introduction.

A more formal statement of this measurement problem explicitly allows for the placement of a credit program to cause a village effect (Ω_j) in addition to a pre-existing village effect μ_j. Equation (8) is then rewritten as:

$$Y_{ij} = X_{ij}\beta_y + V_j\gamma_y + C_{ij}\delta + \Omega_j + \varepsilon_{ij}^{y} \qquad (19)$$

where all terms are defined as before except that a new term Ω_j is added to the conditional demand equation. This term represents the external effects of a program in a village and has the value zero if no program is located in the village. Significantly, the existence of non-zero credit program externalities Ω_j does not affect the consistency of any estimate of δ, only its interpretation.[23] The program effect parameter δ estimated by WESML-LIML-FE captures all program effects only if $\Omega_j=0$ in all villages; that is, none of

[23] This result relies on the linearity of the conditional demand equation.

the village-specific heterogeneity in behavior is caused by programs. If village externalities exist ($\Omega_j \neq 0$), the WESML-LIML-FE estimate of δ represents only the effect of credit on program participants above and beyond its effects on non-participants in the village. If program placement is random and $\Omega_j \neq 0$, then WESML-LIML is a more efficient estimator than WESML-LIML-FE and the estimated δ has the same interpretation as for WESML-LIML-FE. If program placement is non-random, WESML-LIML is inconsistent. It is generally not possible to estimate the village externality Ω_j from a single cross-section of data.

Before describing those results, we first present the results of estimating the credit equations (14) and (15), which are estimated jointly with equation (16) in every case where WESML-LIML-FE is applied. Table 4.2 presents these estimates. Since there are no endogenous right-hand-side regressors in the credit equations, they can be estimated separately from the conditional demand equation (16) using WESML bivariate tobit with village fixed effects, which was the method used for the estimates presented in Table 4.2. Implicit in these estimates is a set of restrictions on the parameters β_{cf} and β_{cm} of equations (14) and (15) that can clearly be seen by rewriting these equations as

$$C_{ijf} = X_{ij}\beta_{cf} + X_{ij}D_m\alpha_{fm} + \mu_{cf} + \varepsilon^{c}_{ijf} \tag{20}$$

$$C_{ijm} = X_{ij}\beta_{cm} + X_{ij}D_f\alpha_{mf} + \mu_{cm} + \varepsilon^{c}_{ijm} \tag{21}$$

where D_m=1 if there is a male credit group in the village, D_m=0 otherwise, D_f=1 if there is a female credit group in the village, D_f=0 otherwise, and α_{fm} and α_{mf} are parameters.[24] The set of village-specific regressors V_j of equations (14) and (15) are replaced by μ's in the equations above, representing the village fixed effects. If the α parameters are non-zero, the determinants of women's (men's) credit participation (the β's) depends on whether men (women) also have a choice of joining the credit program. The restriction that $\alpha_{fm} = \alpha_{mf} = 0$ was tested with a likelihood ratio test and could not be rejected at common levels of

[24] Essentially, the idea is that there may be two regimes each with different parameter vectors for each sex: a regime in which only one sex is able to choose to participate in a credit program and a regime in which both sexes can participate.

significance ($\chi^2(28)=22.6$, $p=0.25$). Note that this does not necessarily imply that the presence or absence of a credit program for the opposite sex does not matter, only that it does not affect the slope parameters (β). The "demand" curve may be shifted up or down but such shifts are not statistically identifiable in this model, since they are fully captured by the village-specific intercepts μ.

The other restriction is that the slope parameters β are common to the three credit programs. Again, the credit equations may be shifted up or down but such shifts are not statistically identifiable in this model as they are fully captured by the village-specific intercepts μ.

While individual loans are small by formal credit market standards, they were never less than Taka 1000 in the data. The censoring threshold for the credit equations (1) and (2) was taken to be 1000 in the estimation. Redefining C_{ijf} and C_{ijm} as the logarithm of program credit provided female and male members of household i in village j, and defining C^*_{jf} and C^*_{jm} as the latent variables associated with these female and male credit variables, respectively, the model estimated is

$$C^*_{ijf} = X_{ij}\beta_{cf} + \mu_{cf} + \varepsilon^c_{ijf} \qquad (22)$$

$$C_{ijf} = C^*_{ijf} \; if \; C^*_{ijf} \rangle \log(1000)$$

$$C^*_{ijm} = X_{ij}\beta_{cm} + \mu_{cm} + \varepsilon^c_{ijm} \qquad (23)$$

$$C_{ijm} = C^*_{ijm} \; if \; C^*_{ijm} \rangle \log(1000)$$

where latent credit demand of less than Taka 1000 results in censoring of the observed credit variable. The logarithmic form implies that latent credit demand is strictly positive. Latent demand less than the censoring threshold of Tk. 1000 does not result in borrowing.

The set of variables describing the availability of potential sources of intra-family transfers was not a significant determinant of credit demand for either gender. The household head's age and sex are apparently important determinants of credit demand for both women and men, but of opposite signs

between the sexes. Having a male head reduces the credit received by women, as do increases in the age of the head. A test of the hypothesis that the slope parameters in women's and men's credit demand are equal is strongly rejected ($\chi^2(14)=50.94$, p=0.00), reflecting to a large extent the opposite and significant sex and age of household head effects.[25]

Table 4.3 presents estimates of the effects of credit program participation on the school enrollment status of children aged 5-17 at the time of the survey. Separate sets of estimates were made for girls and for boys. The WESML-LIML-FE estimates demonstrate that the schooling of boys is increasing in all 6 credit variables, and the schooling of girls is increasing in 4 of 6 credit variables, although only a few of the individual parameters have large t-ratios. Tests of the joint significance of the six credit variables find little evidence of joint significance for girls ($\chi^2(6)=4.11$, p=0.66) but much stronger evidence for boys ($\chi^2(6)=20.00$, p=0.00).[26] It is female program credit that drives the positive credit effect on boys' schooling. The test statistics for women's credit are significant at the 0.01 level ($\chi^2(3)=15.18$, p=0.00). The largest and most precisely estimated individual credit parameter for both boys' and girls' school enrollment is for credit obtained by women from the Grameen Bank (t=2.36 for boys, t=1.30 for girls).[27]

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[25] The variables "No adult females in household" and "No adult males in household" were included as regressors because the adult education variables "Highest grade completed by an adult female in household" and "Highest grade completed by an adult male in household" are undefined when there are no adults (defined as a household member 16 years of age or older) of that sex in the household. Whenever there was no adult member of one sex in the household, the relevant "Highest grade completed..." variable was coded zero. The "No adult..." variable thus picks up the difference between having zero as the highest number of years of schooling of adults of a particular sex and not having any adult of that sex in the household.

[26] All of the χ^2 test statistics from the WESML-LIML-FE estimates are reproduced in tabular form in Appendix C.

[27] There are no *a priori* grounds to expect that the signs of the credit parameters will be positive in this or any other of the conditional demand equations estimated. One might expect school enrollment rates to be increasing in household full and cash income resulting from credit program particaption and borrowing if this kind of human capital formation is a normal good. In addition, to the extent that credit to women increases their bargaining power in the household , and thus their utility weight λ, and their preferences for human capital investment in children, girl children in particular, is "greater" than for household males, credit programs will increase school enrollment rates through changes in the households social welfare function (3). Changes in the social welfare function can also come about from the information credit programs provide women (and men) about the returns on schooling or by altering perceived social pressures that act to reduce schooling. On the other hand, if girls' time is a close substitute for the time of their mothers, an increase in the value of mothers' time in self-employement (production of *Z*-goods) attributable to credit programs may induce a substitution of daughters' time from schooling and into either household goods production or into the self-employment activity, or both. The sign of the sum of the income, substitution and λ effects is indeterminant. Similar types of logic, standard in the household production framework, apply to the other conditional demand equations estimated.

The WESML-LIML girls' schooling estimates (Table 4.1B) are algebraically larger than the WESML-LIML-FE estimates. Furthermore, for each credit program, the parameters on female participation are larger than those on male participation. In this model, participation in the Grameen Bank has the largest effect of all. The striking difference between the WESML-LIML and WESML-LIML-FE estimates of the effects of women's program participation on girls' schooling is mirrored in the estimates of the women's correlation coefficients ρ. The WESML-LIML estimates suggest that women in households that are less likely to educate their daughters than observationally equivalent women are also more likely to choose to participate in a credit program. The WESML-LIML-FE estimates suggest that self-selection into the program is of the opposite sort -- women in households that are more likely to educate their daughters, conditional on the observed regressors and all observed and unobserved village characteristics, are more likely to participate in a credit program.

A joint test of the exogeneity of credit program participation cannot reject the null hypothesis that individual credit program participation is exogenous in the determination of girls' and boys' schooling conditional on the village fixed effects.[28] Table 4.1D presents WESML-FE estimates of those conditional demand equations for which the hypothesis of exogeneity could not be rejected, as well as the relevant test statistics. Imposing the statistically valid restriction of exogeneity provides more efficient estimates of program effects. The estimates in the first column of Table 4.1D demonstrate a strong and statistically significant effect of female Grameen Bank credit on girls' schooling (t=2.92). No other credit parameters are statistically significant. The small effect of women's credit on their daughters' schooling for the other credit programs may reflect the close substitution of women's and girls' time in both the production of household goods and in the self-employment activity. If mothers are drawn into self-employment, daughters' time may be used to replace the time mothers formerly spent on household products, such as child care and food preparation.

Table 4.1D (column 2) provides WESML-FE estimates of the determinants of boys' schooling that demonstrate a pattern of statistical significance conforming to that found in the WESML-LIML-FE

[28] The test is that the two correlation coefficients ρ are jointly zero.

estimates. The estimated t-ratios are higher for female BRDB and Grameen credit and male Grameen credit, but the size of the women's Grameen effect falls.

The two sets of naive parameter estimates presented for the boys' school enrollment equation are quite different from the WESML-LIML-FE. The magnitude and significance of women's BRDB and Grameen credit on boys' school enrollment is strikingly miscalculated by the naive models. For the determinants of girls' schooling, the weighted naive model only finds a significant positive effect for male credit from the BRAC. The point estimate is the same as the WESML-LIML-FE, but the t-ratio for the naive estimate is much larger.

Table 4.4 presents estimates of the program credit impact on the market labor supply, including self-employment (log hours in the past week), by gender using all three rounds of the survey. The WESML-LIML-FE estimates for women find no significant credit effects ($\chi^2(6)=1.39$, $p=0.97$). As both labor supply and credit are entered in logged form, the credit parameters are the elasticities of (latent) hours of market labor supply with respect to credit. The naive estimates (Table 4.4) substantially overestimate the effect of credit provided women on their labor supply. Table 4.1 provides non-fixed-effects WESML-LIML estimates of the determinants of women's labor supply that, except for female credit from the Grameen Bank, are not very different from the fixed-effects estimates.

A test of the null hypothesis that credit program participation is exogenous in the determination of women's labor supply could not be rejected; hence the WESML-FE estimates of Table 4.1D are preferred. As in the case of girls' schooling, these estimates find a statistically significant positive effect of women's participation in the Grameen Bank on women's labor supply. In addition, the women's BRAC and BRDB parameters change sign and are marginally statistically significant, with asymptotic t-ratios above 1.8.

Both own- and cross-effects are important in the male labor supply (Table 4.4). Both male credit ($\chi^2(3)=98.66$, $p=0.00$) and female credit ($\chi^2(3)=53.11$, $p=0.00$) reduce the labor time of adult male household members. Since it seems unlikely that they are substituting home time for market time, the only conclusion to be drawn is that these negative cross-effects reflect income effects. If the market value of men's time is unchanged by women's borrowing, their labor supply should fall if male leisure is a normal

good. This is consistent with a variety of scenarios. One is that men already have ready access to non-program credit markets, so that program credit provides men mostly with rents proportional to the difference between the program and next-best-alternative rates of interest.

Table 4.5 presents estimates of the impact of credit program participation on the natural logarithm of food, non-food and total expenditure per capita using all three rounds of survey data. All three female credit parameters are positive and statistically significant determinants of total expenditure, with no t-statistic less than 3.8, and are jointly significant ($\chi^2(3)=19.03$, p=0.00). By contrast, none of the male credit parameters has a t-statistic over 2.0 and the hypothesis that all the male credit parameters are zero cannot be rejected at the 0.05 level of significance ($\chi^2(3)=4.11$, p=0.25). The estimated female credit effects are approximately double the male credit parameters for the same program. The largest elasticity is, with respect to Grameen Bank credit, provided to women (0.043). The WESML-LIML parameter estimates of the determinants of (log) total expenditure in Table 4.1C again show the importance of the village fixed effects in the estimation. Women's credit effects are underestimated by WESML-LIML, and all three male credit parameters are negative and two (BRAC and Grameen) are statistically significant. The naive estimates presented in Table 4.5 enormously underestimate the positive effects of program credit on total household expenditure.

Credit provided to women and men increases expenditure on both food and non-food items. These parameters are less precisely estimated than the total expenditure parameters, and because of the logarithmic specification chosen, the *adding up* property of expenditure equations does not hold.[29]

Table 4.6 presents estimates of the effects of credit programs on current contraceptive use and the recent (last 36 months) fertility of currently married women aged 15-49 years. The WESML-LIML-FE estimates provide mixed statistical evidence of the influence of program credit on both behaviors. Female credit from all three programs apparently reduces the use of contraceptive devices among program participants ($\chi^2(3)=6.15$, p=0.10), with t-statistics greater than 2.0 (in absolute value) for the BRDB and Grameen. By contrast, male credit from the BRAC and BRDB tends to increase the use of contraceptives

[29] WESML-FE estimates of the determinants of food and non-food expenditures are not provided since they are simply disaggregations of the total expenditure, for which exogeneity was firmly rejected.

($\chi^2(3)=8.58$, p=0.04). The naive weighted contraceptive use equation (Table 4.6) also does not find strong positive effects of credit program participation by women. The WESML-LIML-FE correlation coefficient (ρ) is positive and fairly large ($\rho=.425$) implying that the women who join these credit programs are more likely to already use contraceptives than observationally equivalent women, controlling for village effects.

The WESML-LIML estimates (Table 4.1B) paint an opposing picture of the effects of women's program credit on contraceptive use. Without controlling for village effects, all the female credit parameters are positive and the BRAC and Grameen parameters have t-statistics greater than 2.0. Moreover, all the male credit effects change sign from positive to negative. Contraceptive use is one behavior for which village externalities (as defined above) might be important. Consequently, the total effect of the credit program on a participant $C_{ij}\delta + \Omega_j$ may in fact be positive, but we are still left with the implication that the effect of the credit program on women participants is *less* than its effect on non-participants in the same village, since the estimated δ's are negative.

The null hypothesis that credit program participation is exogenous in the determination of contraceptive use is only marginally rejected ($\chi^2(2)=4.90$, p=0.09), and the null hypothesis for women's credit program participation is more firmly rejected (t=2.075). Nonetheless, WESML-FE estimates for contraceptive use are presented in Table 4.1D because of the marginal significance of the joint test. The WESML-FE estimates find a higher t-ratio for male BRDB credit, and still find negative women's BRDB and Grameen Bank credit effects, although they are no longer statistically significant. There remains a lack of evidence that women's credit program participation increases the use of contraceptives.[30]

The WESML-LIML-FE fertility estimates (Table 4.6) are mostly consistent with the contraceptive use estimates for women's credit. Fertility is increasing with women's participation in the BRAC and BRDB, although only statistically significantly for the BRAC. The set of three women's credit parameters are jointly different from zero ($\chi^2(3)=8.36$, p=0.04), as are the men's credit parameters ($\chi^2(3)=8.17$,

[30] Furthermore, the WESML-LIML correlation coefficient is negative and large in absolute value ($\rho=-0.325$) whereas the WESML-LIML-FE estimate is large and positive ($\rho=0.425$). A negative correlation coefficient implies that women who are less likely to use contraception than observationally equivalent women are more likely to join a credit program, which strikes us as less intuitive than the opposite sort of self-selection.

p=0.04). However, the male BRDB and Grameen credit effects are negative and have t-statistics near or above 2.0 in absolute value. That is, male participation seemingly reduces fertility while female participation increases it. The null hypothesis that women's and men's credit effects on fertility are the same is rejected ($\chi^2(3)=17.85$, p=0.00).[31,32]

Table 4.7 presents the results of estimating WESML-LIML-FE and naive models of the determinants of women's non-land asset value.[33] The WESML-LIML-FE estimates are all positive, implying that credit program participation by both sexes increases the value of women's non-land asset holdings, with the female participation parameters for each program larger than the male participation parameters in each case. However, these parameters are not statistically different from zero ($\chi^2(6)=4.36$, p=0.54), nor are the women's and men's parameters statistically different from each other ($\chi^2(3)=2.95$, p=0.40). The naive estimates find large positive effects for women's BRAC and Grameen participation on the value of their non-land assets. Women's non-land assets is apparently the behavior for which the difference between the unweighted and weighted naive estimates is the greatest amongst those studied. That is, the choice-based nature of the sample matters most. The WESML-LIML estimates show a statistically significant effect of female participation only for the BRAC, but male participation shows such an effect in all three programs, most strikingly in the BRDB.[34]

The null hypothesis of the exogeneity of program credit in the determination of women's non-land assets cannot be rejected ($\chi^2(2)=1.76$, p=0.41). The WESML-FE estimates of Table 4.1D find strong and

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[31] The naive weighted fertility estimates only find women's participation in the Grameen Bank to have a statistically significant effect in reducing fertility. Furthermore, unlike contraception, the WESML-LIML and WESML-LIML-FE estimates of ρ are not of opposite sign. Both sets of estimates suggest that individuals with lower recent fertility, conditional on their observed attributes, are more likely to participate in a credit program.

[32] In work in progress, Pitt and others (1995) investigate the contraceptive and fertility effects of these credit programs in more detail by estimating the model with age-defined subsamples of the data and by altering the econometric specification in other ways.

[33] The asset variables are sex-specific rather than individual-specific in that they are defined as the total value of assets held by all individuals of each sex in the household. Thus, no household contributes more than one observation to each of the sex-specific asset equations estimated.

[34] The quality of asset data is typically suspect in household surveys, even more so when there is an attempt to break down assets by sex of ownership. The relative variance of the asset data is very high (see Table 3.2), with many household reporting zero for women's assets. The male asset data was even more troublesome. We were unable to get the any of the likelihoods for the determinants of male assets to converge.

statistically significant positive effects of credit program participation on women's asset holdings. The BRDB and Grameen Bank parameters are nearly twice as large as the BRAC parameter, and all are larger than male participation parameters.

The last group of reported estimates examines the determinants of the anthropometric status of children aged 0-14 years -- height, weight and body mass index. There are 6 sets of estimates -- the three anthropometric measures for each sex. The high cost of collecting anthropometric data forced us to draw samples of children from only 15 of the 87 villages. All of the 15 villages had credit programs present -- 6 each with the BRAC and Grameen Bank, and 3 with the BRDB -- and all the sampled households were in the target group. As a result, a substantial part of the statistical identification obtained from the quasi-experimental framework was lost. Gender-specific credit effects are still identified from the fact that not all villages in this subsample had credit programs for both sexes. Because the anthropometric dependent variables are strictly continuous, nonlinearity arising from the specification of the errors as having a joint normal distribution is used to identify the model.

Body Mass Index (BMI), defined as the ratio of weight to height squared (weight/ (height^2), is most often the preferred indicator of anthropometric status. The WESML-LIML-FE estimates in Table 4.8 reveal that all six credit variables negatively affect boys' BMI ($\chi^2(6)=4.17$, $p=0.65$) and positively affect girls' BMI ($\chi^2(6)=9.82$, $p=0.13$). Neither the set of three women's credit variables or men's credit variables are significant in the boys' BMI equation ($\chi^2(3)=3.32$, $p=0.34$ for women's credit; $\chi^2(3)=1.76$, $p=0.62$ for men's credit) or in the girls' BMI equation ($\chi^2(3)=4.14$, $p=0.25$ for women's credit; $\chi^2(3)=5.98$, $p=0.11$ for men's credit). The largest positive effects on girls' BMI came from Grameen Bank credit, the smallest from BRDB. The estimated elasticities are quite small; the largest is .009 for Grameen Bank credit provided to men.

The weighted naive girls' BMI equation finds that women's credit has a negative effect on BMI, the opposite sign of the WESML-LIML-FE equation. One reason for the "wrong" sign of the naive model is the negative ρ for women's credit, implying a negative correlation between the errors of the women's credit equation and girls' BMI. The WESML-LIML estimates without village fixed effects (Table 4.1A) similarly estimate the wrong sign for women's credit in the girls' BMI equation. With village unobservables treated

as random effects, the ρ for women's credit is positive but small, suggesting that credit programs are more likely to be placed where girls' anthropometric status is somewhat higher but that the target households that participate in these credit programs are those with girls' BMI of below village average.

Exogeneity could not be rejected for both the girls' and boys' BMI equations, and thus WESML-FE estimates are presented in Table 4.1D. Like the WESML-LIML-FE estimates, these estimates continue to find that the only statistically significant effect is of male Grameen Bank credit on girls' BMI.

Height and weight estimates are presented for completeness. The pattern of the ρ's is interesting here. They suggest that women who borrow tend to have children of higher than average weight and height among target households. No similar selection mechanism appears among men. This is consistent with the preference heterogeneity explanation suggested above, in which more egalitarian households are both more likely to treat their girl children favorably and to permit their adult females access to program credit and self-employment activities.

5. Summary and conclusions

Group-based lending programs for the poor have become a focus of attention in the development community over the last several years. To date, there has been no comprehensive investigation of their impact on household behavior that has been sufficiently attentive to issues of endogeneity and self-selection. Perhaps one reason for this is the absence of any data generated from social experiments associated with these credit programs, and from the difficulty in finding valid instrumental variables (exclusion restrictions) to deal with endogeneity in non-experimental data.

This paper surmounts these issues by treating the choice of participating in credit programs in a sample of Bangladeshi households and villages as corresponding to a "quasi-experiment" conditional on all observed (in the data) and unobserved village characteristics. It uses this same approach to help identify the separate effects, if any, of lending to female and male household members, making use of the fact that credit groups are single-sex and groups for both sexes are not available in all villages. The econometric methods used are much more complex than those ordinarily applied in this area. In order to demonstrate the

value of resorting to these methods, the paper presents alternative estimates of program impacts using simpler approaches such as ordinary least squares. This simplicity is obtained by ignoring to some extent issues of endogeneity. A comparison of these methods clearly indicates the importance of our attentiveness to endogenity in evaluating these credit programs and the mistaken conclusions that could be drawn from the simple "naive" estimates.

The paper provides estimates for a wide variety of household and individual outcomes and separate estimates of the influence of borrowing by both men and women and for each of three credit programs. The results are summarized as follows:

A. Joint tests reveal that credit is often a significant determinant of household behavior. Either the set of female credit variables, male credit variables or both are statistically significant at the 0.05 level of significance in all 8 key behaviors studied (excluding anthropometry and disaggregations of total household expenditure).[35]

B. Joint tests reveal that credit provided to women somewhat more often has a statistically significant effect on these 8 outcomes than credit provided to men. The set of female credit variables is statistically significant in 7 of 8 cases at the 0.05 level. By contrast, the set of male credit variables is significant in 3 of 8 cases. However, the hypothesis that female and male credit parameters are jointly equal for each of the three programs is rejected in only four cases: women's labor supply, women's non-land assets, contraception and fertility.

C. Credit provided by the Grameen Bank had the greatest positive impact on variables typically associated with household wealth and women's power and independence than credit from any other

[35] Identification of the determinants of anthropometric outcomes is somewhat weaker in that anthopometry is only available from villages in which there is a credit program and only for target households, as discussed above, and as a consequence we treat them separately below. Food and non-food expenditures are not counted separately here since they are encompassed by total household expenditure. The 8 outcomes are: girls' and boys' schooling, women's and men's labor supply, total household expenditure, contraception, fertility, and the value of women's non-land assets.

The test statistics referenced here and below are for WESML-LIML-FE estimates unless the joint test of exogeneity could not be rejected, in which case the test statistics are for the WESML-FE estimates of Table 4.1D.

program source.[36] Grameen Bank credit to women had the largest impacts on girls' schooling, women's labor supply and total household expenditure, and Grameen Bank credit to men had the largest impact on fertility (tied with male BRDB credit). Women's credit from the BRDB had the largest impact on boys' schooling and the value of women's assets.

D. Little evidence is provided of any impact of credit on the anthropometric status of children. However, this might reflect the somewhat weaker statistical identification available in the data when estimating the determinants of anthropometric outcomes.

E. Treating the placement of credit programs across villages as non-random, and the decision to join and borrow from one of these programs as endogenous, has an important influence on the estimated program impacts. For example, the WESML-LIML-FE credit parameters in the conditional demand equation for contraceptive use are of the opposite sign of their WESML-LIML (without village fixed effects) counterparts. In addition, the naive estimates, which treat program participation and program placement as exogenous, miscalculate the effects of credit program participation on behavior. For example, they grossly underestimate the effects of the credit programs on increasing total household expenditure.

Our results provide evidence that program participation benefits the poor, especially women and children. Furthermore, the magnitude of the benefits accruing to individuals in a participating household depends on whether the participant is a woman or a man.

Three important policy conclusions can be drawn from this exercise. First, targeted credit programs such as the Grameen Bank can "empower" women by increasing their contribution to household consumption expenditure, their hours devoted to production for the market, and the value of their assets. Second, targeted credit programs can be seen as anti-poverty schemes. Poverty in rural Bangladesh largely means low levels of consumption, and our results clearly indicate that credit from all three programs increases the total per capita consumption of the poor and the asset holdings of women. Third, group-based

[36] These outcomes are girls' and boys' schooling, and women's labor supply, assets, and total expenditure.

credit provided to men can also have beneficial effects, particularly on the schooling of children, contraceptive use, fertility and total household expenditure.

Further research is, however, needed to broaden our understanding of the influence of these credit programs in altering the lives of participants and their families. We are currently undertaking research using data from the survey described above to study the importance of the non-credit services provided by these group-based programs, the determinants of the choice of self-employment activity, the effect of program borrowing on intrafamily transfers and borrowing from other non-program sources, and the effects of program credit and the self-employment it engenders on seasonal patterns of consumption.

Table 2.1
Distribution of villages by credit program and group type

Group type	Credit program				
	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

Source: BIDS-World Bank household survey data, 1991-92.

Table 3.1
Weighted mean and standard deviations of independent variables

Independent variables	No. of observations	Mean	Standard deviation
Age of the individual	9,215	23.00	18.00
Education of individual (years)	7,886	1.377	2.773
Parents of HH head own land	1,725	0.256	0.564
Brothers of HH head own land	1,725	0.815	1.308
Sisters of HH head own land	1,725	0.755	1.208
Parents of HH head's spouse own land	1,735	0.529	0.784
Brothers of HH head's spouse own land	1,735	0.919	1.427
Sisters of HH head's spouse own land	1,735	0.753	1.202
Household land (in decimals)	1,757	76.142	108.543
Highest grade completed by HH head	1,757	2.486	3.501
Sex of household head (1=male)	1,757	0.948	0.223
Age of household head (years)	1,757	40.821	12.795
Highest grade completed by an adult female in HH (in years of education)	1,757	1.606	2.853
Highest grade completed by an adult male in HH (in years of education)	1,757	3.082	3.081
No adult male in HH	1,757	0.035	0.185
No adult female in HH	1,757	0.017	0.129
No spouse present in HH	1,757	0.126	0.332
Amount borrowed by female from BRAC (Tk.)	1,757	350.345	1573.659
Amount borrowed by male from BRAC (Tk.)	1,757	171.993	1565.006
Amount borrowed by female from BRDB (Tk.)	1,757	114.348	747.301
Amount borrowed by male from BRDB (Tk.)	1,757	203.250	1572.667
Amount borrowed by female from GB (Tk.)	1,757	956.159	4293.366

Table 3.1 (continued)
Weighted mean and standard deviations of independent variables

Independent variables	No. of observations	Mean	Standard deviation
Amount borrowed by male from GB (Tk.)	1,757	374.383	2922.794
Non-target household	1,757	0.295	0.456
Has any primary school?	1,757	0.686	0.464
Has rural health center?	1,757	0.300	0.458
Has family planning center?	1,757	0.097	0.296
Is *Dai*/midwife available?	1,757	0.673	0.469
Price of rice	1,757	11.15	0.85
Price of wheat flour	1,757	9.59	1.00
Price of mustard oil	1,757	52.65	5.96
Price of hen egg	1,757	2.46	1.81
Price of milk	1,757	12.54	3.04
Price of potato	1,757	3.74	1.59
Average female wage	1,757	16.154	9.613
No female wage dummy	1,757	0.193	0.395
Average male wage	1,757	37.893	9.400
Distance to bank (km)	1,757	3.49	2.85

Note: Amount borrowed is the cumulative amount of credit ($\geq$ Tk.1,000) borrowed since December 1986 from any of these three credit programs. These amounts are then adjusted with proper CPI indices.

Source: BIDS-World Bank household survey data, 1991-92.

Table 3.2
Weighted Mean and Standard Deviations of Dependent Variables

Dependent Variables	Partici-pants	Obs.	Non-participants	Obs.	Total	Obs.	Non-program areas	Obs.	Aggregate	Obs.
Sum of program loans of females (Taka)	5498.854 (7229.351)	779		326	2604.454 (5682.398	1105-	-		2604.454 (5682.398)	1105
Sum of program loans by males (Taka)	3691.993 (7081.581)	631	-	263	1729.631 (5184.668)	894	-	-	1729.631 (5184.668)	895
Contraceptive use by currently married women aged 14-50 years	.418 (.493)	902	.375 (4.84)	546	.389 (.488)	1448	.322 (.468)	283	.378 (.485)	1731
Fertility: Number of Children Born last 3 years to currently married women aged 14-50 years (Any child Yes=1; No=0)	.679 (.736)	902	.703 (.717)	546	.695 (.723)	1448	.712 (.702)	281	.697 (.719)	1729
Current school enrollment by girls aged 5-17 years (Yes=1; No=0)	.535 (.499)	802	.528 (.500)	434	.531 (.499)	1236	.552 (.498)	225	.534 (.499)	1461
Current school enrollment by boys aged 5-17 years (Yes=1; No=0)	.566 (.496)	856	.555 (.498)	468	.558 (.497)	1324	.560 (.497)	265	.559 (.497)	1589
Weight of girls aged 0-14 years	13.00 (4.00)	263)	12.00 (4.00)	146	12.00 (4.00)	409	-	-	12.00 (4.00)	409
Weight of boys aged 0-14 years (kg)	13.00 (4.00)	287	12.00 (4.00)	91	13.00 (4.00)	378	-	-	13.0 (4.00)	378
Height of girls aged 0-14 years (cm)	96.00 (17.00)	263	94.00 (18.00)	146	94.00 (18.00)	409	-	-	94.00 (18.00)	409
Height of boys aged 0-14 year (cm)	97.00 (17.00)	287	93.00 (16.00)	91	95 (17.00)	378	-	-	95.00 (17.00)	378
Body Mass Index of girls aged 0-14 years	.001 (.000)	263	.001 (.000)	146	.001 (.000)	409	-	-	.001 (.000)	409
Body Mass Index of boys aged 0-14 years	.001 (.000)	287	.001 (.000)	91	.001 (.000)	378	-	-	.001 (.000)	378

Table 3.2 (continued)
Weighted Mean and Standard Deviations of Dependent Variables

Dependent Variables	Partici-pants	Obs.	Non-participants	Obs.	Total	Obs.	Non-program areas	Obs.	Aggregate	Obs.
Sum of program loans of females (Taka)	5498.854 (7229.351)	779		326	2604.454 (5682.398	1105-	-		2604.454 (5682.398)	1105
Employment hours per month by women aged 16-59 years	40.328 (70.478)	3420	37.680 (71.325)	2108	38.905 (70.934)	5528	43.934 (74.681)	1074	39.540 (71.432)	6602
Employment hours per month by men aged 16-59 years	202.758 (100.527)	3534	185.858 (104.723)	2254	191.310 (103.678)	5788	180.94 (98.805)	1126	189.477 (102.902)	6914
Per capita HH food expenditure (Taka)	59.166 (19.865)	2696	62.265 (23.256)	1650	61.242 (22.239)	4326	61.985 (23.897)	872	61.366 (22.522)	5218
Per capita HH non-food expenditure (Taka)	17.848 (31.538)	2696	23.621 (54.791)	1650	21.716 (48.439)	4346	27.676 (51.409)	872	22.706 (48.990)	5218
Per capita HH total expenditure (Taka)	77.014 (41.496)	2696	85.886 (64.820)	1650	82.959 (58.309)	4346	89.661 (66.823)	872	84.072 (59.851)	5218
Female Non-land assets (Taka)	7399.231 (2930.02)	899	4716.416 (19901.035)	542	5608.033 (23509.09)	1441	1801.839 (6287.491)	292	4970.67 (21649.42)	1733
Male Non-land assets (Taka)	54767.57 (73152.98)	873	83116.58 (94047.46)	542	73893.11 (88753.85)	1415	71858.15 (76653.98)	276	73559.46 (86867.58)	1691

Note: Standard deviations are in the parentheses.
Contraceptive use and fertility variables are based on only round 1 data.
Nutrition variables (weight, height and BMI) are based on round 1 and round 2 data of the nutrition survey which match up with round 1 and round 3 of the general household survey.
All other variables are based on all 3 rounds of the general household survey.

Source: BIDS-World Bank household survey data, 1991-92.

Table 4.1A
Fixed- and Nonfixed-Effects Estimates of the Impact of Credit on Women's Log Labor Supply, Boys Log Body Mass Index, Women's Log Non-land Assets and Men's Log Labor Supply

Explanatory Variables	Women's Log Labor Supply		Boys Log BMI		Women's Log Non-land Assets		Men's Log Labor Supply	
	WESML-LIML-FE[a]	WESML-LIML[b]	WESML-LIML-FE[a]	WESML-LIML[b]	WESML-LIML-FE[a]	WESML-LIML[b]	WESML-LIML-FE[a]	WESML-LIML[b]
Amount borrowed by female from BRAC	-.0117 (-.128)	.0096 (.144)	-.0130 (-1.248)	.0020 (2.388)	.0318 (.356)	.0425 (2.302)	-.1813 (-5.884)	-.2008 (-8.350)
Amount borrowed by male from BRAC	-.0448 (-.520)	-.0908 (-1.090)	-.0050 (-0.536)	-.0139 (-2.343)	.1005 (.468)	.2589 (2.367)	-.1369 (-2.155)	.0246 (1.036)
Amount borrowed by female from BRDB	-.0139 (-.139)	.2087 (3.185)	-.0110 (-0.827)	-.0046 (-0.529)	.1257 (1.043)	.0473 (.300)	-.2308 (-7.066)	-.2051 (-7.635)
Amount borrowed by male from BRDB	-.0144 (-.181)	.0281 (.398)	-.0110 (-1.017)	-.0153 (-2.468)	.0334 (.141)	3.8329 (3.340)	-.1440 (-2.129)	.0172 (.777)
Amount borrowed by female from GB	.0152 (.162)	.1449 (2.042)	-.0090 (-0.797)	-.0077 (-0.928)	.1131 (1.317)	1.3484 (1.452)	-.2189 (-6.734)	-.2175 (-8.232)
Amount borrowed by male from GB	-.0570 (-.677)	.0357 (.440)	-.0060 (-0.623)	-.0140 (-2.095)	-.0457 (-.200)	.3377 (2.386)	-.1592 (-2.524)	.0126 (.522)
Rho (women)	.1255 (1.062)	-.0173 (-.196)	.482 (1.156)	.6206 (3.458)	.1136 (1.325)	-.0168 (-.198)	.6564 (7.461)	.7151 (11.698)
Rho (men)	.0560 (.592)	.0415 (.435)	.399 (1.146)	.3423 (1.070)	-.0148 (-.053)	-.7656 (-36.311)	.4929 (2.512)	-.0481 (-.794)
Log likelihood	-15069.781	-15774.111	-2998.448	-3176.737	-4226.176	-4951.408	-18395.082	-18954.702
No. of observations	6602		378		1757		6914	

[a] Weighted Exogenous Sampling Maximum Likelihood:Limited Information Maximum Likelihood:Fixed Effects.
[b] Weighted Exogenous Sampling Maximum Likelihood:Limited Information Maximum Likelihood.

Note: Figures in parentheses represent asymptotic t-ratios.

Source: BIDS-World Bank household survey data, 1991-92.

Table 4.1B
Fixed- and Nonfixed-Effects Estimates of the Impact of Credit on Girls Schooling, Girls Log BMI, Contraceptive Use and Recent Fertility

Explanatory Variables	Girls Schooling		Girls Log BMI		Contraceptive Use		Recent Fertility	
	WESML-LIML-FE[a]	WESML-LIML[b]	WESML-LIML-FE[a]	WESML-LIML[b]	WESML-LIML-FE[a]	WESML-LIML[b]	WESML-LIML-FE[a]	WESML-LIML[b]
Amount borrowed by female from BRAC	-.0203 (-.552)	.0693 (1.990)	.004 (1.365)	-0.002 (-0.175)	-.0735 (-1.693)	.0745 (2.095)	.0790 (2.372)	0374 (.933)
Amount borrowed by male from BRAC	.0495 (1.152)	.0612 (1.891)	.006 (1.070)	.008 (1.571)	.0395 (.745)	-.0212 (-.406)	.0543 (1.353)	.0160 (.399)
Amount borrowed by female from BRDB	-.0099 (-.220)	.0591 (1.616)	.002 (.244)	-0.003 (-0.244)	-.1163 (-2.421)	.0443 (1.214)	.0502 (1.312)	.0218 (.495)
Amount borrowed by male from BRDB	.0321 (.665)	.0341 (1.036)	.000 (.145)	.007 (1.962)	.0839 (1.475)	-.0067 (-.132)	-.0744 (-1.976)	-.0547 (-1.191)
Amount borrowed by female from GB	.0128 (.334)	.0853 (2.289)	.005 (1.822)	-0.001 (-0.098)	-.0905 (-2.011)	.0946 (2.580)	-.0348 (-.951)	-.0160 (-.362)
Amount borrowed by male from GB	.0582 (1.298)	.0697 (2.103)	.009 (2.293)	.010 (2.524)	.4253 (2.975)	-.0879 (-1.625)	-.0743 (-2.193)	-.0420 (-.851)
Rho (women)	.1648 (1.029)	-.2728 (-1.370)	-0.165 (-1.441)	.136 (.242)	.4253 (2.075)	-.3253 (-1.777)	-.4319 (-2.718)	-.2635 (-1.201)
Rho (men)	-.1360 (-.720)	-.1409 (-.922)	-0.051 (-0.534)	-0.161 (-1.184)	-.2032 (-.700)	.1991 (.643)	.3511 (2.701)	.2445 (1.097)
Log likelihood	-3702.947	-3949.170	-2921.321	-3104.000	-2458.954	-2709.3012	-2444.341	-2657.02067
No. of observations	2885		409		1884		1882	

[a] Weighted Exogenous Sampling Maximum Likelihood:Limited Information Maximum Likelihood:Fixed Effects.
[b] Weighted Exogenous Sampling Maximum Likelihood:Limited Information Maximum Likelihood.

Note: Figures in parentheses represent asymptotic t-ratios.

Source: BIDS-World Bank household survey data, 1991-92.

Table 4.1C

Fixed- and Nonfixed-Effects Estimates of the Impact of Credit on Boy's Schooling, Log Expenditure per Capita, Log Expenditure Per Capita on Non-Food Goods, and Log Expenditure Per Capita on Foods

Explanatory Variables	Boy's Schooling		Log Total Expenditure per Capita		Log Total Non-Food Expenditure Per Capita		Log Total Food Expenditure Per Capita	
	WESML-LIML-FE[a]	WESML-LIML[b]	WESML-LIML-FE[a]	WESML-LIML[b]	WESML-LIML-FE[a]	WESML-LIML[b]	WESML-LIML-FE[a]	WESML-LIML[b]
Amount borrowed by female from BRAC	.0394 (.917)	.0991 (3.196)	.0394 (4.237)	.0340 (2.291)	.0220 (.544)	-.0183 (-.822)	.0057 (.658)	.0094 (1.325)
Amount borrowed by male from BRAC	-.0040 (-.107)	.0113 (.333)	.0192 (1.593)	-.0161 (-1.658)	.0364 (1.388)	-.0150 (-.680)	.0060 (.801)	-.0075 (-.890)
Amount borrowed by female from BRDB	.1210 (2.573)	.0956 (3.066)	.0402 (3.813)	.0258 (1.723)	.0139 (.320)	-.0269 (-1.197)	.0101 (1.051)	.0044 (.601)
Amount borrowed by male from BRDB	.0361 (.934)	.0370 (1.181)	.0233 (1.936)	-.0155 (-1.788)	.0349 (1.330)	-.0246 (-1.246)	.0138 (1.845)	-.0055 (-.707)
Amount borrowed by female from GB	.1025 (2.364)	.1307 (4.022)	.0432 (4.249)	.0371 (2.174)	.0199 (.467)	-.0184 (-.759)	.0114 (1.263)	.0114 (1.435)
Amount borrowed by male from GB	.0736 (1.688)	.0561 (1.607)	.0179 (1.431)	-.0225 (-2.291)	.0182 (.665)	-.0220 (-.982)	.0087 (1.163)	-.0142 (-1.602)
Rho (women)	-.2192 (-1.054)	-.4665 (-2.490)	-.4809 (-4.657)	-.3897 (-2.056)	-.0564 (-.222)	.1824 (1.357)	-.1026 (-.697)	-.1023 (-.820)
Rho (men)	-.0284 (-.177)	-.0222 (-.144)	-.2060 (-1.432)	.2999 (2.998)	-.1300 (-.858)	.2152 (1.923)	-.1077 (-.980)	.2050 (1.648)
Log likelihood	-3802.873	-4141.386	-6633.559	-7281.469	-10620.080	-11259.596	-5311.365	-6024.498
No. of observations	2940		5218		5218		5218	

[a] Weighted Exogenous Sampling Maximum Likelihood:Limited Information Maximum Likelihood:Fixed Effects.

[b] Weighted Exogenous Sampling Maximum Likelihood:Limited Information Maximum Likelihood.

[c] These variables are applied to outcomes specific to individuals.

Note: Figures in parentheses represent standard deviations.

Source: BIDS-World Bank household survey data, 1991-92.

Table 4.1D
WESML-FE Estimates of the Impact of Credit on Boy's and Girl's Schooling, Boy's and Girl's BMI, Women's Labor Supply and Assets, and Contraceptive Use[a]

Explanatory variables	Girl's Schooling	Boy's Schooling	Girl's BMI	Boy's BMI	Women's Labor Supply	Women's Log Non-land Assets	Contraceptive use
Amount borrowed by female from BRAC	0.0119 (0.682)	-0.0028 (-0.173)	0.0012 (0.516)	-0.0043 (-1.783)	0.0721 (1.884)	0.1151 (2.003)	0.0081 (0.433)
Amount borrowed by male from BRAC	0.0242 (0.897)	-0.0076 (-0.341)	0.0055 (1.150)	0.0037 (0.948)	-0.0126 (-0.231)	0.0878 (1.007)	0.0075 (0.289)
Amount borrowed by female from BRDB	0.0233 (0.804)	0.0793 (3.106)	-0.0014 (-0.234)	0.0019 (0.301)	0.0766 (1.803)	0.2172 (2.408)	-0.0287 (-1.134)
Amount borrowed by male from BRDB	0.0069 (0.309)	0.0293 (1.475)	-0.0001 (-0.041)	-0.0012 (-0.420)	0.0268 (0.682)	0.0244 (0.426)	0.0524 (2.663)
Amount borrowed by female from GB	0.0469 (2.919)	0.0611 (3.644)	0.0020 (0.937)	0.0009 (0.317)	0.1037 (3.016)	0.1989 (3.950)	-0.0032 (-0.199)
Amount borrowed by male from GB	0.0304 (1.376)	0.0720 (2.743)	0.0081 (2.322)	0.0025 (1.127)	-0.0229 (-0.506)	-0.0603 (-0.878)	-0.0411 (-1.631)
No. of observations	2,885	2,940	409	378	6,602	1,757	1,882
Joint test both ρ's=0 in WESML-LIML-FE $\chi^2(2)$	1.64 (ρ=0.44)	1.20 (ρ=0.55)	2.33 (ρ=0.31)	1.96 (ρ=0.37)	1.53 (ρ=0.47)	1.76 (ρ=0.41)	4.90 (ρ=0.09)

Note: [a]Figures in parentheses represent asymptotic t-ratios except for χ^2 statistics.

Source: BIDS-World Bank household survey data, 1991-92.

Table 4.2
WESML Bivariate Tobit Fixed Effects Estimates of the Demand for Credit by Gender
Dependent Variable: Log of cumulative credit (Taka) since 1986

Explanatory Variables	Women		Men	
	Coef.	t-stat	Coef.	t-stat
Parents of HH head own land	-0.010	-0.098	.042	.250
Brothers of HH head own land	.036	.458	.170	1.622
Sisters of HH head own land	.051	.621	-0.034	-0.339
Parents of HH head's spouse own land	.005	.049	-0.185	-1.126
Brothers of HH head's spouse own land	.002	.034	-0.027	-.295
Sisters of HH head's spouse own land	.100	1.196	-0.004	-0.045
Log household land	.026	.540	.207	3.154
Highest grade completed by HH head	-0.021	-0.352	-0.029	-0.334
Sex of household head	-2.068	-3.532	1.399	1.551
Age of household head (years)	0.015	2.089	-0.024	-2.373
Highest grade completed by an adult female in HH	-0.074	-1.754	-0.026	-0.458
Highest grade completed by an adult male in HH	.029	.534	0.142	1.802
No adult male in HH	-1.257	-1.923		
No adult female in HH			-0.850	-0.961
No spouse present in HH	-0.831	-2.483	-1.351	-2.951
Sigma women's credit	2.083	33.211		
Sigma men's credit			2.312	26.878
Rho - Coef. (t-stat)	-0.075 (-1.313)			
Log likelihood	-1424.393			
No. of observations	1105		895	

Source: BIDS-World Bank household survey data, 1991-92.

Table 4.3
Alternative Estimates of the Impact of Credit on School Enrollment of Children Aged 5-17

Explanatory Variables	Boys			Girls		
	Naive		WESML-LIML-FE	Naive		WESML-LIML-FE
	Unweighted (Probit)	Weighted (Probit)		Unweighted (Probit)	Weighted (Probit)	
Amount borrowed by female from BRAC	.024 (1.515)	.027 (1.745)	.0394 (0.917)	.020 (1.167)	.015 (0.938)	-.0203 (-0.552)
Amount borrowed by male from BRAC	-0.005 (-0.231)	0.002 (.085)	-.0040 (-0.107)	.044 (1.986)	.049 (2.192)	.0495 (1.152)
Amount borrowed by female from BRDB	.042 (2.346)	.035 (1.588)	.1210 (2.573)	.011 (0.612)	.002 (0.082)	-.0099 (-0.220)
Amount borrowed by male from BRDB	.022 (1.466)	.028 (1.447)	.0361 (0.934)	.005 (0.331)	-0.005 (-0.236)	.0321 (0.665)
Amount borrowed by female from GB	.053 (4.141)	.062 (4.461	.1025 (2.364)	.023 (1.785)	.019 (1.412)	.0128 (0.334)
Amount borrowed by male from GB	.053 (2.707)	.074 (3.089)	.0736 (1.688)	.100 (0.614)	.029 (0.532)	.0582 (1.298)
Rho (women)			-.2192 (-1.054)			.1648 (1.029)
Rho (men)			-.0284 (-0.177)			-.1360 (-0.720)
Log likelihood	-786.506	-779.369	-3802.873	-728.630	-729.449	-3702.947
No. of observations	1341	1341	2940	1269	1269	2885

Note: Figures in parentheses are t-ratios.

Source: BIDS-World Bank household survey data, 1991-92.

Table 4.4
Alternative Estimates of the Impact of Credit on Log Labor Supply by Gender

Explanatory Variables	Men			Women		
	Naive		WESML-LIML-FE	Naive		WESML-LIML-FE
	Unweighted (Tobit)	Weighted (Tobit)		Unweighted (Tobit	Weighted (Tobit)	
Amount borrowed by female from BRAC	.010 (1.290)	.013 (1.623)	-.1813 (-5.884)	.028 (1.163)	.054 (2.106)	-.0117 (-.128)
Amount borrowed by male from BRAC	.007 (0.676)	.002 (0.169)	-.1369 (-2.155)	-0.072 (-2.049)	-0.042 (-1.103)	-.0448 (-.520)
Amount borrowed by female from BRDB	-0.002 (-0.169)	-0.000 (-0.020)	-.2308 (-7.066)	.131 (4.969)	.178 (5.043)	-.0139 (-.139)
Amount borrowed by male from BRDB	.006 (0.813)	.001 (0.072)	-.1440 (-2.129)	-0.007 (-0.303)	.043 (1.278)	-.0144 (-.181)
Amount borrowed by female from GB	.012 (1.910)	.013 (1.803)	-.2189 (-6.734)	.116 (6.275)	.134 (6.236)	.0152 (.162)
Amount borrowed by male from GB	-0.014 (-1.594)	-0.027 (-2.488)	-.1592 (-2.524)	.081 (3.012)	.084 (2.406)	-.0570 (-.677)
Rho (women)			.6564 (7.461)			.1255 (1.062)
Rho (men)			.4929 (2.512)			.0560 (.592)
Log likelihood	-10401.817	-10537.668	-18395.082	-9020.541	-8696.531	-15069.781
No. of observations	5846	5846	6914	5693	5693	6602

Note: Figures in parentheses are t-ratios.

Source: BIDS-World Bank household survey data, 1991-92.

Table 4.5
Alternative Estimates of the Impact of Credit on Per Capita Expenditure

Explanatory Variables	Food			Non-food			Total		
	Naive		WESML-LIML-FE	Naive		WESML-LIML-FE	Naive		WESML-LIML-FE
	Un-weighted (OLS)	Weighted (OLS)		Un-weighted (OLS)	Weighted (OLS)		Un-weighted (OLS)	Weighted (OLS)	
Amount borrowed by female from BRAC	.006 (3.040)	.005 (2.563)	.0057 (0.658)	.008 (1.390)	.009 (1.668)	.0220 (0.544)	.007 (3.048)	.007 (2.847)	.0394 (4.237)
Amount borrowed by male from BRAC	.007 (2.544)	.007 (2.296)	.0060 (0.801)	.014 (1.966)	.017 (2.130)	.0364 (1.388)	.010 (2.906)	.010 (2.835)	.0192 (1.593)
Amount borrowed by female from BRDB	.003 (1.523)	.003 (1.025)	.0101 (1.051)	-0.001 (-0.215)	.006 (0.826)	.0139 (0.320)	.002 (0.573)	.003 (0.906)	.0402 (3.813)
Amount borrowed by male from BRDB	.008 (4.721)	.007 (2.727)	.0138 (1.845)	.001 (0.108)	.011 (1.536)	.0349 (1.330)	.007 (3.118)	.007 (2.253)	.0233 (1.936)
Amount borrowed by female from GB	.005 (3.098)	.005 (2.700)	.0114 (1.263)	.000 (0.007)	.009 (1.760)	.0199 (0.467)	.003 (1.400)	.004 (1.765)	.0432 (4.249)
Amount borrowed by male from GB	-0.001 (-0.252)	-0.001 (-0.471)	.0087 (1.163)	-0.001 (-0.216)	.004 (0.476)	.0182 (0.665)	.001 (0.252)	.001 (0.325)	.0179 (1.431)
Rho (women)			-.1026 (-.697)			-.0564 (-0.222)			-.4809 (-4.657)
Rho (men)			-.1077 (-.980)			-.1300 (-0.858)			-.2060 (-1.432)
Log likelihood	-5090.877	-5090.877	-5311.365	-8712.608	-8712.608	-10620.08	-5784.156	-5784.156	-6633.559
No. of observations	4567	4567	5218	4567	4567	5218	4567	4567	5218

Note: Figures in parentheses are t-ratios.

Source: BIDS-World Bank household survey data, 1991-92.

Table 4.6
Alternative Estimates of the Impact of Credit on Contraceptive Use and Recent Fertility of Currently Married Women Aged 15-49 years

Explanatory Variables	Contraceptive Use			Recent Fertility		
	Naive		WESML-LIMLFE	Naive		WESML-LIML-FE
	Unweighted (Probit)	Weighted (Probit)		Unweighted (Probit)	Weighted (Probit)	
Amount borrowed by female from BRAC	0.017 (1.143)	0.006 (0.374)	-.0735 (-1.693)	0.006 (0.414)	-0.008 (-0.493)	.0790 (2.372)
Amount borrowed by male from BRAC	0.012 (0.570)	0.004 (0.170)	.0395 (0 .745)	-0.012 (-0.605)	-0.005 (-0.237)	.0543 (1.353)
Amount borrowed by female from BRDB	-0.023 (-1.348)	-0.032 (-1.285)	-.1163 (-2.421)	-0.015 (-0.849)	-0.106 (-0.447)	.0502 (1.312)
Amount borrowed by male from BRDB	0.026 (1.906)	0.034 (1.610)	.0839 (1.475)	0.019 (1.318)	0.026 (1.215)	-.0744 (-1.976)
Amount borrowed by female from GB	0.033 (2.842)	0.021 (1.469)	-.0905 (-2.011)	-0.024 (-1.991)	-0.035 (-2.534)	-.0348 (-0.951)
Amount borrowed by male from GB	-0.036 (-2.084)	-0.494 (-2.059)	.0000 (0.000)	0.013 (0.735)	0.008 (0.365)	-.0743 (-2.193)
Rho (women)			.4253 (2.075)			-.4319 (-2.718)
Rho (men)			-.2032 (-0.700)			.3511 (2.701)
Log likelihood			-2458.954			-2444.341
No. of observations	1731	1731	1731	1557	1557	1557

Note: Figures in parentheses are t-ratios.

Source: BIDS-World Bank household survey data, 1991-92.

Table 4.7
Alternative Estimates of the Impact of Credit on Log Women's Non-land Assets

Explanatory Variables	Women		
	Naive		WESML-LIML-FE
	Unweighted (Tobit)	Weighted (Tobit)	
Amount borrowed by female from BRAC	.277 (4.359)	.182 (2.834)	.0318 (0 .356)
Amount borrowed by male from BRAC	.141 (1.615)	.110 (1.214)	.1005 (0.468)
Amount borrowed by female from BRDB	.078 (1.040)	-0.096 (-0.949)	.1257 (1.043)
Amount borrowed by male from BRDB	.234 (3.934)	.138 (1.608)	.0334 (0.141)
Amount borrowed by female from GB	.232 (4.402)	.195 (3.318)	.1131 (1.317)
Amount borrowed by male from GB	.125 (1.676)	.096 (1.029)	-.0457 (-0.200)
Rho (women)			.1136 (1.325)
Rho (men)			-.0148 (-0.053)
Log likelihood	-3007.646	-2939.802	-4226.176
No. of observations	1517	1517	1757

Note: Figures in parentheses are t-ratios.

Source: BIDS-World Bank household survey data, 1991-92.

Table 4.8
Alternative Estimates of the Impact of Credit on Log Body Mass Index (BMI) of Children of Age Less Less than 10

Explanatory Variables	Boys			Girls		
	Naive		WESML-LIML-FE	Naive		WESML-LIML-FE
	Unweighted (OLS)	Weighted (OLS)		Unweighted (OLS)	Weighted (OLS)	
Amount borrowed by female from BRAC	-0.003 (-1.692)	-0.003 (-1.602)	-0.013 (-1.248)	.000 (0.105)	-0.001 (-0.299)	.004 (1.365)
Amount borrowed by male from BRAC	-0.000 (-0.102)	.000 (0.095)	-0.005 (-0.536)	.006 (1.256)	.007 (1.390)	.006 (1.070)
Amount borrowed by female from BRDB	-0.004 (-0.975)	-0.003 (-0.496	-0.011 (-0.827)	-0.000 (-0.100)	-0.496 (-0.317)	.002 (.244)
Amount borrowed by male from BRDB	.002 (0.693)	.002 (0.519)	-0.011 (-1.017)	.001 (0.481)	.000 (0.091)	.001 (.145)
Amount borrowed by female from GB	.002 (1.020)	.001 (0.790)	-0.009 (-0.797)	-0.000 (-0.173)	-0.000 (-0.179)	.005 (1.82)
Amount borrowed by male from GB	.001 (0.461)	.001 (0.651)	-0.006 (-0.623)	.005 (2.562)	.007 (2.917)	.009 (2.293)
Rho (women)			.482 (1.156)			-0.165 (-1.441)
Rho (men)			.399 (1.146)			-0.051 (-0.534)
Log likelihood			-2998.448			-2921.321
No. of observations	378			409		

Note: Figures in parentheses are t-ratios.

Source: BIDS-World Bank household survey data, 1991-92.

Table 4.9
Alternative Estimates of the Impact of Credit on Log Height of Children

Explanatory Variables	Boys			Girls		
	Naive		WESML-LIML-FE	Naive		WESML-LIML-FE
	Unweighted (OLS)	Weighted (OLS)		Unweighted (OLS)	Weighted (OLS)	
Amount borrowed by female from BRAC	.001 (0.465)	.002 (1.255)	.024 (.449)	.002 (1.285)	.004 (2.012)	-0.049 (1.401)
Amount borrowed by male from BRAC	.006 (1.969)	.005 (1.646)	.010 (.236)	-0.004 (-0.999	-0.004 (-0.834)	.023 (.598)
Amount borrowed by female from BRDB	-0.001 (-0.266)	-0.001 (-0.223)	.102 (1.814)	.002 (0.705)	.001 (0.121)	.071 (1.583)
Amount borrowed by male from BRDB	-0.003 (-1.342)	-0.003 (-1.084)	.047 (1.100)	-0.002 (-1.083)	-0.006 (-1.903)	.011 (.272)
Amount borrowed by female from GB	-0.004 (-2.820)	-0.003 (-1.923)	.091 (1.738)	.001 (0.94)	.001 (0.528)	.085 (2.554)
Amount borrowed by male from GB	-0.002 (-1.301)	-0.002 (-1.104)	.068 (1.557)	.000 (0.076	-0.001 (-0.261)	.031 (.797)
Rho (women			-0.141 (-0.578)			-0.153 (-1.036)
Rho (men)			-0.060 (-0.344)			-0.011 (-0.083)
Log likelihood			-3542.159			-3497.840
No. of observations	378		1341	409		1269

Note: Figures in parentheses are t-ratios.

Source: BIDS-World Bank household survey data, 1991-92.

Table 4.10
Alternative Estimates of the Impact of Credit on Log Weight of Children

Explanatory Variables	Boys			Girls		
	Naive		WESML-LIML-FE	Naive		WESML-LIML-FE
	Unweighted (OLS)	Weighted (OLS)		Unweighted (OLS)	Weighted (OLS)	
Amount borrowed by female from BRAC	-0.002 (-0.434)	.001 (0.229)	-0.017 (-1.308)	.005 (1.193)	.007 (1.713)	-0.015 (-1.641)
Amount borrowed by male from BRAC	.011 (1.702)	.010 (1.467)	.018 (1.756)	-0.003 (-0.264)	-0.001 (-0.091)	.002 (.177)
Amount borrowed by female from BRDB	-0.005 (-0.730)	-0.005 (-0.439)	-0.019 (-1.030)	.004 (0.576)	-0.000 (-0.044)	-0.030 (-1.623)
Amount borrowed by male from BRDB	-0.004 (-0.855	-0.005 (-0.669)	-0.002 (-0.199)	-0.004 (-0.723)	-0.012 (-1.714)	-0.009 (-0.820)
Amount borrowed by female from GB	-0.006 (-2.067)	-0.005 (-1.340)	-0.027 (-1.981)	.002 (0.751)	.001 (0.401)	-0.022 (-1.987)
Amount borrowed by male from GB	-0.003 (-0.953)	-0.003 (-0.637)	-0.001 (-0.090)	.006 (1.339)	.006 (1.187)	.009 (1.246)
Rho (women)			.560 (2.115)			.655 (3.628)
Rho (men)			-.033 (-0.169)			-0.049 (-0.592
Log likelihood			-3159.857			-3137.600
No. of observations	378			409		

Note: Figures in parentheses are t-ratios.

Source: BIDS-World Bank household survey data, 1991-92.

APPENDIX A

Table A1
Unweighted Naive Estimates of Impact of Credit by Gender on Log Labor Supply
(Tobit)

Explanatory Variables	Men		Women	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Parents of HH head own land	-0.005	-0.113	.574	4.802
Brothers of HH head own land	-0.026	-1.247	-0.066	-1.053
Sisters of HH head own land	.056	2.886	-0.008	-0.134
Parents of HH head's spouse own land	.037	1.169	.183	1.948
Brothers of HH head's spouse own land	-0.025	-1.534	-0.011	-0.214
Sisters of HH head's spouse own land	.018	0.966	.083	1.423
Log HH land assets in decimal	-0.016	-1.358	.011	0.318
Highest grade completed by HH head	-0.069	-5.698	.218	5.035
Sex of HH head (1=male)	.326	2.484	-0.587	-1.440
Age of HH head (years)	-0.007	-3.266	.005	0.924
Highest grade completed by adult female in HH	-0.029	-3.115	-0.112	-2.359
Highest grade completed by adult male in HH	-0.101	-7.964	-0.300	-7.457
No adult male in HH			1.770	3.980
No adult female in HH	.130	0.665		
No spouse present in HH	.059	0.691	.569	2.134
Round 2 dummy	-0.023	-0.251	.076	0.279
Round 3 dmmy	-0.104	-1.025	-0.111	-0.366
Age in years	.128	10.538	.507	14.516
Age in years squared	-0.002	-9.575	-0.007	-13.614
Highest grade completed	.147	13.193	.013	0.241
Amount borrowed by female from BRAC	.010	1.290	.028	1.163
Amount borrowed by male from BRAC	.007	0.676	-0.072	-2.049
Amount borrowed by female from BRDB	-0.002	-0.169	.131	4.969

Table A1 (continued)
Unweighted Naive Estimates of Impact of Credit by Gender on Log Labor Supply
(Tobit)

Explanatory Variables	Men		Women	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Amount borrowed by male from BRDB	.006	0.813	-0.007	-0.303
Amount borrowed by female from GB	.012	1.910	.116	6.275
Amount borrowed by male from GB	-0.014	-1.594	.081	3.012
Participated but did not take credit	-0.289	-3.328	-0.065	-0.246
Has any primary school	.026	0.557	.532	3.861
Has rural Health center	-0.214	-4.330	.130	0.866
Has family planning center?	.225	2.861	-0.031	-0.135
Is *Dai*/Midwife available?	.015	0.315	-0.594	-4.367
Price of rice	.016	0.636	-0.323	-4.119
Price of wheat flour	-0.040	-2.076	.067	1.115
Price of mustard oil	-0.002	-0.623	-0.012	-1.078
Price of hen egg	.000	0.009	.028	0.623
Price of milk	-0.009	-1.161	-0.072	-3.096
Price of potato	-0.005	-0.297	-0.078	-1.654
Average female wage	-0.001	-0.377	-0.049	-4.281
No female wage dummy	-0.025	-0.262	-1.425	-4.962
Average male wage	-0.001	-0.466	-0.007	-0.780
Distance to bank (km)	-0.001	-0.130	.080	3.670
Constant	3.411	7.689	-2.356	-1.840
Log likelihood	-10401.817		-9020.541	
Pseudo R^2	0.037		0.047	
No. of observations	5846		5693	

Source: BIDS-World Bank household survey data, 1991-92.

Table A2
Weighted Naive Estimates of Impact of Credit by Gender on Log Labor Supply
(Tobit)

Explanatory Variables	Men		Women	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Parents of HH head own land	-0.053	-1.213	.559	4.227
Brothers of HH head own land	-0.014	-0.634	-0.044	-0.648
Sisters of HH head own land	.083	4.008	-0.138	-2.175
Parents of HH head's spouse own land	.111	3.269	.099	0.952
Brothers of HH head's spouse own land	-0.031	-1.759	.061	1.082
Sisters of HH head's spouse own land	.002	0.118	.080	1.204
Log HH land assets in decimal	-0.015	-1.177	.034	0.874
Highest grade completed by HH head	-0.066	-5.205	.205	4.357
Sex of HH head (1=male)	.406	3.085	-1.569	-3.774
Age of HH head (years)	-0.004	-2.026	.013	2.243
Highest grade completed by adult female in HH	-0.042	-4.419	-0.115	-2.382
Highest grade completed by adult male in HH	-0.080	-6.231	-0.315	-7.293
No adult male in HH			1.803	3.959
No adult female in HH	-0.005	-0.027		
No spouse present in HH	-0.058	-0.720	.054	0.197
Round 2 dummy	-0.088	-0.950	-0.032	-0.112
Round 3 dmmy	-0.164	-1.594	-0.146	-0.461
Age in years	.161	13.005	.473	12.999
Age in years squared	-0.002	-12.506	-0.006	-12.272
Highest grade completed	.123	10.861	.044	0.834
Amount borrowed by female from BRAC	.013	1.623	.054	2.106
Amount borrowed by male from BRAC	.002	0.169	-0.042	-1.103
Amount borrowed by female from BRDB	-0.000	-0.020	.178	5.043
Amount borrowed by male from BRDB	.001	0.072	.043	1.278
Amount borrowed by female from GB	.013	1.803	.134	6.236

Table A2 (continued)
Weighted Estimates of Impact of Credit by Gender on Labor Supply

Explanatory Variables	Men		Women	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Amount borrowed by male from GB	-0.027	-2.488	.084	2.406
Participated but did not take credit	-0.288	-2.971	.391	1.315
Has any primary school	.022	0.476	.641	4.484
Has rural Health center	-0.290	-5.988	.024	0.155
Has family planning center?	.344	4.182	-0.007	-0.027
Is *Dai*/Midwife available?	.176	3.611	-0.821	-5.648
Price of rice	-0.012	-0.460	-0.298	-3.573
Price of wheat flour	-0.018	-0.848	-0.045	-0.695
Price of mustard oil	-0.001	-0.353	-0.014	-1.252
Price of hen egg	-0.009	-0.525	.069	1.514
Price of milk	-0.014	-1.703	-0.103	-4.155
Price of potato	-0.000	-0.005	-0.077	-1.567
Average female wage	.006	1.646	-0.041	-3.432
No female wage dummy	.056	0.574	-1.550	-5.142
Average male wage	.001	0.335	.003	0.352
Distance to bank (km)	.004	0.452	.090	3.803
Constant	2.569	5.758	-0.456	-0.344
Log likelihood	-10537.668		-8696.531	
Pseudo R^2	0.036		0.051	
No. of observations	5846		5693	

Source: BIDS-World Bank household survey data, 1991-92.

Table A3
Unweighted Naive Estimates of the Impact of Credit on Log Per Capita Expenditure
(OLS)

Explanatory Variables	Food		Non-food		Total	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
Parents of HH head own land	.021	2.270	.065	2.471	.029	2.548
Brothers of HH head own land	.003	0.565	.016	1.144	.003	0.559
Sisters of HH head own land	-0.008	-1.663	.007	0.526	-0.005	-0.785
Parents of HH head's spouse own land	-0.004	-0.539	.049	2.269	.004	0.457
Brothers of HH head's spouse own land	-0.006	-1.347	.012	1.043	.000	0.069
Sisters of HH head's spouse own land	-0.003	-0.683	.001	0.094	-0.004	-0.647
Log household land	.002	0.880	.042	5.307	.011	3.280
Highest grade completed by HH head	-0.005	-1.268	-0.029	-2.885	-0.010	-2.246
Sex of household head (1=male)	.058	1.715	.001	0.011	.037	0.891
Age of household head (years)	-0.002	-3.801	-0.006	-5.233	-0.003	-4.844
Highest grade completed by an adult female in HH	.011	4.574	.045	6.571	.020	6.632
Highest grade completed by an adult male in HH	.015	4.541	.070	7.443	.027	6.580
No adult male in HH	-0.023	-0.596	-0.220	-2.072	-0.051	-1.098
No adult female in HH	.190	4.558	.146	1.250	.209	4.110
No spouse present in HH	.078	3.862	.188	3.298	.104	4.182
Round 2	-0.037	-1.678	.159	2.565	-0.018	-0.675

Table A3 (continued)
Unweighted Naive Estimates of the Impact of Credit on Log Per Capita Expenditure
(OLS)

Explanatory Variables	Food		Non-food		Total	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
Round 3	-0.083	-3.391	-0.762	-11.138	-0.204	-6.856
Amount borrowed by female brom BRAC	.006	3.040	.008	1.390	.007	3.048
Amount borrowed by male from BRAC	.007	2.544	.014	1.966	.010	2.906
Amount borrowed by female from BRDB	.003	1.523	-0.001	-0.215	.002	0.573
Amount borrowed by male from BRDB	.008	4.721	.001	0.108	.007	3.118
Amount borrowed by female from GB	.005	3.098	.000	0.007	.003	1.400
Amount borrowed by male from GB	-0.001	-0.252	-0.001	-0.216	.001	0.252
Participate but no credit	.039	1.872	-0.165	-2.852	.011	0.434
Has any primary school	-0.054	-4.962	-0.132	-4.321	-0.074	-5.617
Has rural health center	-0.043	-3.585	-0.136	-3.997	-0.059	-4.018
Has family planning center?	.068	3.599	.050	0.938	.073	3.178
Is *Dai*/Midwife available?	-0.068	-6.169	-0.001	-0.024	-0.053	-3.927
Price of rice	.029	4.567	-0.021	-1.198	.020	2.567
Price of wheat flour	.012	2.535	.056	4.123	.020	3.425
Price of mustard oil	-0.002	-2.049	-0.006	-2.615	-0.003	-2.90
Price of hen egg	.000	0.058	.008	0.695	.002	0.385
Price of milk	.009	4.632	.016	3.046	.011	4.573

Table A3 (continued)
Unweighted Naive Estimates of the Impact of Credit on Log Per Capita Expenditure
(OLS)

Explanatory Variables	Food		Non-food		Total	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
Price of potato	-0.000	-0.111	.030	2.862	.009	1.952
Average female wage	-0.000	-0.517	-0.008	-3.085	-0.002	-1.641
No female wage dummy	.007	.307	-0.308	-4.775	-0.050	-1.776
Average male wage	.002	2.631	.007	3.718	.002	2.905
Distance to Bank (km)	-0.007	-4.008	-0.006	-1.180	-0.006	-2.979
Constant	3.620	38.503	2.141	8.114	3.900	33.929
Adjusted R^2	0.131		0.257		0.179	
No. of observations	4567		4567		4567	

Source: BIDS-World Bank household survey data, 1991-92.

Table A4
Weighted Naive Estimates of the Impact of Credit on Log Per Capita Expenditure
(OLS)

Explanatory Variables	Food		Non-food		Total	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
Parents of HH head own land	.021	2.127	.058	2.118	.029	2.390
Brothers of HH head own land	-0.000	-0.020	.012	0.832	.000	0.058
Sisters of HH head own land	-0.010	-1.964	.003	0.223	-0.006	-0.936
Parents of HH head's spouse own land	.001	0.134	.062	2.761	.011	1.124
Brothers of HH head's spouse own land	-0.007	-1.649	.005	0.429	-0.001	-0.252
Sisters of HH head's spouse own land	-0.004	-0.730	-0.000	-0.000	-0.006	-0.913
Log household land	.008	2.738	.048	5.769	.017	4.577
Highest grade completed by HH head	-0.001	-0.398	-0.031	-3.036	-0.009	-1.958
Sex of household head (1=male)	.019	0.579	-0.043	-0.463	.010	0.242
Age of household head (years)	-0.002	-5.262	-0.007	-6.283	-0.003	-6.187
Highest grade completed by an adult female in HH	.016	6.208	.066	9.556	.028	9.285
Highest grade completed by an adult male in HH	.011	3.248	.069	7.227	.024	5.686
No adult male in HH	-0.083	-2.171	-0.258	-2.452	-0.091	-2.003
No adult female in HH	.135	3.636	.023	0.228	.123	2.758
No spouse present in HH	.069	3.513	.133	2.480	.085	3.612
Round 2	-0.039	-1.741	.148	2.420	-0.036	-1.367
Round 3	-0.089	-3.636	-0.776	-11.438	-0.223	-7.536
Amount borrowed by female brom BRAC	.005	2.563	.009	1.668	.007	2.847
Amount borrowed by male from BRAC	.007	2.296	.017	2.130	.010	2.835
Amount borrowed by female from BRDB	.003	1.025	.006	0.826	.003	0.906
Amount borrowed by male from BRDB	.007	2.727	.011	1.536	.007	2.253

Table A4 (continued)
Weighted Naive Estimates of the Impact of Credit on Log Per Capita Expenditures
(OLS)

Explanatory Variables	Food		Non-food		Total	
	Coef.	t-ratio	Coef.	t-ratio	Coef.	t-ratio
Amount borrowed by female from GB	.005	2.700	.009	1.760	.004	1.765
Amount borrowed by male from GB	-0.001	-0.471	.004	0.476	.001	0.325
Participated but did not take credit	.039	1.718	-0.141	-2.224	.018	0.666
Has any primary school	-0.034	-3.091	-0.095	-3.163	-0.051	-3.840
Has rural health center	-0.037	-3.154	-0.074	-2.273	-0.042	-2.973
Has family planning center?	.065	3.379	.014	0.264	.059	2.577
Is *Dai*/Midwife available?	-0.045	-3.036	.049	1.556	-0.018	-1.313
Price of rice	.027	4.238	-0.040	-2.286	.014	1.860
Price of wheat flour	.013	2.559	.065	4.674	.023	3.822
Price of mustard oil	-0.003	-2.952	-0.006	-2.486	-0.004	-3.740
Price of hen egg	-0.005	-1.219	.012	1.138	-0.001	-0.196
Price of milk	.002	5.828	.022	4.000	.014	5.906
Price of potato	.001	0.350	.033	3.186	.015	2.957
Average female wage	-0.001	-1.058	-0.008	-3.040	-0.002	-1.927
No female wage dummy	-0.026	-1.093	-0.329	-5.115	-0.073	-2.614
Average male wage	.002	2.575	.007	3.533	.002	2.823
Distance to Bank (km)	-0.006	-3.463	-0.008	-1.480	-0.006	-2.721
Constant	3.671	38.619	2.097	8.005	3.915	34.269
Adjusted R^2	0.135		0.279		0.199	
No. of observations	4567		4567		4567	

Source: BIDS-World Bank household survey data, 1991-92.

Table A5
Weighted and Unweighted Naive Estimates of the Impact of Credit on
Log Non-land Assets by Gender

Explanatory Variables	Weighted (Tobit)				Unweighted (Tobit)			
	Male		Female		Male		Female	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Parents of HH head own land	-0.049	-0.689	.582	1.877	-0.080	-1.099	.305	1.026
Brothers of HH head own land	-0.013	-0.326	.107	0.644	.030	0.76	.141	0.876
Sisters of HH head own land	-0.014	-0.379	-0.099	-0.597	-0.008	-0.205	-0.054	-0.349
Parents of HH head's spouse own land	-0.043	-0.736	.328	1.251	-0.020	-0.338	.305	1.224
Brothers of HH head's spouse own land	.022	0.687	-0.311	-2.101	.018	0.560	-0.250	-1.818
Sisters of HH head's spouse own land	.033	0.872	-0.321	-1.865	.058	.1567	-0.184	-1.179
Log household land	.296	12.980	-0.009	-0.094	.266	11.535	-0.050	-0.536
Highest grade completed by HH head	-0.090	-3.264	.066	0.547	-0.045	-1.610	-0.098	-0.868
Sex of household head (1=male)	7.503	25.454	-7.944	-7.291	7.359	24.403	-7.319	-6.802
Age of household head (years)	-0.005	-1.522	-0.011	-0.771	.003	0.772	-0.021	-1.474
Highest grade completed by an adult female in HH	.070	3.887	.283	3.570	.055	2.877	.289	3.718
Highest grade completed by an adult male in HH	.179	7.007	.143	1.281	.132	5.004	.240	2.274
Non adult male in HH			.070	0.058			.513	0.434
No adult female in HH	-0.587	-2.209			-0.642	-1.941		
No spouse present in HH	-0.224	-1.573	-0.817	-1.234	-0.098	-0.608	-1.053	-1.531
Amount borrowed by female brom BRAC	-0.015	-1.004	.182	2.834	-0.015	-0.920	.277	4.359

Table A5 (continued)
Weighted and Unweighted Naive Estimates of the Imapct of Credit on
Log-Non-land Assets by Gender

Explanatory Variables	Weighted (Tobit)				Unweighted (Tobit)			
	Male		Female		Male		Female	
Amount borrowed by male from BRAC	.061	2.923	.110	1.214	.071	3.260	.141	1.615
Amount borrowed by female from BRDB	.028	1.243	-0.096	-0.949	.006	0.305	.078	1.040
Amount borrowed by male from BRDB	.062	3.180	.138	1.608	.057	3.877	.234	3.934
Amount borrowed by female from GB	.003	0.188	.195	3.318	.013	0.969	.232	4.402
Amount borrowed by male from GB	.037	1.768	.096	1.029	.044	2.415	.125	1.676
Participated but did not take credit	.058	0.354	-0.274	-0.385	.046	0.291	.576	0.909
Has any primary school	-0.061	-0.706	-0.366	-0.977	-0.012	-0.130	-0.699	-1.861
Has rural health center	.326	3.724	1.228	3.197	.331	3.444	1.164	2.987
Has family planning center?	-0.226	-1.558	-2.081	-3.159	-0.214	-1.417	-1.065	-1.684
Is *Dai*/Midwife available?	.121	1.366	.127	0.323	.102	1.115	.071	0.187
Price of rice	-0.131	-2.416	-0.689	-2.878	-0.047	-0.805	-0.702	-2.969
Price of wheat flour	.070	1.524	.867	4.247	.007	0.143	.778	3.822
Price of mustard oil	-0.007	-1.063	.096	3.249	-0.007	-0.995	.062	2.111
Price of hen egg	.007	0.393	.315	4.257	-0.008	-0.397	.335	4.267
Price of milk	.026	1.523	-0.329	-4.312	.022	1.239	-0.355	-4.888
Price of potato	.037	1.452	-0.244	-2.153	.009	0.317	-0.025	-0.223
Average female wage	-0.001	-0.070	-0.011	-0.345	.012	1.600	-.000	-0.010
No female wage dummy	-0.015	-0.086	1.445	1.832	.252	1.352	1.503	1.936
Average male wage	-0.006	-1.097	.037	1.631	-0.010	-1.908	.051	2.442

Table A5 (continued)
Weighted and Unweighted Naive Estimates of the Imapct of Credit on
Log-Non-land Assets by Gender

Explanatory Variables	Weighted (Tobit)				Unweighted (Tobit)			
	Male		Female		Male		Female	
Distance to Bank (km)	-0.076	-5.663	.117	2.003	-0.061	-4.429	.099	1.772
Constant	1.25	1.647	4.896	1.510	.792	0.963	6.259	1.920
Pseudo R^2	0.182		0.054		0.158		.051	
Log likelihood	-2488.602		-2939.802		-2574.151		-3007.646	
No. of observations	1475		1517		1475		1517	

Source: BIDS-World Bank household survey data, 1991-92.

Table A6
Unweighted Naive Estimates of Impact of Credit on Children's School Enrollment by Gender
(Probit)

Explanatory Variables	Boys		Girls	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Parents of HH head own land	.248	2.775	.094	1.083
Brothers of HH head own land	-0.075	-1.860	.049	1.229
Sisters of HH head own land	-0.050	-1.240	-0.043	-1.062
Parents of HH head's spouse own land	-0.098	-1.573	-0.012	-0.188
Brothers of HH head's spouse own land	.045	1.373	.006	0.175
Sisters of HH head's spouse own land	.035	0.949	-0.018	-0.477
Log household land	.079	3.454	.034	1.392
Highest grade completed by HH head	.060	2.301	.027	1.010
Sex of household head (1=male)	.462	1.590	.109	0.293
Age of household head (years)	-0.011	-2.574	-0.008	-1.818
Highest grade completed by an adult female in HH	.051	2.399	.019	0.871
Highest grade completed by an adult male in HH	.027	1.110	.072	2.998
No adult male in HH	.128	0.368	.221	0.539
No adult female in HH	-0.454	-0.838	-0.800	-1.791
No spouse present in HH	-0.075	-0.369	-0.005	-0.022
Age in years	.646	9.178	.836	11.151
Age in years squared	-0.031	-9.607	-0.039	-11.213
Amount borrowed by female brom BRAC	.024	1.515	.020	1.167
Amount borrowed by male from BRAC	-0.005	-0.231	.044	1.986
Amount borrowed by female from BRDB	.042	2.346	.011	0.612
Amount borrowed by male from BRDB	.022	1.466	.005	0.331
Amount borrowed by female from GB	.053	4.141	.023	1.785
Amount borrowed by male from GB	.053	2.707	.031	1.585
Participate but no credit	.243	1.463	.100	0.614
Has any primary school	.098	1.020	.171	1.702
Has rural health center	.129	1.321	-0.049	-0.456
Has family planning center?	-0.245	-1.601	-0.566	-3.305
Is *Dai*/Midwife available?	-0.095	-1.029	.064	0.655
Price of rice	.029	0.485	.139	2.217
Price of wheat flour	.059	1.204	-0.056	-1.139

Table A6 (continued)
Unweighted Naive Estimates of Impact of Credit on Children's School Enrollment by Gender
(Probit)

Explanatory Variables	Boys		Girls	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Price of mustard oil	-0.010	-1.395	-0.011	-1.383
Price of hen egg	-0.003	-0.128	-0.011	-0.487
Price of milk	-0.010	-0.545	.037	2.108
Price of potato	-0.023	-0.723	.015	0.505
Average female wage	.008	1.115	.015	1.883
No female wage dummy	.276	1.473	.369	1.879
Average male wage	.012	2.262	.005	0.876
Distance to Bank (km)	.006	0.479	-0.022	-1.537
Constant	-4.284	-4.637	-5.650	-5.755
Pseudo R^2	0.151		0.169	
Log likelihood	-786.506		-728.630	
No. of observations	1341		1269	

Source: BIDS-World Bank household survey data, 1991-92.

Table A7
Weighted Naive Estimates of Impact of Credit on Children's School Enrollment by Gender
(Probit)

Explanatory Variables	Boys		Girls	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Parents of HH head own land	.263	2.774	.164	1.743
Brothers of HH head own land	-0.125	-3.002	.070	1.745
Sisters of HH head own land	-0.037	-0.876	-0.094	-2.332
Parents of HH head's spouse own land	-0.037	-0.568	-0.040	-0.591
Brothers of HH head's spouse own land	.006	0.169	-0.044	-1.241
Sisters of HH head's spouse own land	.049	1.244	.041	1.021
Log household land	.076	3.106	.013	0.526
Highest grade completed by HH head	.044	1.696	.011	0.393
Sex of household head (1=male)	.352	1.243	.209	0.534
Age of household head (years)	-0.015	-3.688	-0.010	-2.293
Highest grade completed by an adult female in HH	.040	1.822	.036	1.669
Highest grade completed by an adult male in HH	.052	2.114	.087	3.608
No adult male in HH	.196	0.551	.165	0.386
No adult female in HH	.141	0.329	-0.796	-2.012
No spouse present in HH	-0.080	-0.421	-0.006	-0.029
Age in years	.673	9.410	.730	9.711
Age in years squared	-0.033	-9.749	-0.034	-9.675
Amount borrowed by female brom BRAC	.027	1.745	.015	0.938
Amount borrowed by male from BRAC	.002	0.085	.049	2.192
Amount borrowed by female from BRDB	.035	1.588	.002	0.082
Amount borrowed by male from BRDB	.028	1.447	-0.005	-0.236
Amount borrowed by female from GB	.062	4.461	.019	1.412
Amount borrowed by male from GB	.074	3.089	.029	1.222
Participate but no credit	.355	1.964	.094	0.532
Has any primary school	.136	1.438	.235	2.395
Has rural health center	.222	2.321	-0.076	-0.734
Has family planning center?	-0.545	-3.370	-0.551	-3.225
Is *Dai*/Midwife available?	-0.152	-1.596	.102	1.038
Price of rice	-0.015	-0.260	.089	1.440
Price of wheat flour	.081	1.661	.010	0.203

Table A7 (continued)
Weighted Naive Estimates of Impact of Credit on Children's School Enrollment by Gender
(Probit)

Explanatory Variables	Boys		Girls	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Price of mustard oil	-0.014	1.947	.007	0.963
Price of hen egg	.003	0.136	.015	0.729
Price of milk	-0.003	-0.183	.035	1.938
Price of potato	-0.013	-0.410	.027	0.953
Average female wage	.015	1.884	.015	1.885
No female wage dummy	.396	2.070	.316	1.597
Average male wage	.010	1.808	.003	0.526
Distance to Bank (km)	-0.005	-0.325	-0.030	-1.932
Constant	-3.860	-4.298	-6.267	-6.342
Pseudo R^2	0.161		0.1704	
Log likelihood	-779.369		-729.449	
No. of observations	1341		1269	

Source: BIDS-World Bank household survey data, 1991-92.

Table A8
Unweighted Naive Estimates of the Impact of Credit on Children's Log Height by Gender (OLS)

Explanatory Variables	Boys		Girls	
	Coef.	t-ratio	Coef.	t-ratio
Parents of HH head own land	.011	1.531	.012	1.462
Brothers of HH head own land	.008	2.277	-0.009	-2.041
Sisters of HH head own land	.003	0.748	.006	1.300
Parents of HH head's spouse own land	-0.016	-2.152	-0.012	-1.458
Brothers of HH head's spouse own land	-0.001	-0.379	.003	0.779
Sisters of HH head's spouse own land	.008	2.109	.003	0.817
Log household land	.002	0.749	-0.006	-2.079
Highest grade completed by HH head	-0.006	-1.880	-0.005	-1.607
Sex of household head (1=male)	-0.040	-1.109	.023	0.847
Age of household head (years)	-0.001	-1.219	.000	0.419
Highest grade completed by an adult female in HH	0.000	0.003	.008	3.360
Highest grade completed by an adult male in HH	.006	2.037	.005	2.200
No adult male in HH	.080	1.691	.053	1.416
No adult female in HH	-0.071	-0.785	-0.057	-0.861
No spouse present in HH	-0.057	-1.478	.029	1.036
Round 3	-0.007	-0.188	.008	0.231
Age in years	.110	20.385	.104	23.880
Age in years squared	-0.005	-9.783	-0.005	-11.398
Amount borrowed by female brom BRAC	.001	0.465	.002	1.285
Amount borrowed by male from BRAC	.006	1.969	-0.004	-0.999
Amount borrowed by female from BRDB	-0.001	-0.266	.002	0.705
Amount borrowed by male from BRDB	-0.003	-1.342	-0.002	-1.083
Amount borrowed by female from GB	-0.004	-2.820	.001	0.943
Amount borrowed by male from GB	-0.002	-1.301	.000	0.076
Participate but no credit	.044	2.534	.009	0.585
Has any primary school	.011	0.745	-0.049	-3.139
Has rural health center	-0.014	-0.913	-0.003	-0.184
Has family planning center?	.001	0.023	.031	1.359
Is *Dai*/Midwife available?	-0.035	-1.431	.036	1.337
Price of rice	.008	0.965	.001	0.193
Price of wheat flour	-0.012	-1.247	.011	1.190

Table A8 (continued)
Unweighted Naive Estimates of the Impact of Credit on Children's Height by Gender
(OLS)

Explanatory Variables	Boys		Girls	
	Coef.	t-ratio	Coef.	t-ratio
Price of mustard oil	.001	0.907	-0.000	-0.201
Price of hen egg	-0.006	-0.289	-0.033	-1.421
Price of milk	.003	1.486	-0.003	-1.404
Price of potato	.005	0.792	.001	0.265
Average female wage	.000	0.102	.001	1.198
No female wage dummy	-0.015	-0.615	-0.006	-0.223
Average male wage	-0.001	-0.572	-0.003	-1.609
Distance to Bank (km)	.003	0.729	-0.006	-1.420
Constant	4.210	34.155	4.234	34.487
Adjusted R^2	0.843		0.834	
No. of observations	378		409	

Source: BIDS-World Bank household survey data, 1991-92.

Table A9
Weighted Estimates of Impact of Credit on Children's Log Height by Gender

Explanatory Variables	Boys		Girls	
	Coef.	t-ratio	Coef.	t-ratio
Parents of HH head own land	.015	2.096	.019	2.336
Brothers of HH head own land	.005	1.521	-0.011	-2.839
Sisters of HH head own land	-0.001	-0.297	.010	2.174
Parents of HH head's spouse own land	-0.030	-4.166	-0.015	-1.862
Brothers of HH head's spouse own land	.007	1.716	.002	0.430
Sisters of HH head's spouse own land	.008	2.160	.005	1.138
Log household land	.002	0.743	-0.001	-0.225
Highest grade completed by HH head	-0.004	-1.540	-0.002	-0.682
Sex of household head (1=male)	-0.008	-0.227	.019	0.692
Age of household head (years)	-0.001	-1.488	.000	0.170
Highest grade completed by an adult female in HH	-0.002	-1.019	.004	1.717
Highest grade completed by an adult male in HH	.007	2.555	.005	2.128
No adult male in HH	.125	2.346	.045	1.117
No adult female in HH	-0.105	-1.062	-0.077	-1.036
No spouse present in HH	-0.046	-1.062	.037	1.415
Round 3	-0.015	-0.390	-0.028	-0.790
Age in years	.114	20.022	.108	25.221
Age in years squared	-0.006	-10.225	-0.005	-12.525
Amount borrowed by female brom BRAC	.002	1.255	.004	2.012
Amount borrowed by male from BRAC	.005	1.646	-0.004	-0.834
Amount borrowed by female from BRDB	-0.001	-0.223	.001	0.121
Amount borrowed by male from BRDB	-0.003	-1.084	-0.006	-1.903
Amount borrowed by female from GB	-0.003	-1.923	.001	0.528
Amount borrowed by male from GB	-0.002	-1.104	-0.001	-0.261
Participate but no credit	.059	3.070	.024	1.273
Has any primary school	.029	1.971	-0.017	-1.149
Has rural health center	-0.005	-0.327	-0.007	-0.383
Has family planning center?	.000	0.017	-0.029	-1.141
Is *Dai*/Midwife available?	-0.043	-1.737	.024	0.981
Price of rice	.007	0.981	-0.005	-0.732
Price of wheat flour	-0.006	-0.605	.010	1.015
Price of mustard oil	.000	0.277	.001	0.343

Table A9 (continued)
Weighted Naive Estimates of Impact of Credit on Children's Height by Gender
(OLS)

Explanatory Variables	Boys		Girls	
	Coef.	t-ratio	Coef.	t-ratio
Price of hen egg	-0.017	-0.757	-0.024	-1.027
Price of milk	.003	1.387	-0.001	-0.270
Price of potato	.008	1.307	.008	1.544
Average female wage	.001	0.875	.001	0.904
No female wage dummy	.014	0.575	-0.001	-0.019
Average male wage	-0.001	-0.383	-0.003	-1.639
Distance to Bank (km)	.002	0.439	-0.001	-0.288
Constant	4.142	34.849	4.189	37.585
Adjusted R^2	0.837		0.850	
No. of observations	378		409	

Source: BIDS-World Bank household survey data, 1991-92.

Table A10
Unweighted Naive Estimates of Impact of Credit on Children's Log Weight by Gender
(OLS)

Explanatory Variables	Boys		Girls	
	Coef.	t-ratio	Coef.	t-ratio
Parents of HH head own land	.002	0.124	.048	2.536
Brothers of HH head own land	.012	1.496	-0.022	-2.349
Sisters of HH head own land	.007	0.761	.011	1.114
Parents of HH head's spouse own land	-0.035	-2.123	-0.035	-1.947
Brothers of HH head's spouse own land	-0.008	-0.950	.000	0.036
Sisters of HH head's spouse own land	.019	2.240	-0.000	-0.054
Log household land	-0.002	-0.272	-0.011	-1.685
Highest grade completed by HH head	-0.009	-1.271	-0.013	-1.926
Sex of household head (1=male)	-0.006	-0.073	.069	1.133
Age of household head (years)	-0.001	-0.805	.003	2.148
Highest grade completed by an adult female in HH	.002	0.479	.020	3.827
Highest grade completed by an adult male in HH	.014	1.967	.013	2.391
No adult male in HH	.110	1.026	.170	2.022
No adult female in HH	-0.286	-1.390	-0.324	-2.177
No spouse present in HH	-0.031	-0.355	.050	0.775
Round 3	.000	0.002	.050	0.620
Age in years	.188	15.382	.169	17.314
Age in years squared	-0.008	-6.714	-0.007	-7.299
Amount borrowed by female brom BRAC	-0.002	-0.434	.005	1.193
Amount borrowed by male from BRAC	.011	1.702	-0.003	-0.264
Amount borrowed by female from BRDB	-0.005	-0.730	.004	0.576
Amount borrowed by male from BRDB	-0.004	-0.855	-0.004	-0.723
Amount borrowed by female from GB	-0.006	-2.067	.002	0.751
Amount borrowed by male from GB	-0.003	-0.953	.006	1.339
Participate but no credit	.080	2.041	.019	0.532
Has any primary school	.000	0.000	-0.105	-2.999
Has rural health center	-0.036	-1.043	-0.060	-1.538
Has family planning center?	-0.014	-0.273	.034	0.654
Is *Dai*/Midwife available?	-0.037	-0.668	.102	1.695
Price of rice	.018	1.016	.012	0.735
Price of wheat flour	-0.036	-1.713	.001	0.036

Table A10 (continued)
Unweighted Naive Estimates of Impact of Credit on Children's Log Weight by Gender
(OLS)

Explanatory Variables	Boys		Girls	
	Coef.	t-ratio	Coef.	t-ratio
Price of mustard oil	.004	1.148	.000	0.045
Price of hen egg	.036	0.741	-0.030	-0.565
Price of milk	.006	1.214	-0.009	-1.720
Price of potato	-0.004	-0.309	-0.009	-0.740
Average female wage	.001	0.488	.003	1.072
No female wage dummy	-0.012	-0.219	-0.019	-0.329
Average male wage	-0.003	-0.950	-0.003	-0701
Distance to Bank (km)	.014	1.613	-0.005	-0.541
Constant	1.859	6.636	1.830	6.617
Adjusted R^2	0.780		0.759	
No. of observations	378		409	

Source: BIDS-World Bank household survey data, 1991-92.

Table A11
Weighted Naive Estimates of Impact of Credit on Children's Log Weight by Gender (OLS)

Explanatory Variables	Boys		Girls	
	Coef.	t-ratio	Coef.	t-ratio
Parents of HH head own land	.010	0.621	.062	2.580
Brothers of HH head own land	.003	0.398	-0.034	-3.999
Sisters of HH head own land	-0.002	-0.180	.027	2.590
Parents of HH head's spouse own land	-0.049	-2.894	-0.035	-2.037
Brothers of HH head's spouse own land	.003	0.297	-0.006	-0.729
Sisters of HH head's spouse own land	.015	1.672	-0.003	-0.321
Log household land	.002	0.321	-0.001	-0.140
Highest grade completed by HH head	-0.006	-0.826	-0.012	-1.986
Sex of household head (1=male)	.090	1.093	.069	1.179
Age of household head (years)	-0.002	-1.255	.002	2.175
Highest grade completed by an adult female in HH	-0.004	-0.781	.014	2.524
Highest grade completed by an adult male in HH	.016	2.486	.014	2.711
No adult male in HH	.203	1.613	.155	1.757
No adult female in HH	-0.397	-1.703	-0.367	-2.291
No spouse present in HH	.022	0.212	.055	0.976
Round 3	.013	0.147	-0.060	-0.772
Age in years	.199	14.769	.182	19.651
Age in years squared	-0.009	-6.968	-0.008	-8.928
Amount borrowed by female brom BRAC	.001	0.229	.007	1.713
Amount borrowed by male from BRAC	.010	1.467	-0.001	-0.091
Amount borrowed by female from BRDB	-0.005	-0.439	-0.000	-0.044
Amount borrowed by male from BRDB	-0.005	-0.669	-0.012	-1.714
Amount borrowed by female from GB	-0.005	-1.340	.001	0.401
Amount borrowed by male from GB	-0.003	-0.637	.006	1.187
Participate but no credit	.114	2.507	.046	1.139
Has any primary school	.018	0.525	-0.032	-1.008
Has rural health center	-0.027	-0.809	-0.061	-1.611
Has family planning center?	.007	-0.122	-0.117	-2.137
Is *Dai*/Midwife available?	-0.003	-0.044	.084	1.558
Price of rice	.028	1.628	-0.014	-0.942
Price of wheat flour	-0.029	-1.262	.002	0.118

Table A11 (continued)
Weighted Naive Estimates of Impact of Credit on Children's Log Weight by Gender
(OLS)

Explanatory Variables	Boys		Girls	
	Coef.	t-ratio	Coef.	t-ratio
Price of mustard oil	.001	0.313	.000	0.073
Price of hen egg	.014	0.270	-0.022	-0.429
Price of milk	.005	0.870	-0.004	-0.864
Price of potato	-0.002	-0.153	.011	0.965
Average female wage	.003	1.159	.003	1.167
No female wage dummy	.063	1.091	.004	0.075
Average male wage	-0.002	-0.477	-0.001	-0.383
Distance to Bank (km)	.014	1.509	.005	0.535
Constant	1.604	5.723	1.842	7.637
Adjusted R^2	0.757		0.800	
No. of observations	378		409	

Source: BIDS-World Bank household survey data, 1991-92.

Table A12
Unweighted Naive Estimates of Impact of Credit by Gender on
Log Body Mass Index (BMI) of Children Under Age 10
(OLS)

Explanatory Variables	Boys		Girls	
	Coef.	t-ratio	Coef.	t-ratio
Parents of HH head own land	-0.020	-2.381	.023	2.495
Brothers of HH head own land	-0.004	-1.041	-0.005	-1.081
Sisters of HH head own land	.001	0.307	-0.000	-0.082
Parents of HH head's spouse own land	-0.003	-0.393	-0.012	-1.315
Brothers of HH head's spouse own land	-0.006	-1.232	-0.005	-1.321
Sisters of HH head's spouse own land	.003	0.750	-0.007	-1.569
Log household land	-0.006	-1.959	.001	0.323
Highest grade completed by HH head	.002	0.596	-0.003	-1.007
Sex of household head (1=male)	.057	1.395	.023	0.766
Age of household head (years)	.000	0.402	.002	3.579
Highest grade completed by an adult female in HH	.003	0.968	.004	1.699
Highest grade completed by an adult male in HH	.002	0.548	.002	0.880
No adult male in HH	-0.038	-0.696	.064	1.540
No adult female in HH	.		-0.210	-2.846
No spouse present in HH	.055	1.346	-0.009	-0.291
Round 3	.024	0.543	.034	0.836
Age in years	-0.032	-4.973	-0.038	-7.841
Age in years squared	.002	3.678	.003	5.684
Amount borrowed by female brom BRAC	-0.003	-1.692	.000	0.105
Amount borrowed by male from BRAC	-0.000	-0.102	.006	1.256
Amount borrowed by female from BRDB	-0.004	-0.975	-0.000	-0.100
Amount borrowed by male from BRDB	.002	0.693	.001	0.481
Amount borrowed by female from GB	.002	1.020	-0.000	-0.173
Amount borrowed by male from GB	.001	0.461	.005	2.562
Participated but did not take credit	-0.013	-0.655	.000	0.027
Has any primary school	-0.022	-1.256	-0.007	-0.427
Has rural health center	-0.008	-0.423	-0.054	-2.770
Has family planning center?	-0.016	-0.574	-0.029	-1.113
Is *Dai*/Midwife available?	.032	1.103	.031	1.023
Price of rice	.004	0.411	.010	1.136

Table A12 (continued)
Unweighted Naive Estimates of Impact of Credit by Gender on
Log Body Mass Index (BMI) of Children Under Age 10
(OLS)

Explanatory Variables	Boys		Girls	
	Coef.	t-ratio	Coef.	t-ratio
Price of wheat flour	-0.011	-1.023	-0.022	-2.057
Price of mustard oil	.001	0.704	.001	0.451
Price of hen egg	.049	1.941	.037	1.405
Price of milk	-0.001	-0.320	-0.002	-0.953
Price of potato	-0.016	-2.251	-0.012	-1.965
Average female wage	.001	0.808	.000	0.016
No female wage dummy	.021	0.704	-0.008	-0.262
Average male wage	-0.002	-0.959	.003	1.466
Distance to Bank (km)	.008	1.855	.007	1.451
Constant	-6.554	-44.940	-6.638	-48.370
Adjusted R^2	0.131		0.288	
No. of observations	378		409	

Source: BIDS-World Bank household survey data, 1991-92.

Table 13
Weighted Naive Estimates of Impact of Credit by Gender on
Log Body Mass Index (BMI) of Children Under Age 10
(OLS)

Explanatory Variables	Boys		Girls	
	Coef.	t-ratio	Coef.	t-ratio
Parents of HH head own land	-0.020	-2.212	.025	2.902
Brothers of HH head own land	-0.008	-1.776	-0.012	-2.809
Sisters of HH head own land	.001	0.300	.006	1.187
Parents of HH head's spouse own land	.011	1.292	-0.005	-0.645
Brothers of HH head's spouse own land	-0.012	-2.277	-0.009	-2.302
Sisters of HH head's spouse own land	-0.001	-0.289	-0.012	-2.804
Log household land	-0.002	-0.655	.000	0.139
Highest grade completed by HH head	.003	0.750	-0.008	-2.770
Sex of household head (1=male)	.087	2.077	.032	1.101
Age of household head (years)	-0.000	-0.126	.002	4.124
Highest grade completed by an adult female in HH	.001	0.199	.005	1.915
Highest grade completed by an adult male in HH	.003	0.840	.004	1.520
No adult male in HH	-0.029	-0.441	.064	1.482
No adult female in HH			-0.214	-2.725
No spouse present in HH	.076	1.578	-0.019	-0.677
Round 3	.053	1.148	-0.003	-0.086
Age in years	-0.030	-4.216	-0.034	-7.471
Age in years squared	.002	3.222	.002	5.408
Amount borrowed by female brom BRAC	-0.003	-1.602	-0.001	-0.299
Amount borrowed by male from BRAC	.000	0.095	.007	1.390
Amount borrowed by female from BRDB	-0.003	-0.496	-0.002	-0.317
Amount borrowed by male from BRDB	.002	0.519	.000	0.091
Amount borrowed by female from GB	.001	0.790	-0.000	-0.179
Amount borrowed by male from GB	.001	0.651	.007	2.917
Participated but did not take credit	-0.012	-0.515	-0.002	-0.078
Has any primary school	-0.038	-2.125	.002	0.110
Has rural health center	-0.017	-0.981	-0.047	-2.568
Has family planning center?	-0.009	-0.304	-0.059	-2.212
Is *Dai*/Midwife available?	.082	2.666	.034	1.331
Price of rice	.015	1.610	-0.004	-0.543

Table A13 (continued)
Weighted Naive Estimates of Impact of Credit by Gender on
Log Body Mass Index (BMI) of Children Under Age 10
(OLS)

Explanatory Variables	Boys		Girls	
	Coef.	t-ratio	Coef.	t-ratio
Price of wheat flour	-0.015	-1.251	-0.017	-1.674
Price of mustard oil	.000	0.169	-0.001	-0.499
Price of hen egg	.049	1.744	.026	1.063
Price of milk	-0.002	-0.727	-0.003	-1.256
Price of potato	-0.020	-2.743	-0.005	-0.942
Average female wage	.001	0.868	.001	0.677
No female wage dummy	.039	1.279	.005	0.189
Average male wage	-0.001	-0.377	.004	2.312
Distance to Bank (km)	.010	2.144	.007	1.637
Constant	-6.671	-45.063	-6.536	-55.356
Adjusted R^2	0.140		0.316	
No. of observations	378		409	

Source: BIDS-World Bank household survey data, 1991-92.

Table A14
Unweighted and Weighted Naive Estimates of the Impact of Credit on Contraceptive Use of Currently Married Women Aged 15-49 Years (Probit)

Explanatory Variables	Weighted		Unweighted	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Parents of HH head own land	-0.026	-0.369	.007	0.108
Brothers of HH head own land	.008	0.200	.023	0.617
Sisters of HH head own land	-0.063	-1.672	-0.041	-1.139
Parents of HH head's spouse own land	-0.015	-0.265	.003	0.059
Brothers of HH head's spouse own land	.002	0.069	-0.000	-0.009
Sisters of HH head's spouse own land	.026	0.720	.008	0.249
Log household land	-0.030	-1.323	-0.078	-3.615
Highest grade completed by HH head	.023	0.856	-0.002	-0.095
Sex of household head (1=male)	1.016	2.342	1.147	2.751
Age of household head (years)	-0.007	-1.727	-0.007	1.536
Highest grade completed by an adult female in HH	.023	1.270	.041	2.282
Highest grade completed by an adult male in HH	.016	0.655	.026	1.088
No spounse present in HH	.258	1.012	.448	1.540
Age in years	.319	10.790	.291	9.891
Age in years squared	-0.005	-10.614	-0.004	-9.626
Amount borrowed by female brom BRAC	.013	0.868	.019	1.218
Amount borrowed by male from BRAC	.003	0.139	.012	0.573
Amount borrowed by female from BRDB	-0.031	-1.390	-0.024	-1.385
Amount borrowed by male from BRDB	.030	1.546	.023	1.690
Amount borrowed by female from GB	.026	1.942	.035	2.884
Amount borrowed by male from GB	-0.050	-2.310	-0.035	-2.020
Participate but no credit	.138	0.860	-0.032	-0.217
Has any primary school	.094	1.083	.044	0.501
Has rural health center	.148	1.697	.141	1.567
Has family planning center?	.156	1.077	.189	1.348
Is *Dai*/Midwife available?	.162	1.791	.171	1.942
Price of rice	.033	0.598	.065	1.186
Price of wheat flour	-0.140	-3.019	-0.097	-2.076
Price of mustard oil	-0.022	-3.272	-0.022	-3.246
Price of hen egg	.043	2.276	.030	1.598

Table A14 (continued)
Unweighted and Weighted Naive Estimates of the Impact of Credit on Contraceptive Use of Currently Married Women Aged 15-49 Years
(Probit)

Explanatory Variables	Weighted		Unweighted	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Price of milk	-0.023	-1.349	-0.050	-2.945
Price of potato	.034	1.313	.048	1.752
Average female wage	-0.005	-0.629	.002	0.300
No female wage dummy	-0.010	-0.055	.090	0.503
Average male wage	-0.002	-0.394	-0.003	-0.538
Distance to Bank (km)	.004	0.267	-0.024	-1.817
Constant	-3.760	-4.124	-3.954	-4.266
Pseudo R^2	0.113		0.113	
No. of observations	1498		1498	

Source: BIDS-World Bank household survey data, 1991-92.

Table A15
Unweighted and Weighted Naive Estimates of the Impact of Credit on Fertility of Currently Married Women Aged 15-49
(Probit)

Explanatory Variables	Weighted		Unweighted	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Parents of HH head own land	.235	3.330	.168	2.466
Brothers of HH head own land	-0.042	-0.999	-0.017	-0.426
Sisters of HH head own land	-0.053	-1.339	-0.035	-0.928
Parents of HH head's spouse own land	.024	0.405	.008	0.133
Brothers of HH head's spouse own land	-0.012	-0.343	-0.001	-0.019
Sisters of HH head's spouse own land	-0.012	-0.308	-0.004	-0.108
Log household land	.035	1.485	.054	2.355
Highest grade completed by HH head	-0.070	-2.386	-0.059	-2.030
Sex of household head	-0.761	-2.181	-0.570	-1.584
Age of household head (years)	-0.004	-0.847	-0.004	-0.934
Highest grade completed by an adult female in HH	-0.034	-1.725	-0.022	-1.141
Highest grade completed by an adult male in HH	.037	1.407	.024	0.911
No spouse present in HH	-0.639	-2.116	-0.516	-1.613
Age in years	.192	5.089	.200	5.054
Age in years squared	-0.004	-6.207	-0.004	-6.214
Amount borrowed by female brom BRAC	-0.029	-1.752	-0.014	-0.819
Amount borrowed by male from BRAC	.001	0.053	-0.011	-0.538
Amount borrowed by female from BRDB	.008	0.321	.004	0.200
Amount borrowed by male from BRDB	.042	2.129	.031	2.193
Amount borrowed by female from GB	-0.022	-1.558	-0.021	-1.587
Amount borrowed by male from GB	-0.000	-0.018	-0.000	-0.025
Participate but no credit	.066	0.375	-0.009	-0.058
Has any primary school	-0.022	-0.243	-0.005	-0.049
Has rural health center	-0.055	-0.581	.023	0.231
Has family planning center?	-0.206	-1.302	-0.124	-0.825
Is *Dai*/Midwife available?	.047	0.489	.022	0.239
Price of rice	-0.110	-1.931	-0.089	-1.513
Price of wheat flour	.108	2.224	.104	2.083
Price of mustard oil	.020	2.718	.018	2.425
Price of hen egg	-0.011	-0.545	-0.002	-0.115

Table A15 (continued)
Unweighted and Weighted Naive Estimates of the Impact of Credit on Fertility of Currently Married Women Aged 15-49
(Probit)

Explanatory Variables	Weighted		Unweighted	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Price of milk	.040	2.267	.034	1.940
Price of potato	-0.046	-1.595	-0.059	-1.964
Average female wage	-0.001	-0.106	-0.014	-1.837
No female wage dummy	.175	0.932	-0.175	-0.929
Average male wage	.008	1.445	.008	1.447
Distance to Bank (km)	.020	1.422	.025	1.787
Constant	-3.113	-3.287	-3.109	-3.111
Pseudo R^2	0.150		0.148	
No. of observations	1496		1496	

Source: BIDS-World Bank household survey data, 1991-92.

APPENDIX B

Table B1
WESML-LIML-FE Estimates of the Impact of Credit on Log Labor Supply by Gender

Explanatory Variables	Men		Women	
	Coef.	asymptotic t-ratio	Coef.	asympototic t-ratio
Parents of HH head own land	.065	.895	.437	2.262
Brothers of HH head own land	.008	.232	-0.189	-1.672
Sisters of HH head own land	.108	2.797	-0.242	-2.104
Parents of HH head's spouse own land	.114	1.672	.038	.238
Brothers of HH head's spouse own land	-0.067	-1.922	.048	.514
Sisters of HH head's spouse own land	-0.016	-0.399	.001	.045
Log HH land assets in decimal	-0.009	-0.356	-0.025	-0.412
Highest grade completed by HH head	-0.079	-2.770	.228	2.612
Sex of HH head (1=male)	-0.214	-0.352	-1.085	-1.629
Age of HH head (years)	.000	.045	-0.002	-0.254
Highest grade completed by adult female in HH	-0.044	-2.056	-0.048	-0.623
Highest grade completed by adult male in HH	-0.053	-1.858	-0.302	-3.636
No adult male in HH			2.305	3.167
No adult female in HH	-0.070	-0.272		
No spouse present in HH	-0.232	-1.006	-0.186	-0.430
Round 2 dummy	-0.032	-0.678	-0.268	-1.810
Round 3 dmmy	-0.101	-1.755	-0.075	-0.512
Age in years	.119	6.684	.470	8.453
Age in years squared	-0.002	-6.361	-0.006	-7.822
Highest grade completed	.116	4.688	.057	.756
Amount borrowed by female from BRAC	-0.212	-8.470	.234	2.302
Amount borrowed by male from BRAC	-0.157	-3.688	.058	.492
Amount borrowed by female from BRDB	-0.249	-9.149	.233	2.275

Table B1 (continued)
WESML-LIML-FE Estimates of the Impact of Credit on Log Labor Supply by Gender

Explanatory Variables	Men		Women	
	Coef.	asymptotic t-ratio	Coef.	asympototic t-ratio
Amount borrowed by male from BRDB	-0.163	-3.521	.060	.562
Amount borrowed by female from GB	-0.255	-9.619	.320	3.153
Amount borrowed by male from GB	-0.167	-3.604	.027	.231
Participated but did not take credit	-0.303	-2.515	.191	.435
Sigma	1.746	23.982	3.782	41.498
Rho (women)	.697	10.608	-0.206	-1.850
Rho (men)	.503	3.826	-0.034	-0.264
Log likelihood	-13778.692		-12300.124	
No. of observations	5846		5693	

Source: BIDS-World Bank household survey data, 1991-92.

Table B2
WESML-LIML-FE Estimates of the Impact of Credit
by Gender on Log Per Capita Expenditure

Explanatory Variables	Food		Non-food		Total	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Parents of HH head own land	.016	1.074	.039	.991	.020	.991
Brothers of HH head own land	.002	.227	-0.000	-0.016	-0.000	-0.002
Sisters of HH head own land	-0.000	-0.039	.016	.802	.004	.349
Parents of HH head's spouse own land	.015	1.278	.048	1.624	.021	1.400
Brothers of HH head's spouse own land	-0.006	-0.823	.008	.440	-0.000	-0.006
Sisters of HH head's spouse own land	.005	.676	.003	.150	.002	.053
Log HH land assets in decimal	.005	1.026	.055	4.528	.015	2.431
Highest grade completed by HH head	-0.002	-0.426	-0.024	-1.746	-0.007	-0.853
Sex of HH head (1=male)	.096	2.164	.070	.530	.110	1.856
Age of HH head (years)	-0.002	-2.926	.-0.007	-3.642	-0.003	-3.657
Highest grade completed by adult female in HH	.015	3.736	.065	5.996	.029	5.149
Highest grade completed by adult male in HH	.009	1.773	.060	4.528	.019	2.437
No adult male in HH	-0.020	-0.293	-0.176	-1.117	-0.014	-0.167
No adult female in HH	.158	2.090	.132	.910	.159	2.038
No spouse present in HH	.122	4.195	.188	2.483	.141	4.283

Table B2 (continued)
WESML-LIML-FE Estimates of the Impact of Credit
by Gender on Log Per Capita Expenditure

Explanatory Variables	Food		Non-food		Total	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Round 2 dummy	-0.069	-6.284	.230	7.822	-0.021	-1.586
Round 3 dmmy	-0.148	-13.266	-0.657	-19.182	-0.222	-17.302
Amount borrowed by female from BRAC	.026	4.032	.019	.471	.038	3.702
Amount borrowed by male from BRAC	.012	1.343	.041	1.680	.018	1.615
Amount borrowed by female from BRDB	.032	4.491	.017	.395	.041	3.620
Amount borrowed by male from BRDB	.021	2.531	.050	2.228	.024	2.341
Amount borrowed by female from GB	.032	4.926	.022	.518	.044	3.899
Amount borrowed by male from GB	.016	1.752	.029	1.231	.018	1.660
Participated but did not take credit	.056	1.868	.015	.196	.059	1.714
Sigma	.312	37.113	.820	52.067	.383	25.371
Rho (women)	-0.409	-4.917	-0.055	-0.224	-0.464	-3.940
Rho (men)	-0.205	-1.705	-0.187	-1.505	-0.191	-1.633
Log likelihood	-5090.877		-8712.608		-5784.156	
No. of observations	4567		4567		4567	

Source: BIDS-World Bank household survey data, 1991-92.

Table B3
WESML-LIML-FE Estimates of the Impact of Credit by Gender on Log Non-land Assets

Explanatory Variables	Male		Female	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Parents of HH head own land	.121	.963	.361	1.346
Brothers of HH head own land	.042	.723	.086	.613
Sisters of HH head own land	.026	.408	.190	1.305
Parents of HH head's spouse own land	-0.053	-0.498	.167	.688
Brothers of HH head's spouse own land	.014	.227	-0.041	-0.315
Sisters of HH head's spouse own land	.102	1.509	-0.251	-1.718
Log HH land assets in decimal	.342	9.825	.055	.576
Highest grade completed by HH head	-0.101	-2.311	-0.023	-0.209
Sex of HH head (1=male)	7.007	23.409	-6.823	-7.003
Age of HH head (years)	-0.012	-2.389	-0.013	-1.113
Highest grade completed by adult female in HH	.049	1.782	.167	2.440
Highest grade completed by adult male in HH	.198	4.691	.159	1.516
No adult male in HH	-0.518	-1.305	.549	.556
No adult female in HH				
No spouse present in HH	-0.624	-3.131	.375	.554
Amount borrowed by female from BRAC	-0.007	-0.137	.070	.869
Amount borrowed by male from BRAC	-0.156	-4.656	.328	1.733
Amount borrowed by female from BRDB	.003	.042	.189	1.745
Amount borrowed by male from BRDB	-0.169	-5.012	.332	1.906
Amount borrowed by female from GB	.001	.023	.219	2.920
Amount borrowed by male from GB	-0.218	-5.956	.240	1.293
Participated but did not take credit	.037	.140	-0.116	-0.188
Sigma non-land assets	1.361	45.865	3.990	26.992
Rho (women)	.023	.122	.027	.405
Rho (men)	.830	28.686	-0.328	-1.745
Log likelihood	-3245.862		-3403.751	
No. of observations	1475		1517	

Source: BIDS-World Bank household survey data, 1991-92.

Table B4
WESML-LIML-FE Estimates of the Impact of Credit
by Gender on School Enrollment of Children Aged 5-17

Explanatory Variables	Boys		Girls	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Parents of HH head own land	.225	2.172	.260	2.609
Brothers of HH head own land	-0.038	-0.854	.078	1.513
Sisters of HH head own land	-0.053	-1.147	-0.094	-1.802
Parents of HH head's spouse own land	-0.061	-0.783	-0.056	-0.778
Brothers of HH head's spouse own land	.045	1.114	.027	.633
Sisters of HH head's spouse own land	.042	.849	.019	.410
Log HH land assets in decimal	.041	1.400	.056	1.942
Highest grade completed by HH head	.042	1.311	.043	1.551
Sex of HH head (1=male)	.616	1.812	-0.005	-0.032
Age of HH head (years)	-0.015	-2.805	-0.011	-2.419
Highest grade completed by adult female in HH	.054	2.260	.008	.322
Highest grade completed by adult male in HH	.044	1.439	.073	3.013
No adult male in HH	.453	1.267	-0.099	-0.279
No adult female in HH	.137	.222	-0.658	-1.344
No spouse present in HH	-0.122	-0.513	-0.536	.260
Age in years	.669	9.084	.752	9.194
Age in years squared	-0.032	-9.539	-0.034	-9.058
Amount borrowed by female from BRAC	.024	.449	-0.049	1.401
Amount borrowed by male from BRAC	.010	.236	.023	.598
Amount borrowed by female from BRDB	.102	1.814	.071	1.583
Amount borrowed by male from BRDB	.047	1.100	.011	.272
Amount borrowed by female from GB	.091	1.738	.085	2.554
Amount borrowed by male from GB	.068	1.557	.031	.797
Participated but did not take credit	.257	1.375	.249	1.349
Rho (women)	-0.141	-0.578	-0.153	-1.036
Rho (men)	-0.060	-0.344	-0.011	-0.083
Log likelihood	-3542.159		-3497.840	
No. of observations	1341		1269	

Source: BIDS-World Bank household survey data, 1991-92.

Table B5
WESML-LIML-FE Estimates of the Impact of Credit
by Gender on Log Height of Children Aged 0-14 years

Explanatory Variables	Boys		Girls	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Parents of HH head own land	.014	1.526	.010	.939
Brothers of HH head own land	.008	1.857	-0.011	-1.990
Sisters of HH head own land	-0.002	-0.282	.007	1.185
Parents of HH head's spouse own land	-0.030	-2.618	-0.012	-1.153
Brothers of HH head's spouse own land	.004	.725	.002	.417
Sisters of HH head's spouse own land	.007	1.547	.004	.742
Log HH land assets in decimal	.002	.531	.002	.416
Highest grade completed by HH head	-0.008	-2.007	-0.003	-.045
Sex of HH head (1=male)	-0.007	-0.075	-0.013	-0.467
Age of HH head (years)	-0.001	-1.580	.000	.579
Highest grade completed by adult female in HH	-0.002	-0.612	.005	1.526
Highest grade completed by adult male in HH	.009	2.541	.006	2.034
No adult male in HH	.108	2.347	.024	.617
No adult female in HH	-0.073	-0.811	-0.038	-0.855
No spouse present in HH	-0.047	-0.562	.016	.451
Round 3 dummy	.021	3.877	.023	4.587
Age in years	.112	15.199	.107	18.661
Age in years squared	-0.006	-7.184	-0.005	-10.079
Amount borrowed by female from BRAC	-0.004	-0.670	-0.007	-1.800
Amount borrowed by male from BRAC	.007	2.223	-0.001	-0.192
Amount borrowed by female from BRDB	-0.006	-0.818	-0.012	-1.793
Amount borrowed by male from BRDB	-0.000	-0.071	-0.004	-0.704
Amount borrowed by female from GB	-0.011	-1.854	-0.010	-2.282
Amount borrowed by male from GB	-0.002	-0.485	.001	.439
Participated but did not credit	.061	3.654	.023	.940
Sigma	.073	7.885	.083	10.914
Rho (women)	.478	1.546	.634	3.903
Rho (men)	-0.042	-0.357	-0.092	-0.790
Log likelihood	-2930.308		-2859.767	
No. of observations	378		409	

Source: BIDS-World Bank household survey data, 1991-92.

Table B6
WESML-LIML-FE Estimates of the Impact of Credit
by Gender on Log Weight of Children Aged 0-14 Years

Explanatory Variables	Boys		Girls	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Parents of HH head own land	.011	.479	.047	1.769
Brothers of HH head own land	.012	1.186	-0.033	-2.433
Sisters of HH head own land	-0.001	-0.055	.027	1.779
Parents of HH head's spouse own land	-0.051	-1.962	-0.025	-0.994
Brothers of HH head's spouse own land	-0.003	-0.211	-0.007	-0.649
Sisters of HH head's spouse own land	.009	.813	-0.004	-0.312
Log HH land assets in decimal	.002	.233	.007	.655
Highest grade completed by HH head	-0.014	-1.790	-0.014	-2.090
Sex of HH head (1=male)	.041	.204	.003	.048
Age of HH head (years)	-0.001	-0.874	.004	2.215
Highest grade completed by adult female in HH	-0.003	-0.294	.012	1.768
Highest grade completed by adult male in HH	.018	2.293	.014	2.5133
No adult male in HH	.130	1.052	.121	1.386
No adult female in HH	-0.418	-2.477	-0.325	-3.532
No spouse present in HH	-0.003	-0.019	.014	.209
Round 3 dummy	.019	1.227	.039	3.184
Age in years	.198	10.515	.184	13.127
Age in years squared	-0.009	-4.781	-0.008	-6.287
Amount borrowed by female from BRAC	-0.017	-1.308	-0.015	-1.641
Amount borrowed by male from BRAC	.018	1.756	.002	.177
Amount borrowed by female from BRDB	-0.019	-1.030	-0.030	-1.623
Amount borrowed by male from BRDB	-0.002	-0.199	-0.009	-0.820
Amount borrowed by female from GB	-0.027	-1.981	-0.022	-1.987
Amount borrowed by male from GB	-0.001	-0.090	.009	1.246
Participated but did not take credit	.125	3.234	.060	1.140
Sigma	.179	6.881	.189	9.038
Rho (women)	.560	2.115	.655	3.628
Rho (men)	-0.033	-0.169	-0.049	-0.592
Log likelihood	-3159.857		-3137.600	
No. of observations	378		409	

Source: BIDS-World Bank household survey data, 1991-92.

Table B7
WESML-LIML-FE Estimates of the Impact of Credit by Gender
on Body Mass Index (BMI) of Children of Age Less than 10

Explanatory Variables	Boys		Girls	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Parents of HH head own land	-0.016	-1.325	.028	2.299
Brothers of HH head own land	-0.002	-0.325	-0.014	-2.396
Sisters of HH head own land	.002	.344	.013	1.534
Parents of HH head's spouse own land	.006	.568	-0.001	-0.083
Brothers of HH head's spouse own land	-0.009	-1.674	-0.010	-2.091
Sisters of HH head's spouse own land	-0.004	-0.595	-0.013	-2.179
Log HH land assets in decimal	-0.001	-0.250	.002	.566
Highest grade completed by HH head	.000	.044	-0.007	-2.044
Sex of HH head (1=male)	.060	1.085	.051	1.787
Age of HH head (years)	.000	.127	.003	3.328
Highest grade completed by adult female in HH	.001	.333	.004	1.221
Highest grade completed by adult male in HH	.002	.499	.002	.600
No adult male in HH	-0.095	-1.558	.086	2.690
No adult female in HH	-0.288	-3.968	-0.238	-4.756
No spouse present in HH	.092	1.890	-0.014	-0.619
Round 3 dummy	-0.024	-2.435	-0.007	-0.720
Age in years	-0.025	-2.846	-0.028	-3.972
Age in years squared	.002	2.797	.002	3.094
Amount borrowed by female from BRAC	-0.013	-1.248	.004	1.365
Amount borrowed by male from BRAC	-0.005	-0.536	.006	1.070
Amount borrowed by female from BRDB	-0.011	-0.827	.002	.244
Amount borrowed by male from BRDB	-0.011	-1.017	.001	.145
Amount borrowed by female from GB	-0.009	-0.797	.005	1.822
Amount borrowed by male from GB	-0.006	-0.623	.009	2.293
Participated but did not take credit	.007	.254	.011	.513
Sigma	.097	3.900	.088	20.395
Rho (women)	.482	1.156	-0.165	-1.441
Rho (men)	.399	1.146	-0.051	-0.534
Log likelihood	-2998.448		-2921.321	
No. of observations	378		409	

Source: BIDS-World Bank household survey data, 1991-92.

Table B8
WESML-LIML-FE Estimates of the Impact of Credit on Contraceptive Use by and Fertility of Currently Married Women Aged 15-49 years

Explanatory Variables	Contraceptive Use		Recent Fertility	
	Coef.	asymptotic t-ratio	Coef.	asymptotic t-ratio
Parents of HH head own land	-0.002	-0.019	.258	3.019
Brothers of HH head own land	.016	.363	-0.080	-1.719
Sisters of HH head own land	-0.032	-0.714	-0.039	-0.818
Parents of HH head's spouse own land	-0.019	-0.267	.029	.413
Brothers of HH head's spouse own land	-0.003	-0.073	-0.029	-0.707
Sisters of HH head's spouse own land	.001	.016	-0.032	-0.672
Log HH land assets in decimal	-0.056	-1.508	.049	1.538
Highest grade completed by HH head	.019	.580	-0.062	-1.767
Sex of HH head (1=male)	.912	1.931	-1.043	-2.671
Age of HH head (years)	-0.002	-0.447	-0.003	-0.579
Highest grade completed by adult female in HH	.025	1.135	-0.052	-2.024
Highest grade completed by adult male in HH	.021	.685	.030	.901
No spouse present in HH	.307	.903	-0.666	-1.902
Age in years	.344	6.448	.214	3.445
Age in years squared	-0.005	-6.420	-0.004	-4.176
Amount borrowed by female from BRAC	-0.023	-0.444	-0.042	-0.732
Amount borrowed by male from BRAC	.092	1.831	-0.043	-0.689
Amount borrowed by female from BRDB	-0.086	-1.549	-0.046	-0.781
Amount borrowed by male from BRDB	.146	3.002	.040	.665
Amount borrowed by female from GB	-0.051	-0.933	.051	.884
Amount borrowed by male from GB	.040	.687	.033	.533
Participated but did not take credit	.288	1.421	.040	.191
Rho (women)	.226	.932	.097	.364
Rho (men)	-0.464	-1.910	-0.082	-0.323
Log likelihood	-2181.475		-2140.187	
No. of observations	1498		1496	

Source: BIDS-World Bank household survey data, 1991-92.

APPENDIX C

Table C: Wald Test (χ^2) Statistics [a]

Outcome Variables	Joint Significance of [b,c]				
	Credit variables (6)	Female credit variables (3)	Male credit variables (3)	Transfer variables (6)	Equality of gender credit variables (3)
Girl's schooling	4.11	2.16	2.34	7.62	1.64
Boy's schooling	20.10	15.18	5.54	10.00	3.03
Women's labor supply	1.39	0.44	0.79	15.84	1.00
Men's labor supply	98.66	53.11	7.65	23.27	2.26
Per capita food expenditure	7.97	3.41	4.37	10.40	1.06
Per capita non-food expenditure	5.05	0.81	4.08	14.23	2.31
Per capita total expenditure	22.69	19.03	4.11	13.16	3.39
Contraception	16.90	6.15	8.58	4.53	12.42
Fertility	13.87	8.36	8.17	14.20	9.20
Women's non-land assets	4.36	2.42	1.91	2.55	2.95
Girls BMI	9.82	4.14	5.98	26.63	0.92
Boys BMI	4.17	3.32	1.76	6.88	1.77
Girls' Height	9.35	5.78	1.28	6.92	5.50
Boys' Height	14.00	7.89	9.78	17.05	2.54
Girls' Weight	9.34	4.12	2.94	9.77	6.64
Boys' Height	10.39	4.88	7.89	9.06	4.70

[a]Based on WESML-LIML-FE estimates.
[b]degress of freedom in parenthesis
[c]critical values are:

$\chi^2(3)_{.10} = 6.25$ $\chi^2(6)_{.10} = 10.64$
$\chi^2(3)_{.05} = 7.82$ $\chi^2(6)_{.05} = 12.59$
$\chi^2(3)_{.01} = 11.34$ $\chi^2(6)_{.01} = 16.81$

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