Essays on Microfinance: Financial and Social Impacts in Rural Bangladesh

Syed Towhid Saad

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Approved by:

John Akin, Advisor

Helen Tauchen

David Guilkey

Stephen Lich-Tyler

Larry Chavis

Abstract

SYED TOWHID SAAD: Essays on Microfinance: Financial and Social Impacts in Rural Bangladesh.
(Under the direction of John Akin.)

Rural credit programs in developing countries are designed to help the poorest of the poor by providing collateral-free loans at a low cost. In order to properly measure the efficacy of these programs, one needs to examine not only the pecuniary benefits of the programs but also the non-pecuniary benefits. The micro-loans are mandated for income-generating purpose such as investing in a micro-enterprise. To elaborate, one way that credit programs can benefit the poor is by providing them opportunities to increase their income. Another way that these programs benefit is by empowering women. The credit programs tend to target poor women, thereby providing them with income-generating opportunities that they otherwise lack. A woman's potential contribution to the household income may increase her intra-household bargaining power and empower her. This may have far-reaching consequences in terms of household investment in children's health and education, as well as a woman's wellbeing.

In the following thesis, I present two papers that investigate the two different effects of credit programs. The first chapter examines the effect of borrowing from credit and non-credit programs on self-employment profits. The second chapter examines the effect of men's and women's self-employment profits on woman's intra-household bargaining power and how it differs with the gender of the primary borrower. The self-employment activities that are considered were primarily funded by the credit programs or by non-credit sources such as commercial banks and moneylenders.

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Chapter 1

Introduction

1.1 Overview of micro-credit institution

Micro-credit programs are poverty alleviation tools that provide access to loans and savings for poor people who otherwise lack savings or substantial land- assets to use collateral. Credit programs, such as Grameen Bank, started in the 1970s and gradually shifted their target group from men to women in rural Bangladesh.

Dr. Mohammed Yunus, an economics professor, founded the first micro-credit organization, Grameen Bank, in Bangladesh in 1976. The bank is based on the belief that credit is a human right; every human being has a right to life in which his basic needs are met. Poverty, however, challenges this right. One way to challenge poverty is through increased access to credit. In other words, lending to the poor should be obligatory. Therefore, the bank provides loans to the credit-constrained and landless poor (who are defined as those owning less than 1/2 acre of land). The bank uses peer monitoring as a substitute for collateral. Each member self-selects into a group of five. Furthermore, even though loans are given to each member, everyone in the group becomes ineligible (loses future access to loans) if one defaults. Thus, collateral is replaced by group pressure, increasing the likelihood of repayment.

Peer monitoring provides some additional benefits. Since banks do not normally observe individuals with high risk of default and this knowledge may be costly to obtain, banks transfer the liability to the peers. It is often a sunk cost for the peers to gain knowledge of the individual's characteristics. Therefore, not only will the members refuse to group with someone they know will be 'risky', but they also will make sure that group members utilize the loans effectively. In addition to keeping their credit intact, members may decide to repay someone else's loan and mentor each other about timely repayment. This may explain the high loan recovery rate, at approximately 98%, for the Bank.

However, the downside of the approach is that one's financial problem becomes the group's problem. This may lead to a domino effect where if one member defaults, then others may default as well, knowing that they have effectively lost loan access. To prevent this, the Bank has started to disburse loans at different times. At first, two members of the five- member group receive a loan. If they repay regularly for the next six weeks, two more members can apply for a loan. The chairperson of the group is usually the last borrower of the five. Most loans last exactly one year. Therefore, due to different timing, some members would have to repay before they know the default status of other members. In addition, those who have already repaid will have a greater incentive to urge their peers to repay. However, this strategy is not effective in reducing the domino effect if one of the earlier borrowers defaults. It can take several months for a group to be recognized or certified by the Grameen Bank. In order to be recognized, all five prospective borrowers must learn the Grameen Bank's policies and demonstrate their understanding of those policies in an oral exam administered by a senior bank official. Once all members pass the exam, the first loan is issued.

At present, the Grameen Bank has approximately 7.27 million borrowers, 97% of whom are women. There are 2,459 branches in 79,539 villages. The total amount of

loans disbursed by the Bank since its inception is US $6.44 billion, of which US $5.76 billion has been repaid. Most loans last one year with weekly mandatory installments. Repayment starts one week after the loan is issued. The bank charges a simple interest rate of 20% (declining basis) or equivalent 10% flat rate for income-generating loans. The repayment amounts to TK20 per week for every TK1,000. The loan amount for the Bank ranges from TK1,000 to TK16,000. The average loan accounts for about 1.2% of a household's total annual income.

These micro-credit organizations usually have some form of mandatory savings to help borrowers break the vicious cycle of poverty and become self-sufficient. There are also methods of buffering idiosyncratic shocks to some degree. Grameen requires its borrowers to deposit 5% of each loan in a group fund and has a mandatory savings program with interest rate ranging from 8.5% to 12%. In fact, the bank finances 100% of the outstanding loans from its deposits, 58% of which comes from the borrowers. Interestingly, since 1998, the bank ceased receipt of donor funds and became fully funded through its deposits. Since the savings draw interest, I include interest earnings from the subsequent savings as part of the profit from business. A borrower can take an interest free loan from the group fund not exceeding half the fund's total, provided that all members approve of the amount and its usage. By the end of 1998, group savings reached $162 million, of which $152 million were saved by women. In addition to micro-credit, Grameen Bank offers social development programs such as its 16 Decisions, which teach members to become better entrepreneurs, limit family size and educate children among other things (Grameen Bank).

The other two programs addressed in this study are BRAC and BRDB. BRDB is the largest public sector agency in micro-credit lending in Bangladesh. Between 1991 and 1998, BRDB distributed TK10.30 billion as micro-credit to 1.6 million beneficiaries through 0.12 million groups in 440 thanas or districts (Banglapedia). BRAC, an NGO,

was originally set up in 1972 by its founder, executive director Fazle Hassan Abed, to provide relief and rehabilitation assistance to refugees returning from India after the War of Independence in 1971. Later, BRAC turned its focus to poverty alleviation in rural areas. BRAC's credit program was initiated in 1974 and has evolved since then to incorporate Grameen Bank's credit schemes. As of December 2002, the organization had disbursed US$1.8 billion among its members to develop income-generating projects or micro-enterprizes. Members are also encouraged to save regularly. The savings deposited with BRAC amounted to $86 million in 2000. Similar to Grameen Bank, BRAC provides a number of other services to the rural poor, including health-care, education and training programs. It places particular emphasis on the training of its members in trades and income generating activities (Banglapedia).

1.2 Data

The data were collected in an extensive multipurpose quasi-experimental survey in Bangladesh commissioned by the Bangladesh Institute of Development Studies-World Bank in 1991/ 1992 and a follow-up in 1998/ 1999. It was designed to study the impact on borrowers' welfare from three group lending programs: Grameen Bank, BRAC, and BRDB. The survey interviewed 1,798 households in 87 villages of 29 thanas (subdistricts) selected at random from 391 thanas, 24 of which had at least one of the three credit programs under study in operation, while five thanas had none of them. Three villages in each program thana were then randomly selected. Three villages from each non-program thana were also randomly selected from the village census taken by the government of Bangladesh. Only programs that had been in operation for at least three years were included. The survey thus has three groups of people: a target group and a non-target group separated by the exogenous eligibility requirement of land ownership of less than 0.5 acre. Within the target group, there are participants in one of the three

Table 1.1: Number of villages with credit programs and their type

Type of credit	BRAC	BRDB	GB	No group	Total
Male only	0	9	1	0	10
Female only	7	3	12	0	22
Male and female	17	12	11	0	40
No program	0	0	0	15	15
Total	24	24	24	15	87

credit programs and non-participants who chose not to participate even though they were eligible for the credit. Thus, the three groups are target-participants, target non-participants, and non-target. As mentioned before, non-target group was dropped from the estimation to retain comparison between borrowers and non-borrowers. Thus, the sample consists of target-participants and target non-participants from program villages, and target non-participants from control villages.

In a number of the villages surveyed, there were micro-credit programs for both men and women. However, some of the villages had only male or female credit groups. Table 1.1 shows the distribution of credit programs and the type of program in the village. Data from male-only and female-only villages help us analyze the impact of credit programs on outcome variable as differenced by the gender of the participants. The household survey includes information about household characteristics such as age and education level, transfers, land ownership, income from agriculture or self-employment, consumption, savings, amount of borrowing over the last four years, family planning, and fertility behavior. The survey also documents loans from various other sources over the last four years from government and commercial banks, moneylenders, and family and friends. In addition to the household survey, a village-level survey was also administered which provides information on prices, infrastructure, and wages.

Chapter 2

The Effect of Gender-Based Returns to Borrowing on Intra-Household Resource Allocation in Rural Bangladesh

2.1 Introduction

In recent decades, micro-credit organizations such as Grameen Bank in Bangladesh have created revolutions in poverty alleviation by providing access to credit in poor communities. In 1976, Muhammud Yunus founded Grameen Bank because he believed that lack of capital was the primary obstacle to productive self-employment for the poor. Today, that banking program has been replicated all around the world in both

developing and developed countries [1].

Micro-credit programs provide a two-tiered approach to poverty alleviation. First, the programs provide credit to the poor. The poor use the credit to purchase capital for investment in a self-employment activity. The programs target people with little to no collateral such as land and disburse loans under a group-based system that relies on peer-monitoring to prevent defaults. In addition to credits, they provide social development programs such as vocational training, and education about health, family planning, civic responsibilities, and rights. These non-pecuniary aspects of the programs may add to the success of micro-credit programs. Substantial resources are being invested in expanding and maintaining these programs in Bangladesh under the assumption that they help the poor by bootstrapping them out of poverty [2]. Therefore, it is crucial to test this assumption.

I find that credit effects on profit are positive but less than non-credit effects for micro-loans, which means that non-credit services have a profit effect that is above and beyond just the effect of loan amount. In addition, self-employment profit depends on the lending contract as well as different type of micro-credit banks. The relatively low interest rate and collateral-free policy, along with the social programs, differentiate micro-credit lending from non-micro lending. Therefore, the effect of participation on self-employment profit may differ depending on the contract, as well as household

[1]Micro-Business International (Washington); The Good Faith Fund (Arkansas); ADIE Credit for Self-Employment (France); Micro Credit Rainbow (Italy); The First's People's Fund (Canada) are all replications of Grameen Bank in developing countries

[2]World Bank report shows that over the last decade, it provided US $260 million to different micro-finance projects in Bangladesh. *Ten years of World Bank Support for microcredit in Bangladesh*

characteristics such as wealth and education. Households choose how much to borrow and from where to borrow. There may be unobserved characteristics such as ability or effort that may affect these decisions and simultaneously affect the level of profit. A better entrepreneur might wish to borrow more but also may have higher profit due to his or her ability. This would result in upward bias. I use an Instrumental Variables approach to identify the impact of loans and borrowing. By exploiting the gender eligibility restrictions in micro-credit villages as well as the program availability in treated and control villages and cost of borrowing, I control for factors that affect both the self-employment profits and borrowing and loan size.

I analyze a household data set that contain information on loans and self-employment activities, as well as on costs and revenues. World Bank collected the data set first in 1992 and resurveyed in 1998 The sources for loans vary and include loans from commercial banks, local moneylenders, government, and micro-credit organizations. The three main micro-credit programs examined are the Grameen Bank, the Bangladesh Rural Advancement Committee (BRAC), and Bangladesh Rural Development Board's (BRDB) RD-12 program. Pitt and Khandker (1998) examine these three programs and find that the credits from all three lending programs have a positive marginal effect on household expenditures, savings, and assets and a negative marginal effect on male labor supply. However, these could be due to an income effect of the credit itself since they use the loan amount to obtain program effects. Murdoch (1998) counters the Pitt and Khandker conclusion by finding negative average effect of credit on household expenditures. Unlike Pitt and Khandker, MurDoch restricts his analysis to targeted or eligible group

and compares eligible participants and non-participants from treated villages to eligible households in control villages. McKernan (2002) finds positive impact of participation in the lending programs on business profits.

My analysis is similar to that of Pitt and Khandker in that I examine the effect of loan amount. However, unlike their study, I examine the effect of loan on borrower's self-employment profit. The positive effect of loan on consumption and asset could reflect just a consumption-smoothing effect. A more interesting and important question is whether these programs effect people's income levels or business profits. Indeed, this is what this analysis answers. Moreover, I restrict my sample size to households owning less than half and acre of land since that is the eligibility requirement to borrow from micro-credit. This facilitates comparison between borrowers, non-borrowers, and borrowers from different sources, which is another contribution of this analysis. I include and compare micro-loans to non-micro loans in terms of their credit and non-credit effects on household profit. This provides a reference for micro-loans and I can examine how they perform against the already existing formal and informal credit institutions. Finally, I take into account the opportunity costs of time when calculating profit. In addition to the training period, households invest substantial own-labor in the micro-enterprise. An evaluation of the micro-program participation is incomplete without factoring in own-time cost.

2.2 Pathway through which micro-credit affects profit

Micro-credit programs can affect profit via physical capital. As mentioned earlier, lack of collateral and high transaction cost of small loans often preclude the poor from normal sources of banking. With little access to credit, self-employment may never be undertaken or be held at a suboptimal level. Micro-credit can provide credit with which households can purchase additional capital assets, thereby raising the level of capital. This enables households to undertake new or expand an existing Self-Employment (SE) activity. To see more clearly, let us consider the credit market and SE decisions before and after a micro-credit intervention. Prior to the intervention, assume that households are in equilibrium. Some households engage in SE while others work in the wage labor market. Then a micro-credit program decides to locate in the village, offering credit to the resource scarce and lowering the price for credit. Given this, some households who were not operating SE now find it optimal to invest in a SE activity. Yet, others in SE may find it optimal to expand their business. All these would tend to affect profit from SE.

In addition to the effect through physical capital, micro-credit may also affect profit through human capital. Most programs bundle social development programs with the provision of credits. These provide human capital in areas such as literacy, empowerment, legal and political awareness, investment strategies, civil responsibilities, and vocational trainings. These can directly increase stock of human capital. Moreover, the group-based mechanism can also indirectly affect human capital. Group-based programs

such as BRAC, BRDB, and Grameen Bank encourage members to help one another with advice. Beyond this, the group-based feature provides incentive for members within a group to share human capital. Since there is joint liability for the loan within a group, it benefits all members to share information, provide advice, and help each other, so that default, which can lead to loss of future access to credit for all members, is less likely. Varian (1990) presents a incentive model which shows that highly productive agents have incentive to share knowledge with agents with less productivity under a group-based mechanism because highly productive agents will loose access to capital in case of default by other members in the group. Thus, micro-credit programs and their group-based contract encourage human capital sharing which will increase low productive individual's profit as well as his productivity.

2.3 Estimation

2.3.1 Estimation strategy

The goal of this chapter is to measure the credit and non-credit effects of micro-credit program participation on self-employment profit. Moreover, I compare these effects with credit and non-credit effects from non-micro borrowing. The non-micro borrowing includes borrowing from government or private banks and local moneylenders. These loans are under individual lending contract where only the borrower is liable for the loan.

The conceptual framework for this study is the production theory of a household

business where a household chooses its input choices to optimize its self-employment profit in each period. These choices are restricted by a borrowing constraint. The optimal profit is a function of exogenous prices, household and village characteristics, and borrowing amounts. The empirical model is a linear approximation to this function. The equation for profit of household i in village j at period t, π_{ij}, is

$$\pi_{ijt} = \sum_k \delta_{1k} C_{ijtk} + \sum_k \delta_{2k} D_{ijtk} + \delta_3 X_{ijt} + \delta_4 V_j + \epsilon_{ijt} \tag{2.1}$$

where

π_{ijt} self-employment profit for household i in village j at time t;

C_{ijtk} amount of loan that the household i in village j borrowed from a micro-credit program or non-micro source k in the past year, where k = Grameen Bank, BRAC, BRDB, and non-micro;

D_{ijtk} dummy vector for borrowing; equals 1 if the household i in village j borrowed from a micro-credit program or non-micro source k in the past year and 0 otherwise, where k = Grameen Bank, BRAC, BRDB, and non-micro;

X_{ijt} vector of household and time variant village characteristics, such as number of males and female of different ages, land, education, years in business, village level prices and wages;

V_j vector of village fixed effects;

η_{ijt} $\epsilon_{ij} + v_{ijt}$, where ϵ_{ij} is household specific error and v_{ijt} is iid error term.

The micro-credit programs bundle credit with social development programs (non-credit)

such as vocational training, information sharing among members, provisions of health services and awareness and legal awareness. The effects of these are confounded and maybe difficult to separate, but important nonetheless. It would be beneficial to know which aspects of program participation lead to the largest changes in people's income and profit so that the programs can invest heavily on these aspects. In order to capture the credit and non-credit effects of both micro-credit programs and non-micro sources, I include whether the household borrowed from any of the micro-credit banks as well as from non-micro sources. Additionally, I control for the loan size from the three different micro-credit banks as well as from non-micro sources. After controlling for the loan size, any additional effect of borrowing on profit should be attributed to the non-credit effect. Thus, in this analysis, the main coefficients of interest are δ_{1k} and δ_{2k}. The former yields the credit effects while the latter yields the non-credit effects of micro-credit and non-micro borrowing. A hypothesis test of equality between the two sets of coefficients will reveal whether the credit and non-credit effects are much different.

The specification above includes number of people in the household, age distribution, education level of the head of the household and the spouse of the head of the household, and land asset owned by the household. These reflect productivity and thus will affect household self-employment profit. The education level also reflects any training that members might have acquired to operate a business. Cultivable land also represents productive asset which can benefit rural businesses. The data do not have information about the unit prices of the home produced goods. However, village level goods prices would capture some of these prices.

The equation also measures whether borrowing under individual contract affects profit differently than borrowing under group-contract. Individual contract requires only the borrower to be liable for the loan, and thus the responsibility of repayment is not shared by other people. All loans from non-micro sources in the data are under individual contract. There are formal and informal commercial lenders from whom the households can borrow, albeit at an exorbitant cost of 36% interest on average. In contrast, group-based programs impose group liability. If one member defaults on the loan, then the rest defaults also. Therefore, responsibility for repayment is shared by all members of the group. All loans from micro-credit programs in the data are under group contract. A comparison is needed between micro-credit programs and private lenders because this is an issue of sustainability. If households perform well enough to pay off loans and make a profit when they borrow from non-micro lenders and there is demand for loans even at a high interest rate, then micro-credit institutions may not need to provide subsidized credits at a below market interest rate. A test for this is to see whether $\delta_{1nonmicro}$ is statistically different than zero and similar to δ_{1micro}.

I estimate the self-employment profit equation for the sample of eligible households living in the micro-credit and control villages. I exclude the households that are ineligible in the program villages and control villages to enable comparison between the borrowers and non-borrowers. This means that all households with more than 0.5 acre of cultivable land were dropped from the sample. The remaining households were either eligible to borrow or participate in the program villages, or would be eligible to borrow in the control villages had there been a program.

2.3.2 Program evaluation issues

The typical program evaluation issues that would result in biased estimation are self-selection into programs and non-random program placement. These must be addressed when using data to evaluate the impact of micro-credit program participation on outcomes such as profit. If households were not self-selecting in these programs but were randomly picked by some mechanism, then we can just examine the differences in profits of the participants to that of the non-participants to obtain a valid estimate of the program effect. However, households do self-select into the program; the decision to join is based on the participants' and program's qualities. If these qualities are observable, then one can easily control for self-selection. However, some qualities are likely to be unobservable. For example, a household's entrepreneurial ability and willingness to work hard are qualities that are not readily observed but would affect both its program participation decision and profit. If the households that join credit programs or borrow are better entrepreneurs or are more willing to work than those who do not join or borrow, then a comparison of profits between participating and non-participating households would wrongly attribute to the credit program that part of the profits due to the entrepreneurial ability and harder work of households who self-select into the program. This would cause the estimates of program effect to be biased upward. The demand for credit or loan size is endogenous as well. Unobserved household characteristics can affect both the demand for credit and self-employment profit. These characteristics may include ability, ambition, effort. I use an instrumental variable approach to account for endogeneity bias, exploiting variation in gender-specific credit availability at the village

level.

Non-random program placements may bias the results as well. If programs are randomly placed, then one can compare the household profits in program villages and non-program villages to obtain program effect. However, when the program placement is non-random, simply comparing the profits in both types of villages would lead to a downward bias of the program effect. For example, suppose that programs are placed in poorer regions and that a typical household in such a region has poor access to credit and thus limited ability to purchase inputs for business. Credit program participation in this region may increase household profit. Even with the program, however, the profits of household from this region may still be lower than those from wealthier, non-program villages. This may lead to the erroneous conclusion that credit programs are not effective in increasing household profits. In the case of micro-credit program placement, the data show that program placement was indeed non-random [3]. While Grameen Bank was placed in relatively wealthier villages with higher market wage levels and better public infrastructures, BRAC and BRDB were placed in poorer villages with little to no infrastructure. I employ village fixed effects to account for differences between villages.

2.3.3 Identification

I use an instrumental variable approach to address the endogeneity bias discussed above. Eligible households that reside in a village where one of the programs is offered can

[3]I estimate whether a village has a specific program on village characteristics using, a Probit estimation technique

choose whether or not to participate into a micro-credit program. The decision to participate is thus endogenous. However, these households with choice do not provide the necessary identification since unobserved characteristics such as entrepreneurial ability or taste for work that affect the decision to participate may also affect self-employment profit. Thus, measuring the program impact by comparing profits of participants and non-participants may confound the participation effect with these un-observables. Households that are in the non-program villages and eligible for participation if there were a program in their village would provide identification. If credit programs are placed randomly across some villages, then households in these villages serve as the exogenous control group. However, the programs are non-randomly placed based on the village characteristics and thus the estimation must control for village-specific unobservables. I employ village fixed effects (FE) technique to address the bias due to program placement.

Households are exogenously excluded either because of their residence in non-program villages or through the exogenous gender restriction. Because men can join 'men only' groups and women can join 'women only' groups, the gender-based restriction is enforceable and observable. Therefore, I use the gender-based program design to identify program effects on self-employment profit. There are three different micro-credit programs (BRAC, BRDB, GB) and there are some villages where only women can borrow from micro-credit and some villages where only a man can borrow. The rest of the micro-credit villages allow both genders to borrow (see Table 1.1). The program placement and gender restrictions lead to six gender- and program-specific dummy variables

when disaggregating borrowing from micro-credit by the three different programs and two gender-specific dummy variables. I obtain the first set of instruments by interacting these six gender- and program-specific dummy variables with household land and education of the head of the household.

Identification on the basis of land ownership requires that it be exogenous to the population. This requirement may not hold if the households sell land to meet eligibility criteria. However, market sales of land have been historically documented to be low in South Asia. For example, using data containing rural farm households in India, Rosenzweig and Wolpin (1985) find that less than 1.75% of the land-holding households sold land, a very low percentage. Indeed, the data in this study contain information on land transactions prior to borrowing and I find no evidence of land sales by the borrowers to meet eligibility requirement. I also do not find evidence of land purchase prior to the program participation. In rural Bangladesh, the most land acquisitions are through inheritances or gifts; passed down from previous generations. Therefore, I treat land-ownership as exogenous.

To identify demand for credit or size of the loan, I use village average loan amount from BRAC, BRDB, GB, and non-micro sources. In addition, I use the information on access to inter-household transfers. These are measured by the number of landed and living relatives by relationship to the head of the household and the head's spouse. The potential transferees satisfy exclusion restrictions if they affect profit only through the loan or participation in the program. One reason that the exclusion restrictions may not be satisfied is if household utility and profit are jointly determined. If households are

risk averse and prefer lower mean profit to higher risk (variance), then having potential transferees serve as insurance against adverse outcomes may induce them to undertake riskier businesses for higher mean profit than they otherwise would in the absence of such insulation. In this case, potential transferees would affect profit other than through the loans (McKernan 2002).

To identify borrowing from non-micro loan sources, I use distance to the lender from borrower's house, its square term, and interest rate. All these variables should only affect self-employment profit through borrowing and loan size only. The distance to the lender also identifies micro-credit participation for those households where a woman borrows. A woman is less likely to be able to travel on her own to the bank. Therefore, the distance would be a deciding factor in whether or not she borrows but would not affect her profit.

2.4 Data description

Table 2.1 presents the descriptive statistics of the household and village level exogenous variables. The average distances to the nearest market or shop in the village range from 5 kilometers to 9 kilometers. Many of the villages are very remote. Average loan size from Grameen Bank is TK 6,710 while average loan size from BRDB is TK 3,352. Average loan size from non-micro sources is TK 9,874. I differentiate the household level variables by micro-credit and non-micro borrowers. On average, non-micro borrowers are more educated than micro-credit borrowers. Highest grade completed by the head of the

household with non-micro borrowing is 2.16 years of schooling, which is 0.42 years higher than micro-credit borrowing households. Non-micro borrowers also are wealthier than micro-credit borrowers in terms of average land-holdings. Another interesting difference between micro and non-micro borrowers is that micro-credit borrowing households have more middle-aged and older women on average than non-micro households. Typically, unmarried women do not borrow from micro-credit programs. In addition, as women get older, they get wiser and may exercise their will. Therefore, they are more likely to borrow and borrow from micro-credit organization, which are targeted toward women. In contrast, non-micro households have more young and middle-aged men than micro-credit households.[4] These statistics show that there are significant differences between the two types of households and these would affect their self-employment profits differently.

The profit is defined as the sum of the total household yearly revenue from the business and the value of household consumption from own-production less the yearly operating cost and opportunity cost of time. The operating expense is the sum of expenditure: production, raw material, and labor excluding their own. The opportunity cost of time is the product of the time investment and market wage, and any other time cost associated with membership. I account for the opportunity cost of household labor using village level wages for males and females and time investment by both genders. Previous papers in the literature have ignored the opportunity cost of labor. However, households on average spend 1,921 hours per year in a self-employment activity. This is a large time investment that could potentially yield more earnings in the labor market.

[4]See Appendix 2A for detail descriptions about the variables and sample size

Therefore, any evaluation study on micro-credit should take into account these large opportunity costs.

Table 2.2 presents the average profits and percentages of households that are self-employed disaggregated by micro-credit and non-micro borrowers, eligible non-borrowers in villages with micro-credit programs, and control villages. Therefore, all households presented in this analysis meet the eligibility criteria of owning less than half acre of land in both program and non-program villages. However, some of these households opted to not participate in micro-credit programs (the households in non-program villages do not have a choice to participate but they would be eligible if a program were available in their village). Of these non-participants, some do not borrow at all while others borrow from non-micro sources. The percentage of households managing an enterprise is only four percentage points higher for micro-credit participants than for households that are eligible non-participants. This suggests that credit programs may not play a significant role in a households' decision to undertake a self-employment activity. Table 2.2 shows that non-borrowers in both program and control villages have lowest average profits than micro and non-micro borrowers. Moreover, non-borrowers' profits are higher on average in program villages. However, these higher profits are driven by the households in Grameen Bank villages which are generally richer than other villages. This also shows that micro-credit programs are non-randomly placed. On average, non-micro borrowers in program villages have the highest profit at TK 28,510. The average profit for micro-borrowers is TK 21,980, with Grameen Bank borrowers making TK 25,741 and BRDB borrowers making TK 17,682. This table shows that there is differences in

the self-employment profit for different types of borrowers . The table also shows the loan amounts by micro- and non-borrowers. The average loans are largest for Grameen Bank and smallest for BRDB.

2.5 Results

This analysis examines the effects of credit and non-credit services provided by the micro-credit programs on the borrower's self-employment profits. Moreover, the analysis compares the credit and non-credit effects of micro-credit loans to those of non-micro loans. I estimate equation (1) using an Instrumental Variable (IV) approach to address endogeneity bias and village fixed-effect to address biases due to non-random program placement. I shall refer to this approach as IV-FE.

Table 2.3 presents the results from the first stage regressions of the IV-FE for selected instruments. There are eight endogenous variables for the full model; four variables for the source of the loans (Grameen Bank, BRAC, BRDB, non-micro) and four variables for the size of the loans from the four sources. The estimates have the expected signs. The F-statistics from a test of the null hypothesis that the instruments can be excluded from the first stage equations ranges from 6.67 to 19.88. Six of the eight F-statistics are above the "rule of thumb" minimum value of 10 for sufficiently powerful instruments (Staiger and Stock, 1997). The loan interest rate has a decreasing effect on whether households borrow and how much they borrow. Nearest distance to the lender has a negative effect on borrowing but a positive effect on how much households borrow. Further away the

lending institutions are, less appealing is the borrowing and thus would need to be given a larger loan to offset the higher costs associated with distance. These costs may be time costs, monetary costs, or social costs. The latter is especially true for a woman borrower since traveling unaccompanied for a woman is not socially appropriate in rural Bangladesh. Borrowing from non-micro source is less likely when the bank is further away from the village of residence. Therefore, borrowers may substitute private loans for micro-credit loans which are usually in their own village. The distance also increases the amount of borrowing. The average loan sizes in the village have positive effect on the likelihood and amount of borrowing as well.

Table 2.4 presents results from Ordinary Least Squares (OLS), fixed-effects, and IV-FE estimations for household yearly self-employment profit. All results are qualitatively similar. However, OLS overestimates the effect of borrowing and loan size on profit when compared to fixed-effect and IV-FE results. This suggests that unobserved characteristics such as entrepreneurial ability or effort bias the OLS results upward. The OLS estimates treat borrowing, loan size, and program placement as exogenous while fixed-effects estimates treat borrowing and loan size as exogenous but program placement as non-random. If programs are randomly placed in the villages, then OLS estimates are consistent and efficient. I perform a Lagrange multiplier test that tests whether fixed-effects should be included in the model. The χ^2 test statistic 121.23 with 40 degrees of freedom, thus rejecting the null hypothesis that fixed-effects should be excluded from the model. IV-FE estimates treat borrowing, loan size and program placement as endogenous. I use a Hausman test to measure if the estimates from OLS are significantly

different than the estimates from IV-FE. The classic Hausman test can be estimated as $(\hat{\theta}_{IV} - \hat{\theta}_{OLS})'(Var[\hat{\theta}_{IV}] - Var[\hat{\theta}_{IV} - \hat{\theta}_{OLS}])^{-1}(\hat{\theta}_{IV} - \hat{\theta}_{OLS})$. However, the test statistic is negative which suggests that the inverting matrices are not positive definite. Therefore, I perform an omitted variable version of the Hausman test. Either the predicted values of the endogenous variables or the estimated residuals are included as additional regressors in the profit equation. The null hypothesis is that the OLS parameters on the potentially endogenous variables are consistent. Therefore, if the predicted values or the estimated residuals are statistically different than zero, one rejects the null. The predicted values and the estimated residuals are significantly different than zero. Thus, I conclude that IV-FE model is the preferred model.

The main results from IV-FE are presented in table 2.5. I present four different models with different restrictions. The first column does not distinguish among the different micro-credit banks. It shows that borrowing from micro-credit banks increases borrower's profit by TK 8,477 while borrowing from non-micro source increases profit by TK 4,388. These effects are the non-credit effect or the effect of just the non-credit services by the banks. The credit effects are also positive. A Tk 1,000 increase in micro-credit increases profit by TK 380 while the same increase in non-micro loan increases profit by TK 520. Therefore, even though both the credit and non-credit effects from all sources are positive, the credit effect from non-micro loans is greater than micro-loans while non-credit effect from micro-loans is greater than non-micro loans. As mentioned earlier, micro-credit programs offer lot of social programs and offer group-based loans. The results show that these additional resources have an effect above and beyond the

traditional credits.

The second and third columns show the effect of borrowing and the effect of loan size from different sources, respectively, on profit. Since I do not control for loans in the second column and borrowing in the third column, these effects are the total effect of borrowing, which includes credit and non-credit effect. The last column is the full model, which distinguishes among the different micro-credit banks as well as non-micro source. BRDB has the largest non-credit effect on profit at TK 15,629, followed by BRAC and then Grameen Bank at TK 9,700. Non-micro borrowing increases profit by TK 4,800. In contrast, non-micro source has the largest credit effect on profit at TK 600 to a TK 1,000 borrowed. An increase in TK 1,000 BRDB loan increases profit by TK 520 whereas the same increase in Grameen loans increases profit by TK 360. The table also presents the p-values for the Sargan-Hansan test of over-identifying restriction. The null hypothesis of this test is that overidentifying restrictions are exogenous assuming that identifying restrictions are exogenous. The p-value for the full model is 0.90, which suggests that I cannot reject the null hypothesis and establishes the validity of the instruments.

2.6 Discussion

This chapter examines the credit and non-credit effect of micro-credit borrowing and non-micro borrowing on household self-employment profit. These results confirm that credit and non-credit effects are different and different micro-credit banks affect profit

differently. In particular, the group-based aspect and the social programs of the micro-credit banks affect profits above and beyond the loans and these effects are substantial, ranging from TK 9,700 to TK 15,629. The largest non-credit effect comes from BRDB. The reason for this is that BRDB has more social services that include training, awareness-raising, informal education. Another interesting result is that loan effect on profit is largest for non-micro source. This suggests that poor households can borrow from conventional lenders at high cost and can make a profit. Microfinance justifies its relatively low cost of borrowing by arguing that higher cost would hamper the poor's profit making ability. The results in this chapter raises question to this argument. The households may indeed have a time inconsistent preferences or hyperbolic discounting rather than exponential discounting. Time inconsistent preference implies a conflict between optimal contingent plan from today's perspective and that of tomorrow. For example, today an agent may desire to quit smoking starting from a future date. However, when the previously set date arrives, his taste may change or he may not find it optimal anymore to quit smoking. In this instance, the agent would be out all cost incurred in preparation for the event. This type of preference is shown by hyperbolic discounting.

Households who are not aware of their time inconsistent preferences may desire to undertake a self-employment activity in the next period. If funding for this activity is possible, then they prepare for this by participating into the credit programs and obtaining loans to be invested into the business. However, they underestimate this cost in the next period from the perspective of the current period. When the next period

comes, they may find that they have overestimated their capabilities or business skills. Because of the low cost associated with micro loans, which includes the lack of collateral, households may not acquire the necessary information about the actual potentials for their businesses. In contrast, when banks impose a high interest rate, it increases the probability needed to succeed in the business. In other words, the benefits of learning the probability of success or acquiring information outweigh the costs. This may be one reason for the larger effect of non-micro loans on profit than micro-loans.

In terms of policy recommendations, the results show that non-credit services are important in raising borrowers' profits. Therefore, if the goal is to increase profit, micro-credit programs should expand on their non-credit services. In addition, the banks could first introduce its non-credit services to the clients. These could include vocational and business training. Upon completion, clients, especially women participants, are likely to be more skilled in realizing and making good business plans.

Finally, if microfinance wants to increase the efficacy of its loans relative to those from conventional sources, they should increase the cost of borrowing. This could be in terms of higher interest rate or stricter screening process for business loans, lending to those with good business plan or potential for profit. The higher interest rate means higher likelihood of profitability for such institutions. They would be free from any government or donor funds, and would thus become financially self-sufficient. A profitable and self-sufficient financial institution can provide financial services at a much larger scale, reaching far more economically active poor than the current alternative. Thus, raising the cost of borrowing may resolve the issue of sustainability. Critiques may argue that

higher cost will harm the very poor by excluding them out of the credit market. However, the extremely poor should not be the responsibility of the financial sector. The basic needs of the poorest of the poor to overcome extreme poverty should be met by the government and donor subsidies and grants. These are the responsibilities of the health, labor, social welfare and other ministries, donor agencies, and charities (Robinson, 2001). And since subsidized credit is usually rationed, it should be made available to anyone who not only demands it, but can also utilize it effectively. The scarce government and donor funds may probably be better spent on other forms of poverty alleviation.

Table 2.1 : Descriptive statistics for exogenous variables

Variable	*Full Sample*	*Std Dev*	*Micro Borrower Sample[A]*	*Non-Micro Borrower Sample[A]*	*Difference[B]*
Household Characteristcs					
Education ratio (female/male)	1.07	1.26	0.98	1.12	-0.13**
Highest grade completed by female spouse	0.99	2.17	0.84	1.27	-0.42***
Highest grade completed by household (HH) head	1.65	2.86	1.73	2.16	-0.42***
Household land (in decimal)	8.44	14.29	7.19	10.93	-3.74***
Number of people in HH	4.80	2.12	5.08	5.09	-0.01
Religion (1 if muslim)	0.93	0.64	0.94	0.93	0.10
Duration of the self-employment	4.97	7.74	6.52	4.37	2.15***
Residence in a micro-credit village	0.82	0.38	1.00	0.68	0.32***
# of female age 10-20	0.52	0.72	0.55	0.59	-0.04**
# of female age 20-30	0.43	0.54	0.43	0.44	-0.01
# of female age 30-40	0.30	0.46	0.35	0.30	0.05**
# of female age 40-50	0.18	0.38	0.19	0.13	0.06***
# of female age 50-60	0.13	0.34	0.22	0.13	0.09**
# of female over 60	0.12	0.33	0.14	0.09	0.05**
# of male age 10-20	0.55	0.77	0.61	0.58	0.03
# of male age 20-30	0.36	0.60	0.36	0.41	-0.05***
# of male age 30-40	0.32	0.48	0.34	0.36	-0.02***
# of male age 40-50	0.22	0.41	0.26	0.29	-0.03***
# of male age 50-60	0.12	0.33	0.13	0.14	-0.01
# of male over 60	0.11	0.32	0.10	0.13	-0.03*
# of girls under 10	0.70	0.85	0.74	0.73	0.01
# of boys under 10	0.70	0.81	0.75	0.72	0.03
Village level variables					
Price of rice (per kg)	11.60	1.65			
Price of mustard oil (per kg)	55.98	5.55			
Price of egg (4-count)	2.58	0.64			
Price of milk (kg/litre)	14.06	4.09			
Price of potato (per kg)	7.42	2.06			
Price of flour (per kg)	10.02	1.42			
Price of Sugar (per kg)	28.94	3.03			
Price of onion (per kg)	15.71	6.78			
Price of garlic (per kg)	35.59	13.15			
Price of turmeric (per kg)	55.56	12.59			
Price of salt (per kg)	8.14	2.28			
Price of chicken (per kg)	70.87	19.96			
Price of beef (per kg)	54.80	13.83			
Price of soap (per bar)	10.70	2.45			
Price of tobacco (per pack)	2.34	0.33			
Nearest distance to the market (km)	9.15	13.51			
Nearest distance to the shop (km)	9.16	8.68			

Variable	*Full Sample*	*Std Dev*	*Micro Borrower Sample[A]*	*Non-Micro Borrower Sample[A]*	*Difference[B]*
Nearest distance to the weekly market (km)	5.11	6.10			
Household level instruments					
Distance in km to the lender	4.67	9.71	4.26	5.59	-1.33**
Interest rate (%)	23.98	27.58	17.80	37.03	-14.92***
# parents of HH head who own land	0.17	0.48	0.15	0.18	-0.03***
# brothers of HH head who own land	0.37	0.92	0.40	0.33	0.07***
# sisters of HH head who own land	0.42	0.90	0.45	0.40	0.04***
# uncles of HH head who own land	0.75	1.39	0.72	0.81	-0.09**
# aunts of HH head who own land	0.48	1.19	0.51	0.49	0.03
# sons of HH head who own land	0.03	0.28	0.05	0.01	0.04**
# daughters of HH head who own land	0.06	0.37	0.07	0.06	0.01
# living parents of HH head	0.67	0.76	0.68	0.70	-0.12***
# living brothers of HH head	1.63	1.61	1.62	1.70	-0.08***
# living sisters of HH head	0.57	0.93	0.56	0.60	-0.04
# living uncles of HH head	0.74	1.24	0.70	0.90	-0.20**
# living aunts of HH head	0.25	0.69	0.23	0.26	-0.03
# living sons of HH head	0.83	1.24	0.97	0.66	0.31***
# living daughters of HH head	0.64	1.03	0.74	0.51	0.23*
Village level instruments					
Average village Grameen Loan (in thousands of Taka)	6.71	10.15			
Average village BRAC Loan (in thousands of Taka)	3.69	6.14			
Average village BRDB Loan (in thousands of Taka)	3.35	5.97			
Average village Non-Micro Loan (in thousands of Taka)	9.87	13.08			
Sample size (household-year)	2,873		1,263	598	

Note: Mean for all households owning ½ acre or less land i.e. Eligible households.
All prices are measured in Tk. 69TK= $ 1. All amounts are expressed in 1998 Taka.
A. Means for micro borrowing households and non-micro borrowing households conditional on borrowing.
B. Difference is calculated by mean(micro borrower)-mean(non-micro borrower). * difference in mean significant at 10%, ** at 5%, *** at 1%

Table 2.2. Mean and standard deviation of self-employment profit by different groups and loan size

	# Obs	% self-employed	Mean yearly profit	Standard deviation
All households	2,873	96%	19,301.63	10890.52
Micro-credit program village	2,415	95%	21,218.67	11708.78
Micro-credit participant	1,263	96%	21,980.58	13242.21
Grameen Bank participant	533	99%	25,741.26	15309.53
BRAC participant	379	93%	20,672.37	21115.54
BRDB participant	351	98%	17,682.51	11943.46
Non-micro borrowers	407	94%	28,510.62	9,634.91
Non-borrowers	745	91%	15,570.50	17691.90
Non-program village	458	95%	9,193.24	16441.72
Non-micro borrowers	191	100%	8834.13	13590.40
Non-borrowers	267	99%	9,450.14	18053.69
Bank borrowers in program and non-Program villages	598	98%	22,225.99	10232.79
All loans	1,861		12,190.28	14,006.59
Micro-loan	1,263		13,398.33	15,424.05
Grameen Loan	533		17,801.35	18,384.63
BRAC Loan	379		11,153.69	13,881.25
BRDB Loan	351		9,135.95	9,096.12
Non-micro Loan	598		9,638.83	12,308.69

All profits and loans are yearly and given in 1998 Bangladeshi currency.

Table 2.3: First stage estimates of selected identifying instruments

Variables	Grameen Borrowing	BRAC Borrowing	BRDB Borrowing	Non-micro Borrowing	Amount of Grameen Loan	Amount of BRAC Loan	Amount of BRDB Loan	Amount of Non-micro Loan
Distance to lender	-0.019	-0.001	-0.003	-0.004	32.22	12.66	21.46	73.62
	(0.005)***	(0.000)***	(0.000)***	(0.000)***	(16.62)*	(11.21)	(7.84)***	(21.48)***
Interest Rate	-0.010	-0.001	-0.001	-0.003	-19.01	-10.73	-11.81	-6.47
	(0.001)**	(0.000)***	(0.000)***	(0.000)	(6.14)***	(4.14)***	(2.89)***	(0.79)***
Average Grameen Loan	0.002	0.001	0.000	0.000	0.94	-0.09	-0.01	-0.052
	(0.000)***	(0.001)	(0.000)	(0.000)	(0.12)***	(0.08)	(0.05)	(0.001)***
Average BRAC Loan	0.000	0.003	0.000	0.000	0.14	0.71	-0.03	-0.057
	(0.000)	(0.000)**	(0.000)	(0.000)	(0.265)	(0.17)***	(0.12)	(0.34)
Average BRDB Loan	0.000	0.001	0.001	0.001	0.62	-0.81	0.77	0.39
	(0.000)	(0.001)	(0.000)***	(0.000)***	(0.90)	(0.40)	(0.28)**	(0.78)
Average Non-Micro Loan	0.000	-0.008	-0.006	0.003	-0.24	-0.08	-0.01	0.95
	(0.000)	(0.005)*	(0.005)	(0.000)***	(0.18)	(0.12)	(0.08)	(0.23)***
Nearest Distance to a Bank	0.002	-0.002	0.013	-0.004	3.32	35.29	26.84	5.20
	(0.002)	(0.002)	(0.002)***	(0.001)***	(68.05)	(45.89)	(32.12)	(2.91)*
R-Square	0.56	0.41	0.41	0.24	0.42	0.26	0.24	0.49
F-statistics	17.31	6.67	19.88	18.71	16.26	7.29	13.54	15.23

Note: Standard errors are clustered by households. Loan amount are measured in 1998 taka. All specifications control for household characteristics and local prices and conditions. F-statistic is from a joint test of null hypothesis that coefficient estimates on all instruments are equal to zero. * indicates significance at 10 % (** at 5%, *** at 1%). The remaining instruments include 14 variables of land owned husband's relatives and of number of living relatives in the village, 3 variables of interaction between household land and whether the village has one of the three programs, and 4 variables of interactions between land and average loans from BRAC, GB, BRDB and Non-micro source. All regressions include village fixed effects.

Table 2.4. Effect of borrowing and loan amount on Self-employment Profit (Yearly)

Variables	OLS	FE	IV-FE
Micro-Credit Borrowing			
Grameen Bank	19398.99	11,914.03	9,716.35
	(2,956.09)***	(10,450.87)	(4224.53)**
BRAC	7,584.08	14,431.12	13,620
	(3,177.41)**	(3,798.09)***	(3,783.33)***
BRDB	19,821.05	19,479.08	15,629
	(3710.13)***	(4,741.81)***	(4,665.46)***
Non-Micro Borrowing	8,272.70	9,146.94	4,804.07
	(2314.68)***	(4743.01)*	(1,948.97)**
Microcredit Loan amount			
Grameen Loan amount	0.45	0.60	0.36
	(0.12)***	(0.14)***	(0.17)**
BRAC Loan amount	0.57	0.61	0.29
	(0.17)***	(0.18)***	(0.22)
BRDB Loan amount	0.87	1.19	0.52
	(0.25)***	(0.30)***	(0.24)**
Non-Micro Loan amount	0.67	0.68	0.60
	(0.08)***	(0.132)***	(0.31)*
R-Square	0.45	0.49	
Number of observations	2,873	2,873	2,873

Note: All regressions include household and village level characteristics
The standard errors are in parenthesis, with significance ***-at 1%, **- at 5% and *- at 10%.

Table 2.5. Effect of borrowing and loan amount on Self-employment Profit (Yearly)

Variables	(1)	(2)	(3)	(4)
Micro-Credit Borrowing	8,477.47			
	(1,758.00)***			
Grameen Bank		12,950.5		9,716.35
		(6,491.05)**		(4224.53)**
BRAC		7,275.03		13,620
		(7,025.11)		(3,783.33)***
BRDB		4,306.14		15,629
		(6,928.68)		(4,665.46)***
Non-Micro Borrowing	4,388.61	10,921.74		4,804.07
	(1,664.63)***	(6,726.28)*		(1,948.97)**
Microcredit Loan amount	0.38			
	(0.13)***			
Grameen Loan amount			0.43	0.36
			(0.05)***	(0.17)**
BRAC Loan amount			0.56	0.29
			(0.32)*	(0.22)
BRDB Loan amount			0.24	0.52
			(0.29)	(0.24)**
Non-Micro Loan amount	0.52		0.71	0.60
	(0.24)**		(0.36)**	(0.31)*
Over-Identification Test (Chi-sq p-value)	0.891	0.252	0.183	0.904
Number of observations	2,873	2,873	2,873	2,873

Note: All regressions include household and village level characteristics and village fixed-effects.
The standard errors are in parenthesis, with significance ***-at 1%, **- at 5% and *- at 10%

Table 2.6. Effect of exogenous explanatory variables on Self-employment Profit (Yearly)

Variable	*Estimate*	*Std Error*
Household Characteristcs		
Education ratio (female/male)	302.02	(467.00)
Highest grade completed by household (HH) head	296.46	(24.35)***
Household land (in decimal)	140.18	(4.26)***
Number of people in HH	1383.30	(203.63)***
Religion (1 if muslim)	187.59	(116.88)
Duration of the self-employment	570.50	(15.60)***
Residence in a micro-credit village	242.76	(246.00)
# of female age 10-20	-1250.18	(1043.99)
# of female age 20-30	-226.17	(187.11)
# of female age 30-40	-248.26	(143.16)*
# of female age 40-50	1224.10	(401.90)***
# of female age 50-60	288.59	(328.50)
# of female over 60	-1154.92	(1277.30)
# of male age 10-20	-1353.14	(627.70)**
# of male age 20-30	-368.00	(260.46)
# of male age 30-40	442.56	(198.24)**
# of male age 40-50	1128.81	(319.33)***
# of male age 50-60	-522.02	(251.41)**
# of male over 60	-990.12	(255.06)***
# of girls under 10	-1299.29	(219.93)***
# of boys under 10	-1332.55	(231.16)***
Village level variables		
Price of rice (per kg)	330.97	(109.54)***
Price of mustard oil (per kg)	232.91	(120.24)**
Price of egg (4-count)	435.71	(228.95)**
Price of milk (kg/litre)	359.88	(76.86)***
Price of potato (per kg)	639.36	(294.55)**
Price of flour (per kg)	102.43	(45.93)**
Price of Sugar (per kg)	51.08	(56.57)
Price of onion (per kg)	271.22	(317.33)
Price of garlic (per kg)	119.27	(101.64)
Price of turmeric (per kg)	-85.80	(60.21)
Price of salt (per kg)	33.56	(25.42)
Price of chicken (per kg)	353.29	(164.32)**
Price of beef (per kg)	-210.03	(119.33)*
Price of soap (per bar)	63.27	(70.01)
Price of tobacco (per pack)	78.44	(103.54)
Nearest distance to the market (km)	-197.85	(33.65)***
Nearest distance to the shop (km)	-235.60	(49.24)***
Nearest distance to the weekly market (km)	-415.00	(56.13)***

Note: All regressions include village fixed-effects.
The standard errors are in parenthesis, with significance ***-at 1%, **- at 5% and *- at 10%

Chapter 3

The Effect of Gender-Based Returns to Borrowing on Intra-Household Resource Allocation in Rural Bangladesh

3.1 Introduction

Over the past decade and a half, micro-credit programs have been increasingly targeting women in rural Bangladesh. These programs distribute collateral free and low cost microloans to the very poor under a group-based system.[1] On global scale, the number of women reached has increased from 10.9 million in 1999 to 79 million in 2007. Women

[1]The very poor are defined by World Bank as those living below a $1 a day, or in the case of micro-credit programs, those with less than half acre of land.

make up 85% of the clientele for these programs.[2] However, the economic impact of the programs has failed to improve with increased number of women in the program. On average, women's businesses yield lower profits than do men's businesses. The type of business a woman can undertake is often limited, given the conservative view toward women arising from social and religious norms. Unable to travel outside, women generally tend to invest in safer and home-based businesses. Therefore, an evaluation of the economic impact of microcredit programs may reveal that the loans are not cost-effective. If one hundred dollar given to men yields higher profit than one hundred dollar given to women, it may be better to target men instead of women. However, researchers should consider the social and development impact of microcredit programs as well. The programs increase a woman's income earning opportunity and income, which can increase her bargaining power within the household. The social impact of the programs may compensate for the low economic impact to make these programs cost-effective and expand membership to women.

In this paper, I estimate the differential impact of returns to women's and men's borrowing from micro-credit programs on intra-household resource allocation. From the perspective of policy makers, analysis of intra-household resource allocation is important. Individuals' well-being may be influenced by the way money is injected into the household. Ten dollars allotted to the male head of household may have different effects on child health, labor, education and on tobacco and alcohol purchases than the same amount allotted to his wife (Kanbur and Haddad, 1994). Moreover, different individuals

[2]Daley-Harris, Sam (2007), "State of the Microcredit Summit Campaign Report 2007".

may have different standard of living within the same household. Some households with average per capita income above the poverty line may have members whose standard of living is below the poverty line due to inequality in resource allocation (Haddad and Kanbur, 1990). These issues are interesting and important when studied in terms of husbands and wives in rural areas of developing countries such as Bangladesh where women are usually disempowered and lack formal labor market opportunities.[3] Under these circumstances, programs such as microcredit that target women may improve their standard of living by increasing their bargaining power so that allocation of resources are in favor of them. Thomas, Contreras, and Frankenberg (2002) and Lundberg, Pollack, and Wales (1997) find that children's education and health improve and expenditure on child clothing increases when the mother's non-labor income or assets increase or when the mother is the welfare recipient. Thus, examining intra-household allocation of resources may reveal unanticipated consequences.

I measure intra-household resource allocation by the gender-oriented expenditure patterns of rural households in Bangladesh. A finding that an increase in female returns to borrowing leads to allocation of resources that is relatively skewed toward the goods that are of primary interest to her would offer evidence of empowerment or increased bargaining power. The difference in resource allocation would result from the increase in female income, which depends on her labor inputs. Thus, her bargaining power is determined endogenously because it is now a function of her labor income. Past studies

[3]Women's labor force is not institutionalized. In rural areas of the country, women may work outside the household informally for irregular hours with no benefits.

have treated the determinants of bargaining power as exogenous. This paper offers a theoretical model that allows for the endogenous determinants of the power to include choice variables. Thus, it adds to the bargaining literature.

In addition, most micro-credit studies examine the impact of program participation or loan amount. I estimate the social impact of returns to borrowing on resource allocation, as differentiated by the gender of the borrower. The return to borrowing is the net income or profit a household receives from a business that was primarily funded by micro-credit loans. When the primary borrower is female, I presume that the income is from her business and vice-versa for male borrower. Program participation or loans without positive income may leave a household and the borrower worse off since he or she has to repay the loan. This paper also estimates the effect of returns to borrowing from different loan sources, namely- micro-credit and non-micro sources. To my knowledge, no other papers have examined different loan sources. Finally, in contrast to the previous literature discussed in the next section which relies on ordinary least squares estimation, I use instrumental variable estimation method with selection and fixed effect to address endogeneity of returns to borrowing and gender of the borrower due to unobserved heterogeneity, sample selection, and non-random program placement. I rely on variations in distance to the lender and interest rate, time variant village-level variables, and gender-restrictions placed by the programs, as well as functional forms to identify the impact of returns to borrowing on intra-household resource allocation by the gender of the borrower.

I use a survey from Bangladesh Institute of Development Study of 1991 and 1998

(BIDS) and find that the return or profit is spent differently depending on the gender of the borrower. The return from micro-credit borrowing increases consumption of goods that are more valuable to women when a woman borrows. In contrast, when a man borrows, the return lowers consumption of goods valuable to women and increases consumptions of goods valuable to men. When differentiated by the source of borrowing, micro borrowing leads to greater allocation of income toward women's goods than non-micro borrowing. I also find that income from different sources, such as income from business versus income from employment activity or unearned income, is spent differently. This suggests that households do not pool their income. I also use alternative measures of empowerment. These include indices on a woman's decision making ability and mobility. I find that return from micro-credit borrowing improves women's empowerment. Moreover, female returns to borrowing lead to women taking greater role in major economic and non-economic household decisions. The female returns also have a positive effect on physical mobility. In contrast, male returns to borrowing lead to women losing their roles in decision making.

3.2 Background

3.2.1 Sources of loan

Micro-credit programs have become a central part of poverty alleviation strategies in rural Bangladesh. The main purpose of these programs is to provide small and low cost loans to the poor who may have little or no collateral. These loans either supplement or

serve as the sole source of funds needed to start self-employment activities. Credit programs identify the poor on the basis of land ownership; only those owning fewer than half an acre of cultivable land are eligible to borrow from these programs. Thus, if land ownership proxies for wealth, richer households are ineligible to borrow. However, this land restriction is often not enforced, which creates some estimation problems discussed later. The programs disburse loans under a group-based scheme with each group consisting of five to seven members who self-select into the group. If one member defaults on his loan, then all members of the group lose access to loans in the future. Naturally, this scheme facilitates peer monitoring and group liability which ensure repayment through group pressure, replace the need for collateral, and reduce the administrative costs associated with collateral.

Individuals can also borrow from private non-micro sources such as commercial banks, family and friends, and local money lenders. Indeed, these are the only borrowing options available for people who are ineligible to borrow from micro-credit programs. However, even those who are eligible for micro-credit occasionally choose to borrow from other sources. I examine the effect of men's and women's business returns from investments of loans from non-micro sources as well as those from micro-credit programs on household allocation. This comparison is important since there are structural differences in these two sources of borrowing. While micro-credit programs mainly target women, non-micro lenders are gender neutral. In addition, micro-credit programs lend under group contracts while non-micro lenders lend under an individual contract, where only the borrower is liable for his or her loans. The latter requires collateral and those

with less collateral pay a higher interest rate. In my data, the average interest rate is 18% for micro loans and 37% for non-micro loans. However, time costs may be higher for micro loans, which often require a training period and regular attendance to group meetings. The micro loans also require repayment in weekly installments. In contrast, non-micro loans are repaid monthly. Micro-credit programs have mandatory provisions for savings and offer social development services such as paralegal, vocational, and business training, technical advice, access to inputs, informal primary education, and health and family planning facilities. These social services are not available with non-micro loans. These differences allow me to determine how the effect of returns to borrowing on women's empowerment depends upon the sources of borrowing.

3.2.2 Discussion of Intra-household resource allocation

There have been considerable debate and conflict over the notion of treating household as a single unit, where preferences are aggregated, or as a collection of individuals with different preferences. The traditional approach assumes that a household behaves as a single decision-making unit. Thus, given a household budget constraint, one can derive household demands by maximizing household preferences. This refers to the unitary model [4]. Paul Samuelson and Gary Becker were among the first to provide justification for this type of model. Samuelson (1956) sets structure on the household decision-making process such that the household utility function collapses to a unitary one, i.e. in which preferences and resources are aggregated. He assumes a weakly separable

[4]Other names have been proposed: benevolent dictator model etc

household utility function as a function of individual utility functions or subutilities. This aggregation would be achieved by consensus among household members, although he never discusses how this consensus maybe reached. Becker (1974, 1981) uses a similar approach. However, he suggests there be a benevolent dictator or head in the family who takes other members' preferences into account and allocates resources accordingly. In his 'rotten kid theorem', he posits that any one member will not try to gain at the expense of the benefactor or any other members in fear that the benefactor will lower his transfer to that member by more than the potential gain the member can achieve. Ergo, no member will behave rottenly and the preferences of the head will represent the preferences of the household.

Formally, a household with two partners or two working-age adults will maximize the aggregate welfare function similar to Bergson-Samuelson welfare function

$$W = W[U_m(X, l; \mu), (U_f(X, l; \mu)] \tag{3.1}$$

where U_m is the male partner's utility and U_f is the female partner's utility that are strongly quasi-concave, increasing, and twice continuously differentiable functions in their arguments. These include household consumption vector $X = (x_1, , x_n)'$ and leisure $l = (l_m, l_f)'$. Finally, μ is the household specific heterogeneity. Household resource constraint can be shown through a budget constraint:

$$P'X + W_m l_m + W_f l_f \leq Y_m + Y_f + Y_h + W_m T + W_f T \tag{3.2}$$

where $P = (P_1, , P_n)'$ is the price vector, W_i and Y_i are the wage rate and nonlabor income for individual i, respectively, Y_h is the total household nonlabor income that cannot be assigned to any member, and T is the total time endowment.

The unitary model of the household may have two different interpretations. The simplest one implicitly assumes that individuals have equivalent preferences. This implies that the sub-utility functions in (1) are identical. Another interpretation is that of the benevolent head expounded by Becker in which one individual makes all the resource allocation decisions. In this case, the aggregate welfare function $W(.)$ represents the utility of that member where he assigns zero weights to all but own-utility function. Consequently, heterogeneity in preferences would not affect resource allocation and thus household demands would depend on the total household income, not individual income. Then maximizing (1) subject to (2) will result in $n+2$ differentiable Marshallian demand functions for goods and labor supply:[5]

$$\widetilde{X} = X(Y_t + W_m T + W_f T, \widetilde{P}) \tag{3.3}$$

where $\widetilde{X} = (X', l')$ denotes consumption and leisure bundles and $\widetilde{P} = (P', W_m, W_f)$ is the price vector. $Y_t = Y_m + Y_f + Y_h$ is the aggregate nonlabor income. It is important to note that the unitary model implies 'income pooling hypothesis' where individual

[5]The demand functions must satisfy *i*) Walrus' law *ii*) homogeneity *iii*) slutsky symmetry, and *iv*) negative semidefiniteness. However, empirically, only walrus' law has been proven. The other three restrictions have been rejected repeatedly in various empirical studies. See Deaton and Muellbauer (1980), Blundell (1988), Fortin and Lacroix (1997), Browning and Chiappori (1998]) etc. for further discussion. However, these rejections have been attributed to data and specification problems or functional form rather than erroneous theory of consumer behavior

nonlabor income are pooled into Y_t. This asserts that the source of the income does not affect intra-household resource allocation problem, i.e. changes in different income have the same effect on household demands : $dX/dY_m = dX/dY_f = dX/dY_h$. This assertion, along with equality of cross-substitution effects on labor supply , has been strongly rejected in various empirical studies (Ashenfelter and Heckman, 1974; Bourguignon et al., 1993; Browning et al., 1994; Fortin and Lacroix, 1997; Lundberg et al., 1997; Thomas, (1990, 1993) among many others).

As an alternative to the unitary model, two other approaches have been proposed that take into account the individual role in household decision-making, i.e. demands, with heterogeneous preferences. The first of these approaches models household behavior in a non-cooperative framework (see, e.g., Ashworth and Ulph, 1981; Ulph, 1988; Carter and Katz, 1997; Lundberg and Pollack, 1993; Browning, 2000; and Chen and Woolley, 2001). This framework assumes that individuals cannot enter into binding and enforceable contract and thus maximize their utility, taking actions of other members' as given. This Nash equilibrium results in more restrictions on household behavior than the unitary approach and suboptimal or Pareto inefficient resource allocation. The second approach presents a cooperative framework with cooperative game theory concepts and axiomatic bargaining theories. Household members cooperate with each other to divide the gains from living together, i.e. gains from cooperation, and a Pareto efficient allocation is obtained depending on the bargaining power of the household members. Thus, this type of model imposes more structure on the household allocation process. Manser and Brown (1980) consider the Nash and the Kalai-Smorodinsky solutions to

derive the implications on intrahousehold resource allocation, while Bjorn and Vuong (1985) (cited in Thomas, 1993) consider a Stackleberg concept. McElroy and Horney (1981) focus on Nash bargaining solution to derive conditions for Nash demand system that collapse to traditional unitary model. In their model, the household maximizes the utilities less the threat-point utility, which is the highest utility a member would get if he or she withdraws from the household. Therefore, in a two person setting, the household utility if given by the following "utility-gain product function":

$$N = [U_m(X, l) - V_m(\tilde{P_m}, Y_m; \alpha)][U_f(X, l) - V_f(\tilde{P_f}, Y_f; \alpha)] \tag{3.4}$$

where V_k represents the threat point utility. Therefore, household maximizes the product of the gains from marriage. The α are the relevant shift parameter or the "extra-environmental parameters" (EEPs). These are the changes in the opportunities outside marriage such as changes in divorce and alimony laws, sex ratio, assets at marriage, parental income, or income opportunities in developing countries. Any changes in alpha would affect the threat point and thus would shift the bargaining power of the individual within marriage, where the threat is dissolution of marriage. The household commodity and leisure demand functions are obtained by maximizing (4) subject to (2) with respect to $\widetilde{X}$:

$$\widetilde{X} = X(Y_m, Y_f, \widetilde{P}) \tag{3.5}$$

A criticism of this approach is the imposition of specific structure on allocation decisions

which are based on the assumed threat point. Since a particular bargaining concept has to be chosen to model household behavior, if the empirical results are rejected, then it is impossible to determine whether the particular choice itself or the bargaining setting is rejected (Vermeulen, 2002). Therefore, Chiappori (1988a, 1992) and Apps and Recs (1988) suggest an alternative model of collective framework. According to this framework, household utility is defined as the weighted sum of the utilities of individual members in the households. These Pareto weights can be interpreted as proxies for bargaining power for each individual in the household. The only assumption of the collective model is that the solution to the household allocation process is Pareto efficient. There is no restriction on which point will be chosen on the Pareto frontier by the household. Since so little structure is imposed, the model has testable restrictions.

Numerous studies have applied the bargaining theories for empirical tests in an attempt to disprove the unitary model. Bourguignon et al. (1993) have rejected the income pooling hypothesis to find that the share of husbands' and wives' own income affects the consumption structure within the household significantly. Lundberg et al. (1997) use the transfer of child allowances from men to women in the U.K. in the late 1970s and find that such a transfer increases women's and children's clothing expenditure relative to that of men's. Thomas et al. (2002) and Quisumbing and Briere (2000) find that mothers with more assets currently or at marriage (as indications of more power) devote more resources toward their children's clothing, education, and health than do fathers. Other empirical evidences suggest that households in which women have higher levels of non-labor income have healthier children, conditional on total income

(Thomas,1990; Schultz, 1990; Dufflo, 2003). Using Brazilian budget data, Thomas (1993) finds that a higher income ratio of women to men results in less spending on food but more spending on human capital such as health and education, as well as leisure activities such as recreation. These tests of the income pooling hypothesis provide compelling evidence to reject the traditional unitary model. In addition, improving the status of women in households benefits children, and thus, justifies many social programs' practice of targeting women.

One limitation to these household bargaining models and the empirical studies is that they assume the bargaining power or Pareto weight is determined only by exogenous factors. Indeed, this assumption is necessary for the Pareto efficiency. However, in reality, the bargaining power of a woman need not depend on exogenous parameters. Consider a household with two members- a husband and wife- and define the Pareto weight of the wife as $\mu(Z)$ in [0,1].[6] In the traditional collective model, Z denotes a set of variables exogenous to the household. Some examples include female assets, non-labor income, changes in the divorce law, and the sex ratio. However, Basu (2001) criticizes the exogeneity assumption and argues that μ may depend on the households' choice variables. For example, the share of the household income earned by the woman would certainly influence her power over resource allocation. This share is endogenous since it depends on her labor supply, which is determined within the model. However, when using endogenous bargaining parameters, Z, any solutions to these models would not be

[6]Thus, the husband's bargaining or Pareto weight is given by $1 - \mu(Z)$. This also represents the balance of power in the household.

Pareto optimal. In this paper, I argue that returns to borrowing (profit) will increase a woman's bargaining power or empowerment when the gender of the borrower is female, as evidenced from increased allocation of income toward female-dominant goods such as women's clothing and expenditures on children. Thus, the determinant of power is earned income, which is endogenous because it depends on her choice of labor supply or time investment into the business. One of the contributions of this paper is a two-stage model within a dynamic framework that allows the determinants of bargaining power, Z, to be endogenous. In this study, the Z is the male or female return to borrowing from either micro-credit source or non-micro sources.

Over the past decade, there have been some household level studies of micro-credit programs. The critiques of micro-credit programs claim that the loans are often controlled by men, regardless of the gender of the borrower. If this is true, the program should not increase a woman's bargaining power and might actually decrease it, because the woman would still be responsible for repayment. Goetz and Sen Gupta (1996) find a negative relationship between micro-credit and women's empowerment in research that focuses on who controls the loan. They find that a significant portion of married women (as compared to widows) have lost control of the loans, while some have no information as to the usage of the loans. In contrast, Hashemi et. al. (1996) show a positive relationship between credit participation by women and women's empowerment in Bangladesh in terms of increased ownership of assets, an expanded ability to make decisions and purchases, and decreased domestic violence. Other studies find a positive effect of micro-credit participation on contraceptive use (Schuler and Hashemi, 1994; Schuler et. al,

1997), while Pitt et al. (1999) fail to find any significant effect. Most of these studies. however, do not correct for nonrandom program placement and self-selection into the program. Pitt and Khandker (1998) use fixed effects and a quasi-experimental design to control for heterogeneity and selection bias at both the individual and village level. They find that the programs have a greater impact on total household expenditures, savings, and assets when females borrow than when males borrow.

However, these studies do not examine intra-household resource allocation or the power dynamic within a household due to credit program participation or borrowing from non-micro sources. The current paper provides an alternative method by which to evaluate these credit programs and to compare the social or empowerment effects of these programs to alternative sources of borrowing. I do so by examining the differential effects that male and female returns to borrowing have on household expenditure patterns. In addition, previous studies examine the financial or social impact of micro-credit program participation or loan amount. Neither reveals the impacts accurately since they do not take into account the interest rate and other monetary costs of borrowing. This is true especially if the borrower invests the loan into income-generating activities. Consider a case where the business income generated fails to cover the cost of the outstanding loan. In this case, the borrower may actually be worse off. Since all loans from micro-credit institutions are to be repaid within a year in weekly installments, the actual income that the household receives is the profit from the business less these extra costs. Thus, if these costs are not taken into account and the loan amount is used to study a program's impact, then an analysis of these programs may attribute undue benefit to

the loan amount. In addition, program participation without positive income may leave a household and the borrower worse off since she must now depend on her husband to repay the loan. In this case, an analysis of the program's impact using program participation may show worsening of balance of power and disempowerment of women when in fact it is the unsuccessful business venture that worsens the position of the woman in the household. To correct for these misinterpretations, the present study uses the income generated from the business less the cost of borrowing, to be defined as profit or returns to borrowing from micro or non-micro sources for the remainder of this document.

3.3 Theoretical framework

The bargaining models discussed in the previous section assume that the bargaining power of spouses is determined by exogenous factors in a static framework. In this section, I present a dynamic model that explains why and how intra-household bargaining influences resource allocation in the presence of endogenous parameters in a variable representing bargaining power. It is assumed that the relative bargaining power of a woman depends on her share of total household income when she participates in income-generating activities. Specifically, a higher share of total income would lead to greater power in household resource allocation.

Since the main issue in this paper is how profit, as it differs by the gender of the borrower, affects the allocation in the household, the consumption, leisure, borrowing, and

investment decisions should be modeled under a dynamic framework. Since bargaining power is endogenously determined according to individuals' labor income, individuals take into account how their labor-supply decisions and income affect consumption decisions through the bargaining process. Thus, the household decision can be modeled as a two-stage process within each period of the dynamic model. In the first stage, individuals decide on matters that influence income and bargaining power. After the realization of income and bargaining power, they make Pareto optimal consumption decisions in the second stage, taking as given the labor, borrowing, and investment decisions from the first stage.[7] The model is useful to explain why people borrow and how that affects other decisions. However, a dynamic estimation model is not necessary for estimation of the relationships of input in this research. The estimation is attempted using a more tractable static framework. Essentially, I analyze a single period of a dynamic scenario. The predictions on consumption in any period will not change as a result of the dynamic relationship since when decisions regarding consumption are made, the income and bargaining power variables have already been determined.

3.3.1 Utility

In the theoretical model below, I consider a household with two adult members - a husband and a wife - and with caring preferences, i.e. each cares about the other's

[7]Uncertainty of income may come from production. This is one example of uncertainty. There are many other uncertainties or shocks that would result in a two-stage decision making process.

consumption and leisure levels (Becker, 1981)[8]. Each individual in the household derives utility from consumption, C_t, and leisure, l_t. The decision process starts after marriage and ends at T, so the household plans over a horizon of fixed length T. Each period is assumed to be a year. The utility function for individual i, (i=h for husband, i=w for wife), is

$$U_{it} = U(C_{ht}, C_{wt}, l_{ht}, l_{wt}; D_t) \tag{3.6}$$

where C_{ht} and C_{wt} are the respective consumption vectors for the husband and the wife and l_{ht} and l_{wt} are their leisure consumptions. D_t is a vector of preference shifters including demographic characteristics. Each utility function is increasing in both the husband's and wife's consumption and leisure but the individuals do not necessarily have the same marginal utility for the spouses' goods as for their own goods.

3.3.2 Constraints

The household is allowed to operate a self-employment activity which generates income. The individuals allocate their time among leisure, self-employment activity, and employment wage-earning activity. The income from self-employment is uncertain and depends on production shocks. Finally, a household allocates self-employment and labor income plus new borrowing among consumption goods of both spouses, debt, and

[8]Note that an egoistic preference would include only own level of demand in the utility function (Chiappori, 1988a)

investments. The budget constraints are as follows:

$$P_{ht}C_{ht} + P_{wt}C_{wt} = w_{ht}L_{ht} + P_t^Q Q_t - d_t + b_t - P_t^k I_t \tag{3.7}$$

$$Q_t = f(K_t, S_t, \epsilon_t) \tag{3.8}$$

$$L_{ht} + l_{ht} + S_{ht} = H \tag{3.9}$$

$$l_{wt} + S_{wt} = H \tag{3.10}$$

$$d_t = \begin{cases} M_{t-1}(1+r)b_{t-1} & \text{if } b_t = 0 \\ (12 - M_t)(1+r)b_t & \text{if } b_t > 0 \end{cases} \tag{3.11}$$

where $f(.)$ is a strictly concave production function; Q_t represents production; K_t is the capital stock; I_t is gross investment; b_t is the amount of borrowing and d_t is debt liability; L_{ht} is time spent in wage earning for the husband, and S_{ht} and S_{wt} are time spent in a self-employment activity by husband and wife; w_{ht}, P_t^Q, P_t^k, and r are the market wage, production good price, capital good price, and interest rate, respectively. Lastly, M_t is the month the household initiated the loan.

Equation (7) defines total household consumption in period t to be earnings from wage employment and self-employment plus any borrowing less the debt liability and

total investment expenditure. The production level in equation (8) is determined by capital and labor and ϵ_t reflects any shock to production and thus profit. The shock, ϵ_t, is assumed to be well-behaved and normally distributed and given by $f(\epsilon_t)$ with mean 0 and variance, σ. Equations (9) and (10) show the time allocations for the husband and the wife. The husband divides his total time endowment, H, among time spent on wage earning, self-employment, and leisure. However, the wife divides her time between the latter two and I assume few women work outside the home. Finally, equation (11) shows the amount of household debt liability. The loans are yearly, with installments paid out weekly. Therefore, the households that borrowed in the previous period or current period will have a partial amount of the loan to repay in the current period.

3.3.3 Optimization problem in the second stage conditional on first stage decisions

The problem of each individual can be written in recursive form. The state variables at time t are $(K_{t-1}, d_{t-1}, M_{t-1}, D_t) = Z_t$. The choice variables at time t can be categorized into two types. In the first stage, a household chooses $(L_{ht}, S_{ht}, S_{wt}, b_t, I_t) = A_{1t}$. In the second stage, household chooses consumption, $(C_{ht}, C_{wt}) = A_{2t}$, where C_{it} is a consumption vector. I start with the last period utility for the household, U^{HT}, defined as the weighted utility of the husband and the wife.

$$U^H(A_{1T}, A_{2T}) = \mu_{wT} U_{wT}(A_{1T}, A_{2T}) + (1 - \mu_{wT}) U_{hT}(A_{1T}, A_{2T}) \tag{3.12}$$

The weight is given by μ_{wt} and represents the bargaining power of the wife. This depends on distribution factors or choices. In this paper, the factors that affect μ_{wt} are the returns to borrowing or the self-employment profit from business operated by the husband or the wife. Of course, this in turn depends on the time investment and borrowing decisions, which are component of A_{1t}. The decision making process is static at T. At this point, the couple may decide to bequeath all household matter to their eldest son and his wife. Without any subsequent period, the last period value function in stage two is

$$V_T^{S2}(Z_T, A_{1T}, \epsilon_T) = \max_{A_{2T}} \left\{ U^H(A_{1T}, A_{2T}) \right\} \tag{3.13}$$

subject to constraints (7)-(11). Let $\widehat{A_{2T}}(Z_T, A_{1T}, \epsilon_T)$ denote the optimal allocation. Given the above, the last period value function in stage one is

$$V_T^{S1}(Z_T) = \max_{A_{1T}} \left\{ E_{\epsilon_T} V_T^{S2}(Z_T, A_{1T}, \epsilon_T) \right\} \tag{3.14}$$

subject to constraints (7)-(11), where the consumption vector in the last period is $\widehat{A_{2T}}(Z_T, A_{1T}, \epsilon_T)$. Having derived the value function of the last period, I can define the value functions for period $T-1$ and period t. The value function of stage two in period t is

$$V_t^{S2}(Z_t, A_{1t}, \epsilon_t, Z_t) = \max_{A_{2t}} \left[U^H(A_{1t}, A_{2t}) + \beta V_{t+1}^{S1}(Z_{t+1}) \right] \tag{3.15}$$

subject to constraints (7)-(11). Given above, the value function in stage 1 of period t is

$$V_t^{S1}(Z_t) = \max_{A_{1t}} \left\{ E_{\epsilon_t} V_t^{S2}(Z_t, A_{1t}, \epsilon_t, Z_{t+1}) \right\} \tag{3.16}$$

subject to constraints (7)-(11), where the consumption vector is $\widehat{A_{2t}}(Z_t, A_{1t}, \epsilon_t, Z_{t+1})$. The optimal decision rules for consumptions are given by $C_{ht}(Z_t, \mu_{wt}, P_t)$, $C_{wt}(Z_t, \mu_{wt}, P_t)$ for any period t where $P_t = (P_{ht}, P_{wt}, P_t^k, P_t^Q, w_{ht}, \delta)$.

In summary, the household engages in a sequential decision making process within each period of the dynamic model. First, the husband and wife choose (i) how to allocate their time, and (ii) how much to borrow and invest. Given these decisions, income and bargaining power are realized. In the second stage, the household selects its consumption bundle. Consequently, I can analyze the second stage of the per period game since I am interested in how borrowing and returns to borrowing affect intra-household resource allocation. By the time the household makes these consumption decisions, anything that affects income and bargaining power is set from the first stage. Therefore, consumption decisions would depend on exogenous parameters such as prices, state variables, income, and bargaining power. The returns to borrowing or the self-employment profit from a business, funds for which came from credit programs, determine the bargaining power in this paper. Via changes in μ_t, increased returns to borrowing may have different effects on consumptions depending on the gender of the borrower. This paper examines whether an increase in female returns increases consumption of the goods that are female-oriented by more than a similar increase in male returns. A higher income should increase a

female's bargaining power and lead to greater allocation toward female-oriented goods. This serves as evidence of female empowerment resulting from programs such as micro-credit in rural areas that target women.

Lastly, it is important to note that in the model above, the individuals make decisions cooperatively in both stages, which need not be true. Indeed, I do not wish to make any assumption about how the household makes first stage decision. To accommodate this, I can replace V_t^{S2} in equation (16) with an agnostic function $W_t(.)$. Thus, equation (16) may be written as

$$V_t^{S1}(Z_t) = \max_{A_{1t}} \left\{ E_{\epsilon_t} W_t(Z_t, A_{1t}, \epsilon_t, Z_{t+1}) + \beta V_{t+1}^{S1}(Z_{t+1}) \right\} \tag{3.17}$$

The last term in equation (17) does not further encumber the model since no component of A_{2t} affects Z_{t+1}. The implication for stage two remains unchanged. The consumption choices will be influenced by only prices, household income, and bargaining power, μ_t.

3.4 Empirical model

3.4.1 Empirical Specification

I use the theoretical model to motivate my empirical specification. As discussed in the previous section, theory implies that consumption decisions would depend on prices of goods, household characteristics, income, and bargaining power. The empirical model presented below can be interpreted as a linear approximation to the consumption

decisions. Thus, for a household i in village j in period t for good n, the specification is

$$LogX_{ijnt} = H_{ijt}\lambda_n + logI_{ijt}\lambda_{1n} + logN_{ijt}\lambda_{2n} + logN_{ijt}G_{ijt}\lambda_{3n} + G_{ijt}\lambda_{4n} + V_j\lambda_{5n} + \eta^X_{ijnt} \quad (3.18)$$

$$\begin{aligned} P_{ijt} &= H_{ijt}\alpha_p + Z_{ijtp}\alpha_{1p} + V_j\alpha_{2p} + \eta_{ijtp} \\ N^*_{ijt} &= H_{ijt}\alpha + Z_{ijt}\alpha_1 + V_j\alpha_2 + \eta^N_{ijt} \\ N_{ijt} &= N^*_{ijt}, \qquad P_{ijt} = 1 \quad if \quad P^*_{ijt} > 0 \\ N_{ijt} &= \text{not observed}, P_{ijt} = 0 \quad if \quad P^*_{ijt} \leq 0 \end{aligned} \quad (3.19)$$

where

X_{ijnt} household yearly expenditure on goods;

H_{ijt} a vector of household and village characteristics;

I_{ijt} household income from working in the labor market plus any other non-labor income, including business profit;

G_{ijt} dummy variable of whether the primary borrower is female. It equals 1 if the borrower is female;

N_{ijt} returns to borrowing or the net profit from investment of the loans for the current year;

V_j vector of village fixed effects;

P_{ijt} 1 if the individual borrows, 0 otherwise;

η^X_{ijnt} $\epsilon_{ijn}+v_{ijnt}$, where ϵ_{ijn} is household specific error and v_{ijnt} is iid error term.

The consumption decisions of the household are a function of the household characteristics, H_{ijt}, such as education levels and ages of the head of the household and the spouse, number of children and adults in different age category, religion, amount of land, and number of years in business. The variable H_{ijt} also includes village level prices.

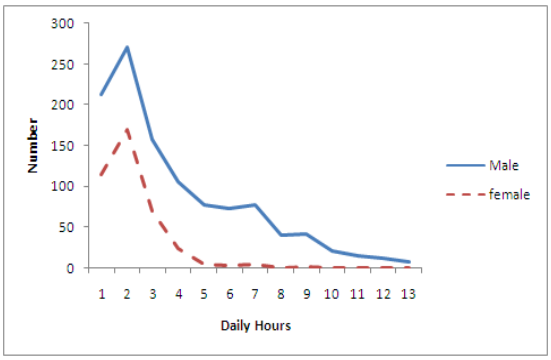
In this paper, the returns to borrowing by the gender of the borrower determine the bargaining power which affects intra-household resource allocation-measured by the expenditure pattern, X_{ijnt}. The returns to borrowing, N_{ijt}, is the net profit from the household business, the primary fund for which comes from micro-credit programs or non-micro sources. It takes into account the cost of borrowing, namely the loan repayment, interest and other transaction fees. Thus, N_{ijt} is business revenue, R_{ijt}, less the cost of operation, C_{ijt}, and cost of borrowing.

$$N_{ijt} = R_{ijt} - C_{ijt} - (rb_{ijt} + F_t)D_f \tag{3.20}$$

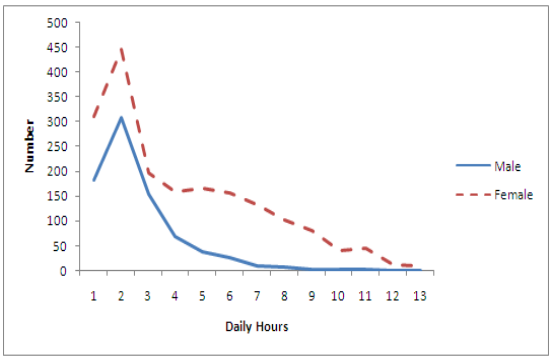
The last part of the equation represents the cost of borrowing where b_{ijt} is the loan amount, r is the interest rate of the loan, F_t is transaction costs. Finally, D_f is a dummy variable that equals 1 if the household has yet to finish paying or have paid back within the last 12 months and 0 otherwise. I assume that a borrowing household has not finished paying if I observe it still paying or if it finished paying any time within 12 months prior to the time of the survey. The reason for this distinction is that household expenditures, business revenue, and cost are reported for the past 12 months in the data. If a household had fully repaid the loan at least a year before the survey,

cost of borrowing is zero. However, if a household paid its loan anytime within the past 12 months, the effect of profit on consumption will be biased if it does not account for the cost of borrowing.

Empirically, I identify the effect of male returns to borrowing through N_{ijt} and female returns to borrowing through the interaction between N_{ijt} and borrower gender, G_{ijt}. One concern with defining male and female returns to borrowing this way is that they may not reflect husband's business earning and wife's business earning, respectively. Indeed what I would like to know is whether profit from a wife's business is spent differently than the profit from a husband's business. Separate earning from husband's and wife's businesses would be the ideal measures. However, I only observe if the household owns any business, how that business is initially funded, and who is the primary borrower. I do not observe to whom the business belongs. Figure 1(a) shows the number of husbands and wives in alternative levels of daily self-employment hours when the husband borrows. The number of men working longer is higher. In contrast, figure 1(b) shows the numbers when the wife borrows. The number of women working longer is higher than that of men. These figures show that women spent more time in the business when they are the primary borrowers and vice-versa for men. Therefore, I presume that if wife is the borrower, then profit comes from her business and if husband is the borrower, then profit comes from his business. Consequently, the coefficient λ_2 is the effect of husband's business income or male returns to borrowing on household allocation. And the coefficient λ_3 is the effect of wife's business income or female returns to borrowing on household allocation.



(a) male borrower



(b) female borrower

Figure 3.1: Women's and men's self-employment hours and gender of the borrower

Another concern with male and female returns to borrowing is that they may pick up income effect rather than bargaining or empowerment effect. I control for household total income, which includes business profits, to isolate the income effect. If no other effect but income effect exists, then the coefficient λ_2 will not be statistically different from zero. This also proves the income pooling hypothesis. However, a statistically significant λ_2 will show that different income sources have different effects on household allocation and these differences are born from household members' bargaining powers that are determined by their income. The member that has more bargaining power will be able to influence allocation in his or her favor. Therefore, the coefficients λ_2 and λ_3 provide the bargaining or empowerment effect of male and female returns to borrowing on intra-household allocation.

3.4.2 Estimation Strategy

If there are unobservable (to the econometrician) household or individual specific characteristics that affect resource allocation as well as decision to borrow, source of

borrowing, gender of the borrower, and returns to borrowing, then estimation of the expenditure equations using Ordinary Least Squares will result in biased estimates. For example, a more savvy woman may earn higher returns to borrowing and also be able to negotiate terms of her marriage that favor her. The effect of returns to borrowing will be overstated. Or a woman who is more empowered maybe more likely to borrow and start a business. Not accounting for this correlation would wrongly ascribe the part of the shifts in allocation from this unobserved characteristic to just her borrowing and result in an upward bias.

However, the selection bias can also go in the opposite direction. Micro-credit programs target poor households and women.[9] If women from poorer households are likely to be less empowered, it can result in a downward bias of the effect of gender of the borrower on allocation. At the extreme, effective targeting of poorest women can create an impression that women become less empowered when they borrow from micro-credit programs or as their business income increases. Source of the loans may also be correlated with unobserved characteristics. A woman who chooses to borrow from non-micro sources such as commercial banks when they could have chosen from micro-credit banks may be more empowered, shrewder, more intelligent, all of which will influence her ability to allocate resources in her favor. In such case, effect of returns to borrowing from micro-credit may be biased downward. Moreover, measurement errors can also understate the effects. Finally, household preferences may influence both consumption and

[9]Pitt and Khandker (1998) find that poorer households are more likely to borrow from Grameen Bank than their neighbors, conditional on observable characteristics and village of residence.

labor decisions and thus labor income.

I address the potential endogeneity problem with an Instrumental Variable approach using Two Stage Least Squares. I treat variables N_{ijt}, G_{ijt}, I_{ijt}, and whether the loan is from micro-credit program as endogenous.

In addition to selection bias, there exists a sample selection problem. I do not observe N_{ij} for households that do not borrow. To address sample selection of N_{ijt}, I estimate the main equation, X_{ijn}, with selection. A selection equation of whether the household selected into borrowing is estimated through the Probit estimation technique. I construct the sample selection correction term- inverse mills ratio- from the predicted probability, according to Heckman (1979), by using the following formula where $\phi(.)$ if *pdf* and $\Phi(.)$ is CDF of a normal distribution:

$$\Psi = \frac{\phi(H\gamma)}{\Phi(H\gamma)}$$

This sample selection term, Ψ, is included as an additional regressor in the main equation (18). A significance test of the coefficient of Ψ will show if there is indeed sample selection.

Another important source of bias is non-random program placement. Some micro-credit programs target poorest, underserved villages. These villages may be more parochial about treatment toward women and their roles. Failure to account for this unobserved village characteristic would bias the empowerment effect downward. In contrast, other programs may locate in richer villages with better infrastructure; villages

that may be more secular in their treatment toward women. This would lead to an overestimation of the impact. The estimation strategy must control for village-specific unobservables. I use a village Fixed Effect approach to address the bias due to non-random program placement. All standard errors are bootstrapped and clustered by households.

3.4.3 Identification

I need to identify the selection equation as well as first stage equations. To identify the former, I need a variable that is correlated with borrowing but uncorrelated with returns to borrowing, N_{ij}. I use distance to the lender as the instrument here. This would likely affect whether the household borrows; the further one has to travel, the less likely she may borrow. However, distance should not affect N_{ij}. The square and cube of distance to the lender are also used as explanatory variables.

To identify the first stage equations for N_{ijt}, G_{ijt}, I_{ijt}, and whether the loan is from micro-credit program, the main identification comes from the gender-based restriction of the programs. Households are exogenously excluded through their residence in non-program villages. Since men can join men only groups and women can join women only groups, the gender-based restriction is enforceable and observable. Therefore, I use the gender-based program design to identify the effects of the endogenous variables. There are three different micro-credit programs (BRAC, BRDB, GB) and some villages where only women can borrow from micro-credit and other villages where only a man can borrow. The rest of the micro-credit villages allow both genders to borrow (see Table

1.1). This leads to six gender- and program-specific dummy variables, disaggregated by borrowing from the three different micro-credit programs and two gender-specific dummy variables when examining borrowing from micro-credit. I define the gender restriction by Z_{ijk} where

$$Z_{ijk} = \begin{cases} 1 & \text{if village } j \text{ has program } s \text{ of gender } k \\ 0 & \text{otherwise} \qquad s\text{=GB, BRAC, BRDB} \quad \text{and} \quad k\text{=male, female} \end{cases}$$

Therefore, the first set of instruments is interactions between Z_{ijk} and household exogenous variables such as owned land and the age and education of the head of the household. I use amount of land as an interaction because land-holdings proxy for wealth. This term should identify the change in the effect of N_{ij} as the household's wealth changes. Aside from the gender-restrictions, there may be a second reason a household may have a female participant rather than a male participant. Men and women on average face different wait times to obtain a loan. Men, on average, wait 14 weeks to access the loan while women wait 9 weeks. The borrowers also have to bear the time cost of joining; they have to attend training and group meetings.

The interest rate and the distance to the lending institution serve as additional instruments. Distance to the lending institution may also determine whether a female borrows or whether a household borrows from micro-credit. The borrowers were asked the main reasons they decided to join the micro-credit program. 65% of the borrowers replied that it is because the programs offered relatively cheaper credit; 20% said the access to credit is easier. Another reason for participation in credit program is the lack

of collateral. These answers suggest that interest rate and lender's distance determine, in part, whether the individuals borrow and from where they borrow and serve as initial validation for the use of these instruments. Finally, I include some village level variables such as the nearest distance to the bank, bus stop, paved road, health facility, high school, religious school, college, fertilizer shop, whether the village has electricity, whether the buildings were made of corrugated iron sheet or brick, male wages, female wages, and average male and female loans as instruments.

I present the descriptive statistics of all the instruments, differentiated by the gender of the borrower in Table 3.1B. The table shows that there is statistically significant variation in the household level instruments depending on the gender of the borrower. As a check for validity of these instruments, I present selected results from the first stage of the IV procedure, reduced form estimation of total expenditure, and the selection equation in Table 3.4. The instruments have the expected signs in all columns. The F-statistic from a test of the null hypothesis that the instruments can be excluded from the estimation ranges from 13.78 to 152.62. These suggest that the instruments are jointly powerful. When the main variables of interest are the empowerment indicators, I use an additional set of instruments. The data contain information about access to inter-household transfers which can influence the decision to borrow. These are measured by the number of landed (one-half acre or more) or living relatives of the head of the household and the head's spouse. I use the head's relatives as instruments since the spouse's relatives who are rich and live nearby may influence the empowerment

indices.[10] In total, there are fourteen such instruments. I estimate a reduced form for the empowerment indicators and first stage of the IV procedure with these new instruments, along with the previous instruements (results not shown). The results and F-statistics maintain the instruments' relevance.

3.5 Data: Construction of the major variables

3.5.1 Dependent variables

The survey asks about household expenditures on specific goods such as food, adult clothing, children's clothing, education, health, recreation, personal expenses, non-food kitchen expenses, repairs on the house, etc. that the household incurred within the past year. I calculate the food expenditure by adding all expenses on food items over the past four months, three times a year. I also calculate expenses on men's and women's clothing by multiplying the amount of these items purchased by their respective prices which vary across villages. Only the first wave of the survey asks about the amount of men's and women's clothing item purchased. I assign goods to different genders on the basis of the findings from previous literature in section 2. Accordingly, female-oriented expenditures are children's clothing, education, health, women's clothing, soap, and kitchen goods. Male-oriented expenditures are recreational expenses, personal items, men's clothing, and household repairs. I do not assign expenditures such as adult

[10]These instruments become suspect if the household head's wealthy relatives elevate their status in the village, thereby restricting mobility of the women of the households for reasons of propriety. Since mobility is one of the empowerment indicators, the instruments will no longer be valid.

clothing and food. Table 3.2 shows the mean of these variables by the gender of the borrower. Female-oriented expenditures are higher when females borrow. In contrast, male-oriented expenditures are higher when males borrow. The last column reports statistically significant differences of expenditures by the gender of the borrower.[11]

In addition to differential expenditure patterns to measure empowerment or allocation, another form of empowerment may be a woman's ability to make major economic and non-economic decisions, her mobility, etc. It is plausible that the ability to borrow money on her own and earn income would influence these factors as well. Therefore, I use these variables as alternative measures of empowerment, which could be influenced by a woman's borrowing opportunity and returns to borrowing. The second wave of the survey asks the wives of the heads of the households who are between 15 and 60 years of age questions regarding mobility, economic and non-economic decision making ability, legal and political awareness. I use their responses to create indices of the main variables. Figure (2) presents the percentages of women with varying non-economic decision making power or index when the wife borrows and when the husband borrows. It shows that more women report higher decision making ability when they borrow. In contrast, less women report higher ability to make decisions when their husbands borrow. Female borrowing is correlated with empowerment. The rest of the indices follow a similar pattern. Appendix A explains the construction of these indices.

[11]In addition, when I differentiate expenditures by borrowing status and program villages, I find that the borrowers and households in program villages have slightly higher expenditures than non-borrowers and households in control villages, respectively.

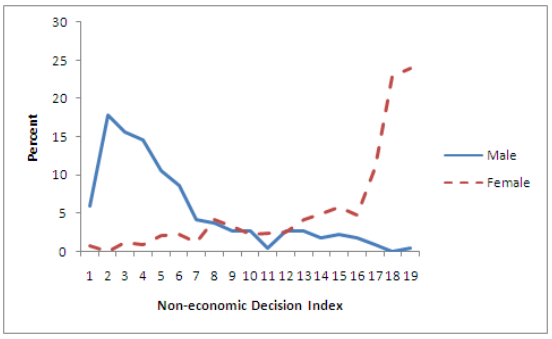


Figure 3.2: Percentage of women with varying major non-economic decision index and borrower's gender

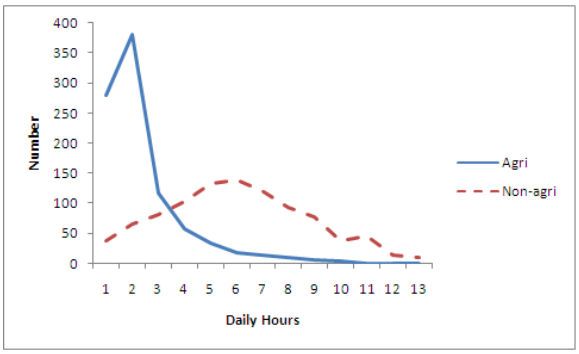


Figure 3.3: Women's self-employment hours when females borrow, by business type

3.5.2 Main independent variables

I calculate N_{ij} by the formula given in equation (20). For borrowing households, it is the revenue minus the cost of operating the business less interest payment and any other fees associated with borrowing. For non-borrowers, it is missing. Households are asked if and when they borrowed, the identity of the primary borrower, and the purpose of borrowing. In the self-employment questionnaire, households were asked about the type of business they operate and the length of time they have been operating it. I also have the information on the primary source of funding for the business. Therefore, I can match the year of operation for the business to the year of borrowing, for the business which was funded primarily from borrowing loans. The revenue from this business for the current year less the cost of operating, including the cost of borrowing is then defined as the profit from a self-employment activity that was funded mainly by loans. In this paper, these are defined as returns to borrowing from micro and non-micro sources.

Table 3.3 presents the summary description of profit for different groups and three other endogenous variables: gender of the borrower, household total income, and whether

the individual borrows from micro-credit programs. The average profit from Grameen Bank is higher than BRAC and BRDB. This is not surprising since Grameen Bank is bigger and dispenses larger loan amounts. The furthermore, the bank generally locates in villages with better infrastructure and higher income levels. The profit is also higher for micro-borrowers when compared to non-micro borrowing. Male borrowers have higher profit than female borrowers on average. One reason is that women tend to be more risk averse in investments and are socially restricted in the range of businesses they can operate. The credit amount borrowed is also higher for micro-credit than that for non-micro lenders.

Household businesses are categorized into agricultural and non-agricultural enterprises. Agriculture includes farming, livestock rearing, nursery, sericulture, horticulture, etc. Non-agriculture include services, transportation, construction, etc. Relatively more men work in non-agriculture than women. This is not surprising since the non-agricultural sector requires trades that are outside the household and in the marketplace. These businesses are more male-dominant. Interestingly, more women work in these types of businesses when they are the primary borrowers. Figure (3) presents the number of women with varying level of self-employment hours in either agriculture or non-agriculture, conditional on female borrowing. It shows that more women tend to work longer in non-agricultural businesses when they borrow. This suggests that borrowing may influence switching. It increases the level of work and the range of activities that a female can undertake. A Woman performing activities or working in male-dominant businesses may itself enhance empowerment.

Household income is the sum of total labor income of all members and unearned income for households that do not borrow. For households that borrow, household income includes business income. Three times a year every four months, the survey asks respondents the number of days they spend working outside for wage during the past four months, not including own business, and the pay they receive in a given day. I calculate the yearly labor income by multiplying number of days with per-day earning for all three segments and adding them. On average, household yearly income is TK 38,940

Land is defined as the amount of cultivable land that the household owns, which includes all irrigated and non-irrigated land. Since the land eligibility restriction of the credit programs is 0.5 acres or fewer, I exclude all households with more than 0.5 acres of land to facilitate comparison between borrowers and non-borrowers in the treated and control groups. One potential problem with such exclusion is that the land eligibility criterion was not strictly enforced. Indeed, 25% of the program participants have more than 0.5 acres of land. Thus, excluding these households may create selection problems. After excluding all households with land greater than 0.5 acre, the sample is reduced to 2,873, of which 1,861 borrow. Of this, 1,263 borrow from micro-credit and 598 borrow from non-micro lenders such as commercial banks, government, and informal money lenders.

The wife's education level is defined as the years of education household head's wife received and the ratio of education is derived from her education divided by the highest level of education obtained by her husband. I also include household age categories,

number of people, a survey time dummy, and village characteristics such as prices and infrastructure. Table 3.1A reports the descriptive statistics of the household and village level exogenous variables, differentiated by the gender of the borrower. Women borrowers are relatively more educated than their husbands and more likely to live in micro-credit villages. They are also from poorer and smaller households and less likely to be muslims. The table shows that there is statistically significant variation in household characteristics with the gender of the borrower.

3.6 Estimation Results

This paper examines the effect of male and female returns to borrowing on intra-household resources allocation and how the effect differs when source of the loan varies. I use a IV estimation approach with selection to control for endogeneity and sample selection and village fixed effect to control for non-random program placement. I shall refer to this approach as IV-FE.

I estimate a selection equation in which the choice is to borrow for investment into self-employment activities. When asked about the use of their loans, some borrowers report that they were borrowing for consumption purposes. However, I do not distinguish among different uses of the loans as borrowers may not differentiate between consumption and investment. The results are shown in the last column of Table 3.4. The interest rate, distance to the lending institution, and village wages have negative effects on the probability of borrowing. As wages increase, the opportunity cost of self-employment

increases. An average amount of loans disbursed to men and women both have a positive effect on the probability of borrowing as does the availability of a micro-credit program in the village where women are eligible to borrow. The presence of a program that systematically targets women would likely ease social norms and constraints, allowing women to borrow. The estimates are significantly different from zero. Household size and education levels have a positive effect, while land has a negative effect on the probability of borrowing.

3.6.1 Marginal effects of returns to borrowing on allocation

3.6.2 Borrowing from any sources

I estimate equation (18) using the IV-FE approach, where the main explanatory variables are the profit from the business and its interaction with the gender of the borrower. Thus, the coefficient of business profit is the effect of male returns to borrowing and the coefficient of the interaction between profit and borrower gender is the effect of female returns to borrowing. The dependent variables are yearly log expenditures on different items. The profit and total household income are logged since they are skewed to the right. However, about 17% of the households realize a negative profit; the average at the 10th percentile is TK -4,868. I take account of these negative profits by creating a new variable consisting of only the negative values and take the logarithm of the absolute value. Table 3.5 presents results from Ordinary Least Squares (OLS) and IV-FE estimations for household total expenditure and food expenditure. OLS

underestimates the effects of male and female returns on both expenditures, although the results are qualitatively similar. Both male and female returns have positive effect on total and food expenditure, while the negative returns have a negative effect. In addition, household total income has a positive impact on expenditures. The results show the importance of taking into account unobserved heterogeneity and the bias it causes.

Table 3.6 reports the IV-FE results in terms of elasticities for expenditures on different items. The first row reports the effect of positive male returns to borrowing on expenditures. This effect is positive for total expenditure, adult and men's clothing, food, education, medicine, recreation, household repair, and personal items. This is not surprising since men's clothing, recreation, repair, and personal items may be deemed male-oriented, or goods that provide more value to men than to women. Therefore, when a man, who is usually the head of the household, borrows, the business income or male returns to borrowing is allocated toward items that are more valued by him. In particular, a 10% increase in positive profit results in 5.7% increase in total expenditure. In the level scale, this is an increase of TK 820. Expenditure on men's clothing increases by 3% or TK 6, food by 2.3% or TK 226, education by 5.6% or TK 51, medicine by 5.4% or TK 20, recreation by 1.1% or TK 1, and personal items by 11.7% or TK 25.[12] In contrast, when a woman- usually the spouse of the head of the household- borrows, profit has a downward or negative effect on male-oriented items. The expenditure on

[12]I calculate the level effects by using retransformation of the log model and a smearing factor. Retransformation of the log model yields $Y = e^{\beta lnX+\epsilon}$. The marginal effect $\frac{dY}{dX} = \frac{\beta_x}{X}E(Y)$ where $E(Y) = e^{\hat{\beta}lnX+.5\hat{\sigma}^2(x)}$.

recreation is reduced by 1% and personal items by 0.8%, while expenditure on men's clothing still increases by 0.6%. This suggests that while a portion of female income is still allocated toward "male" items, it is smaller than one from his income (3% compared to 0.6%). Female returns to borrowing lowers "frivolous" consumption such as recreation. Indeed, the banks urge women to keep "empty" expenditures low and save more. Finally, when a female borrows, positive profit leads to more spending in total, food, education, and medicine than when a man borrows. These effects are significantly different than zero.

Women's clothing, soap, kitchen items, and child clothing are items that are more valuable to women than to men. Therefore, any income earned by a man may be allocated away from these goods whereas any income earned by a woman may be allocated toward them. The latter case would suggest an increase in bargaining power of the woman. A 10% increase in men's profit decreases expenditures on women's clothing by 5.3%, soap by 5.2%, kitchen items by 4.5%, and children's clothing by 5.5%. A 10% in women's profit leads to an increase in women's clothing by 3.3% and kitchen by 2.3% but a decrease in children's clothing by 1.3% and soap expenses by 0.6%. The decrease in latter two items is much more favorable allocation than when a man borrows. While a woman may not be able to increase allocation of income for some of her goods, she is able to dampen the level of resources that are allocated away from the goods more valuable to her.

The table also presents results for the negative profit in rows 3 and 4. Aside from accommodating log-transformation, the negative profit may also reveal household risk

aversion. For example, a 10% increase in men's returns or business income leads to a 5.7% increase in total expenditure. However, a 10% increase in negative profit leads to a 8.1% decrease in total expenditure. This shows that households, in general, are risk averse. Women's negative returns or business income exacerbates the negative effect and leads to a 11.5% decrease in total expenditure. Similar results are seen for adult's, women's, and children's clothing expenditures. Increase in men's negative profit increases recreation and personal spending. These reflect small expenditures. Therefore, when a business suffers a loss, households may be more likely to spend on items that cost less but bring immediate satisfaction. Increase in women's negative business income increases spending on recreation but by less than the increase from men's income. In contrast, men's negative income lowers expenditure on women's clothing by 4.9% and women's negative income lowers it further by 11.6%. A 10% increase in women's negative income also reduces education expenditure by 74.3%. These suggest that women lose more allocation power than men do when they are faced with reduced income from an already negative income. In bad economic times, goods that are first to cut back are the ones that are more valuable to women.

Household income has a positive and statistically significant effect on most types of expenditure. The effect ranges from a 0.6% to 5.4% increase when income increases by 10%. Income, however, has a negative impact on kitchen and soap expenditures. Household income includes business profit. Since women generally do not work outside the household, only male borrowing means the total income may comprise mostly of male income, increase in which leads to allocation away from female oriented items.

Nevertheless, the statistically significant effect of household total income, in addition to the effects of male or female returns, proves that households do not pool their income. The source of income influences its allocation.

Another interesting result is for women's education relative to men's. It has a positive and statistically significant effect on education, food, medicine, soap, and kitchen expenditure. This ratio is also significant and negative for children's, men's and women's clothing. A woman with relatively more education will likely shift her priorities toward investment in her children and their future. Moreover, this ratio can be regarded as another factor that influences bargaining power within a household. Lastly, I include the ratios of women's clothing to that of men's. This represents the spending on goods more valuable to women relative to spending on goods more valuable to men. The results show that men would spend more on their goods relative to women's goods as male returns increase.

The last row of the table presents the p-values from a Sargan-Hansan test of overidentifying restrictions. The null hypothesis of this test is that overidentifying restrictions are exogenous assuming that the identifying restrictions are exogenous. The values range from 0.29 to 0.77, which suggests that I cannot reject the null hypothesis, and establishes the validity of the instruments.

3.6.3 Borrowing from different sources: micro-credit versus non-micro loans

Table 3.7 presents the results from different loan sources, namely micro-credit and non-micro sources. The p-values from the over-identification tests range from 0.52 to 0.94, suggesting valid instruments. The differing sources are interesting as they offer different loan contracts. Micro-credit offers loans under a group contract with joint liability, whereas non-micro sources offer loans under individual contracts. The former targets women while the latter appears to be gender neutral. The estimates in the first row show the effect of men's returns to borrowing from non-micro sources. They are qualitatively similar to the estimates in Table 3.6. A 10% increase in men's returns or business income increases total expenditure by 6.6%. It also increases expenditures on food by 5.9%, education by 10.6%, medicine by 13.5%, recreation 5.4%, personal items 18.3%, children's clothing by 7.2%, adult clothing by 5.8%, and men's clothing by 3.5%, and decreases spending on women's clothing by 2.1%. However, when the loan is from micro-credit banks, men's returns to borrowing increase the total expenditure by 7.4%. It also increases spending on education by 29.1%, medicine by 19.1%, and men's clothing by 1.1%.[13] In contrast, an increase in men's return to borrowing from

[13]The second row gives the estimates of the interaction between profit and whether the household borrowed from micro-credit. Thus, when a man borrows from micro-credit, the total effect of profit is the sum of the estimates from row 1 and row 2. Similarly, to obtain the effect of profit when a female borrows from non-micro source, I add an interaction between profit and the gender of the borrower. The effect is then the sum of the estimates from row 1 and row 3. Finally, to obtain the effect of profit when a female borrows from micro-credit, I need to add an additional interaction among profit, gender of the borrower, and whether a household borrows from micro-credit. The effect is the sum of the first four rows.

micro-credit sources lowers expenditure on recreation by 1.5% and women's clothing by 0.4%. These results show that households spend more on some female oriented items and less on some male oriented items with men's returns to borrowing from micro-credit sources than non-micro sources. When it does lead to an increase in men's goods and decrease in women's goods, these effects are less than those of borrowing from non-micro sources. Finally, men's returns from non-micro sources decrease the ratio of spending of women's clothing to men's clothing whereas returns from micro-credit source increase the ratio.

When a female borrows from a non-micro source, her returns to borrowing or business income has a positive effect on total expenditure, spending on child clothing, food, education, medicine, recreation, soap, and men's and women's clothing but has a negative effect on spending on adult clothing and personal items. In comparison, women's returns to borrowing from micro-credit sources have a larger positive effect on total expenditures and spending on food, education, medicine, and men's, women's, children's, and adult clothing. Female returns to borrowing from micro sources have a larger negative impact on recreation and personal expenditures. Household total income also has positive effect on expenditures that is different from the effect of men's or women's business income. This differential impact contradicts the income pooling hypothesis.

Households spend more on goods such as education, medicine, clothing, and food when there is an increase in both men's or women's returns to borrowing from micro-credit as compared to non-micro sources. However, women's returns from micro-credit results in larger positive impact than men's returns. This may be the result of the social

development efforts like the "sixteen decision" that teach women the value of education, nutrition, sanitation, and taking care of oneself and one's children.[14] The results above show that women spend differently than men in rural Bangladesh. In particular, when a woman starts contributing to the household income, she is able to allocate more of this income toward goods that are valuable to her, proving that the income improves her bargaining power.

3.6.4 Marginal effects of returns to borrowing on empowerment indices

The second wave of the survey asks all married women between 15 and 60 years old extensive questions about their economic and non-economic decision making power, mobility, political and legal awareness, networking ability, household tolerance toward domestic violence, etc. These provide alternative measures of empowerment. I estimate the effect of men's and women's returns to borrowing from different sources on these empowerment measures using the same estimation strategy explained in section 4.2.

Table 3.8 reports the results and the p-value from the over-identification test which range from 0.18 to 0.78. An increase in men's returns to borrowing from non-micro source leads to an increase in women's economic decision making power, such as buying or selling land and livestock while an increase in men's returns from micro source lower a woman's ability to make these decisions. In contrast, men's returns from micro source

[14]In the estimation, I include the logarithm of the absolute of negative profits and the interactions of gender of the borrower and micro-credit. However, I do not report the results in Table 3.7 as none of the results are statistically significant.

lead to an increase in a woman's ability to make major non-economic decisions such as fertility and children's education. Women's returns to borrowing from micro and non-micro sources have positive effect on both of these decision making abilities but returns from micro source have larger impacts. Women's income also has larger positive impact on their mobility when they borrow from micro-credit banks. Mobility measures the ease of traveling outside the household. Household income has a positive effect on the economic decision making index but negative effect on mobility. As a household gets wealthier, the sense of social propriety heightens which restricts the freedom of a woman traveling outside the household. As a woman becomes more educated relative to her husband, she is more involved in decisions regarding herself and her children, as evidenced by the positive effect on non-economic index.

These result suggests that education and training are important for women in making their own decisions, thus strengthening the argument for the need for social development programs targeted toward women. The credit programs provide a group atmosphere and a safety net where women can share information and network, building their self-esteem and confidence to assert their rights at home, invest in business, become self-sufficient and contribute to the family, which in turn lead to empowerment.[15]

[15]I estimate other indices as well, some of whose results are reported in Table 3.8. However, these results are not significantly different than zero. Therefore, I do not discuss them any further.

3.6.5 Program eligibility: mistarget

I examined alternative specifications to check for the robustness of my findings. One alternative included estimation with a different land cut-off. The micro-credit programs require the household to own no more than 0.5 acre of land to be eligible. However, this restriction is not always enforced. One reason is mistargeting. Yet, another reason may be misreporting by the participants, especially when the land is located far from the village of residence. In rural communities, information verification is costly. Therefore, program staff may rely on participants' and their group members' accounts. In addition, they may be susceptible to bribes and corruption. The loan officers may adjust for land quality as well and allow a household with more land to qualify. [16]

Regardless of the reason for lax enforcement, excluding these mistargeted participants may lead to sample selection bias. One way to check the robustness of such exclusion is to reestimate the model using a progressively higher land cutoff for program eligibility and see how sensitive the results are with the inclusions. I use four different cutoffs- 0.75 acre, one acre, one and a half acres, and two acres. With the original cutoff at one-half acre, 25% of the participants were mistargeted. This proportion falls to 17% at 0.75 acre, 12% at one acre, 6% at one and a half acre, and 3% at two acre. A comparison of the results shows that they are virtually identical to the results reported above for total expenditure. The increase in total expenditure ranges from 4.6% to 6% with varying land cutoffs when there is a 10% in profit from male borrowing. This is

[16]Pitt (1999) finds that participating households owning more than 0.5 acre of land have lower land value than their non-participating counterparts.

similar to the 5.7% increase found above. When females borrow, this effect ranges from 0.4% to 1.2%, again can be compared to the 0.7% found above. A similar story can be told for negative profit, household income and the relative education of women to men. Therefore, I conclude that the results reported above are robust and households owning more than 0.5 acres can be safely excluded.

3.7 Discussion

This paper examines the effect of returns to borrowing, as it differs with the gender of the borrower, on intra-household resource allocation. The paper highlights several interesting results. First, different sources of income affect allocation of the income differently. For the purpose of this paper, this result means that increase in women's business income from increased income earning opportunities for women will affect the allocation of resources in their households differently than increase in men's income. The second main finding is that increase in a women's income leads to increased consumption of goods that provide them with greater utility. In contrast, increase in men's income decreases consumption of goods more valuable to women and increases consumption of goods more valuable to men. This result means that allocation of household resources favors the woman when her income increases. This is evidence of increased empowerment or bargaining power. Thus, the first result shows that allocation of resources differs by who earns while the second result shows how the allocation differs.

A third set of results find that households in rural Bangladesh are risk averse. The

marginal effect of negative profit on consumption is greater than the marginal effect of positive profit. Women and children become worse off than men when their income further worsens. In addition, the results show that borrowing by itself doesn't empower women. On the contrary, borrowing without positive returns lowers women's bargaining power as evidenced from the allocation of resources away from female oriented goods. This is not surprising because they would have to depend on other household members to repay her loans. Thus, borrowing must accompany positive returns to have any significant empowerment effect in women's lives. As such, credit programs must concentrate on enhancing market accessibility and business training for women.

Finally, female micro-credit borrowers are better able to allocate their business income toward their goods, make major household decisions, and travel outside the household than their non-micro counterparts. Thus, non-micro borrowing serves as reference point and shows that the social aspects of micro-credit programs affect women's empowerment above and beyond the monetary aspects. From policy perspective, credit programs should emphasize social programs and try to include men as well. In addition, commercial banks should introduce some social programs to women and men as well and raise gender awareness.

I motivated this paper by the necessity to examine beyond the financial impact of micro-credit programs so as not to erroneously conclude that targeting women is not cost-effective. The results from this study show that micro-credit programs do have social and development impact, namely, empowerment of women in a patriarchal society. Once this impact is account for, targeting women may indeed prove to be cost-effective.

Actually, credit programs should equally target men and women so as not to intensify exploitation of women due to credit scarcity. Indeed, I have found that women borrowers in villages with no gender exclusion are more empowered than those in villages with only women's programs.

Table 3.1A : Descriptive statistics for exogenous variables

Variable	*Full Sample*	*Std Dev*
Household Characteristics		
Education ratio (female/male)	1.07	1.26
Highest grade completed by female spouse	0.99	2.17
Highest grade completed by household (HH) head	1.65	2.86
Household land (in decimal)	8.44	14.29
Land for micro-credit participants	7.19	13.35
Land for non-participants	9.59	15.03
Number of people in HH	4.80	2.12
Religion (1 if Muslim)	0.93	0.64
Duration of the self-employment	4.97	7.74
Residence in a micro-credit village	0.82	0.38
# of female age 10-20	0.52	0.72
# of female age 20-30	0.43	0.54
# of female age 30-40	0.30	0.46
# of female age 40-50	0.18	0.38
# of female age 50-60	0.13	0.34
# of female over 60	0.12	0.33
# of male age 10-20	0.55	0.77
# of male age 20-30	0.36	0.60
# of male age 30-40	0.32	0.48
# of male age 40-50	0.22	0.41
# of male age 50-60	0.12	0.33
# of male over 60	0.11	0.32
# of girls under 10	0.70	0.85
# of boys under 10	0.70	0.81
Village level variables		
Price of rice	11.60	1.65
Price of mustard oil	55.98	5.55
Price of egg	2.58	0.64
Price of milk	14.06	4.09
Price of potato	7.42	2.06
Price of flour	10.02	1.42
Price of Sugar	28.94	3.03
Price of onion	15.71	6.78
Price of garlic	35.59	13.15
Price of turmeric	55.56	12.59
Price of salt	8.14	2.28
Price of chicken	70.87	19.96
Price of beef	54.80	13.83
Price of soap (per bar)	10.70	2.45
Price of tobacco	2.34	0.33
Nearest distance to the market (km)	9.15	13.51
Nearest distance to the shop (km)	9.16	8.68
Nearest distance to the weekly market (km)	5.11	6.10

Table 3.1A : Descriptive statistics for exogenous variables (continued)

Variable	*Full Sample*	*Std Dev*
Household level instruments		
Distance in km to the lender	4.67	9.71
Distance in km (microcredit)	4.26	4.02
Distance in km (private loans)	5.59	19.85
Interest rate (%)	23.98	27.58
Interest rate (microcredit)	17.80	13.78
Interest rate (private loans)	37.03	51.53
# parents of HH head who own land	0.17	0.48
# brothers of HH head who own land	0.37	0.92
# sisters of HH head who own land	0.42	0.90
# uncles of HH head who own land	0.75	1.39
# aunts of HH head who own land	0.48	1.19
# sons of HH head who own land	0.03	0.28
# daughters of HH head who own land	0.06	0.37
# living parents of HH head	0.67	0.76
# living brothers of HH head	1.63	1.61
# living sisters of HH head	0.57	0.93
# living uncles of HH head	0.74	1.24
# living aunts of HH head	0.25	0.69
# living sons of HH head	0.83	1.24
# living daughters of HH head	0.64	1.03
Village level instruments		
% of irrigated land in village	44.83	31.46
Whether the village has electricity	0.52	0.50
Distance to the nearest fertilizer shop (km)	1.91	1.41
Distance to the nearest health facility (km)	0.26	0.24
Distance to the nearest high school (km)	2.62	2.13
Distance to the nearest college (km)	8.85	5.50
Distance to the nearest religious school (km)	3.56	3.49
Whether the village has paved road	0.39	0.45
Distance to the nearest paved road (km)	3.38	3.48
Distance to the nearest bus stop (km)	12.36	15.67
Whether the village has a bank	0.11	0.32
Distance to the nearest bank (km)	6.25	6.94
Whether the village has brick building	0.67	0.81
Average village loan amount to women (in thousands of Taka)	5.89	7.63
Average village loan amount to men (in thousands of Taka)	10.43	7.28
Village level wage for female (per day)	25.93	14.03
Village level wage for male (per day)	51.32	18.72
Village level wage for children (per day)	25.01	10.67
Sample size (household-year)	2,873	

Note: Mean for all households owning ½ acre or less land i.e. Eligible households.
All prices are measured in Tk. 69TK= $ 1. All amounts are expressed in 1999 Taka.

Table 3.1B : Descriptive statistics for exogenous variables by gender

Variable	*Female Borrower Sample*[A]	*Male Borrower Sample*[A]	*Difference*[B]
Household Characteristics			
Education ratio (female/male)	1.29	0.88	0.41***
Highest grade completed by female spouse	1.14	0.89	0.25***
Highest grade completed by household (HH) head	1.59	2.40	-0.81***
Household land (in decimal)	7.28	9.04	-1.76***
Land for micro-credit participants	7.13	7.38	-0.25**
Land for non-participants	7.93	10.55	2.62***
Number of people in HH	4.67	5.38	-0.71***
Religion (1 if Muslim)	0.73	0.92	-0.19***
Duration of the self-employment	9.54	8.38	1.16**
Residence in a micro-credit village	0.90	0.80	0.10***
# of female age 10-20	0.58	0.50	0.08***
# of female age 20-30	0.41	0.47	-0.06***
# of female age 30-40	0.36	0.29	0.07***
# of female age 40-50	0.21	0.14	0.07***
# of female age 50-60	0.13	0.13	0.00
# of female over 60	0.12	0.09	0.03***
# of male age 10-20	0.61	0.58	0.03**
# of male age 20-30	0.32	0.48	-0.16***
# of male age 30-40	0.32	0.40	-0.08***
# of male age 40-50	0.21	0.14	0.07***
# of male age 50-60	0.13	0.11	0.02
# of male over 60	0.10	0.13	-0.03*
# of girls under 10	0.70	0.81	-0.11***
# of boys under 10	0.67	0.86	-0.19***
Household level instruments			
Distance in km to the lender	4.08	5.84	-1.75***
Distance in km (microcredit)	3.84	5.69	-1.85***
Distance in km (private loans)	5.07	5.95	-0.88***
Interest rate (%)	18.84	33.76	-14.92***
Interest rate (microcredit)	17.91	17.41	0.50
Interest rate (private loans)	22.61	46.77	-24.16***
# parents of HH head who own land	0.12	0.22	-0.10***
# brothers of HH head who own land	0.33	0.45	-0.12***
# sisters of HH head who own land	0.36	0.56	-0.20***
# uncles of HH head who own land	0.67	0.90	-0.23***
# aunts of HH head who own land	0.39	0.71	-0.32***
# sons of HH head who own land	0.31	0.46	-0.15
# daughters of HH head who own land	0.06	0.07	-0.01
# living parents of HH head	0.64	0.76	-0.12***
# living brothers of HH head	1.52	1.86	-0.32***
# living sisters of HH head	0.56	0.60	-0.04
# living uncles of HH head	0.66	0.94	-0.28***

Table 3.1B : Descriptive statistics for exogenous variables by gender (continued)

Variable	*Female Borrower Sample*[A]	*Male Borrower Sample*[A]	*Difference*[B]
# living aunts of HH head	0.22	0.27	-0.05
# living sons of HH head	0.79	1.02	-0.23***
# living daughters of HH head	0.59	0.81	-0.22***
Sample size (household-year)	1,220	641	

Note: Mean for all households owning ½ acre or less land i.e. Eligible households.

All prices are measured in Tk. 69TK= $ 1. All amounts are expressed in 1999 Taka.

A. Means for female borrowing households and male borrowing households conditional on borrowing.

B. Difference is calculated by mean(female borrower)-mean(male borrower). * difference in mean significant at 10%, ** at 5%. *** at 1%

Number of observation is 1,263 for micro-credit borrowers and 598 for non-micro borrowers in full sample.

Table 3.2 : Summary statistics of the dependent variables by gender of borrower

Variables	Means and sample sizes								
Expenditures	*Full sample*	*Obs (Full)*	*All Borrower*	*Obs (Borrower)*	*Female borrower*	*Obs (female)*	*Male borrower*	*Obs (male)*	*Difference*[a]
Total expenditure	21285.84	2873	23265.75	1861	23617.59	1220	22596.09	641	1021.50***
Children's medical	803.11	2790	908.42	1861	1009.47	1220	855.13	641	-154.34**
Child clothing	315.63	2085	331.97	1717	331.23	1098	294.24	619	36.99**
Adult clothing	1137.66	2873	1248.62	1861	1203.69	1220	1334.13	641	-130.44**
Marriage	3282.42	126	3770.16	92	3643.88	63	4044.48	29	-400.60
Recreation	172.10	2692	179.53	1520	133.89	805	244.27	715	-110.38**
Personal	128.52	2722	137.27	1784	131.05	1148	148.50	636	-17.45***
Textile	338.26	503	355.26	344	394.87	220	332.94	124	61.92
Furniture	1099.92	283	1050.60	203	1061.07	140	1027.35	63	33.71
Household improvement	8857.28	291	9739.71	211	9616.04	139	9978.47	72	-362.42
Household repair	712.84	991	739.98	891	689.48	470	847.36	221	-157.88**
Household effect repair	51.06	214	61.23	146	51.35	99	82.042	47	-30.69
Kitchen	149.75	2689	159.00	1861	178.09	1220	148.71	641	29.37***
Soap	296.29	2856	325.58	1852	346.30	1213	314.66	639	31.63***
Children's Education	952.00	1630	982.55	1475	1118.35	965	909.76	510	208.59**
Food	16555.51	2873	17861.99	1861	18432.84	1220	16775.49	641	1657.35***
Women's clothing	562.23	1357	569.57	867	596.46	492	504.88	375	91.58***
Men's clothing	201.03	1357	198.99	858	199.27	483	201.04	375	-1.76

Note: The expenditures are measured yearly in Tk. 69TK= $ 1. All amounts are expressed in 1999 Taka.
Sample sizes are household-year observations.
a. Difference is calculated as mean(female borrower) – mean (male borrower)
*** Difference in mean significant at 1%, ** at 5%, * at 10%

Table 3.3 : Summary statistics of returns to borrowing, N, and other endogenous variables

Variable (in thousands of Taka)	*Observation*	*Mean*	*Standard Deviation*
N for all borrower	1861	16.63	57.11
N from micro-credit	1263	18.07	50.69
Grameen Bank	533	20.57	61.21
BRAC	379	16.42	40.94
BRDB	351	16.05	41.78
N from private lender	598	13.57	68.66
N from female borrower	1220	15.78	48.79
Micro-credit	979	17.39	53.07
Private-lender	241	9.20	23.67
N from all male borrower	641	18.24	40.28
Micro-credit	284	20.41	41.46
Private lender	357	16.52	86.63
Amount borrowed from private lender	598	9.63	22.30
Amount borrowed from micro-credit	1263	13.39	15.42
Gender of the borrower	2873	0.57	0.39
Household borrows from micro-credit	2873	0.44	0.49
Household income	2873	38.94	6.35

Note: The expenditures are measured yearly in Tk. 69TK= $ 1. All amounts are expressed in 1999 Taka.
Sample sizes are household-year observations.

Table 3.4 : First stage and reduced form estimates of selected identifying instruments

	Dependent Variable					
Identifying Instruments	**Log Positive Return**	**Log Negative Return**	**Borrower Gender**	**Micro-Credit**	**Log Total Expenditure**	**Selection Equation**
Male wage	0.003 (0.003)	-0.001 (0.002)	0.002 (0.001)**	-0.004 (0.001)***	0.006 (0.0009)***	-0.001 (0.002)
Female wage	0.004 (0.003)	0.001 (0.001)	-0.011 (0.001)***	-0.002 (0.001)**	0.004 (0.0008)***	-0.009 (0.002)***
Average male loan	0.018 (0.003)***	-0.004 (0.001)***	-0.002 (0.0015)	0.008 (0.003)***	0.012 (0.001)***	0.004 (0.004)
Average female loan	0.036 (0.012)***	0.01 (0.002)***	0.005 (0.001)***	0.004 (0.001)***	-0.0045 (0.0015)***	0.021 (0.004)***
Interest Rate	-0.003 (0.001)***	0.002 (0.000)***	-0.002 (0.000)***	-0.003 (0.000)***	-0.0014 (0.0008)*	-0.004 (0.001)***
Distance to lender (km)			-0.172 (0.040)***	-0.226 (0.061)***	0.002 (0.0007)***	-0.009 (0.002)***
F- Statistic	14.14	13.78	32.33	42.00	29.97	152.62

Note: Standard errors are bootstrapped with 100 replications and clustered by households. Log positive and log negative returns have 1,861 observations. Columns 3-6 have 2,873 observations. Average male and female loan amount are measured in 1,000 1998 taka. All specifications control for household characteristics and local prices and conditions. F-statistic is from a joint test of null hypothesis that coefficient estimates on the instruments are equal to zero. Exception is the last column which was estimated by Probit technique and therefore presents the χ^2 value instead of the F-statistic. * indicates significance at 10 % (** at 5%, *** at 1%). All regressions include village fixed effects.

Table 3.5: OLS and IV-FE marginal effects of returns to borrowing

Variables	Total Expenditure		Food Expenditure	
	OLS	IV-FE	OLS	IV-FE
Log N (positive)	**0.05** (0.01)***	**0.57** (0.15)***	**0.14** (0.04)***	**0.23** (0.11)**
Log N (positive)*female borrower	**-0.07** (0.34)	**-0.50** (0.13)***	**0.16** (0.07)**	**0.29** (0.10)***
Log N (negative)	**-0.06** (0.02)***	**-0.81** (0.46)*	**-0.04** (0.02)*	**-0.15** (0.22)
Log N (negative)*female borrower	**-0.03** (0.25)	**-0.34** (0.16)**	**-0.02** (0.26)	**-0.09** (0.25)
Log Household income	**0.06** (0.01)***	**0.54** (0.12)***	**0.06** (0.01)***	**0.39** (0.11)***
R-Squared	0.605		0.603	

* Statistically significant at P < .10
** Statistically significant at P < .05
*** Statistically significant at P < .01
Standard errors are bootstrapped with 100 replications
Coefficients for N and household income are in terms of increase in Taka 1,000

Table 3.6: Marginal effects of returns to borrowing on log expenditure

Variables	*Total expenditure*	*Adult clothing*	*Child clothing*	*Food*	*Education*	*Medicine*	*Kitchen*
Log N (positive)	**0.57**	**0.39**	**-0.45**	**0.23**	**0.56**	**0.54**	**-0.45**
	(0.15)***	(0.16)	(0.15)***	(0.11)**	(0.20)***	(0.26)**	(0.21)**
Log N (positive)*female borrower	**-0.50**	**-0.12**	**0.32**	**0.29**	**0.34**	**0.53**	**0.68**
	(0.13)***	(0.05)	(0.11)***	(0.10)***	(0.15)**	(0.22)**	(0.29)**
Log N (negative)	**-0.81**	**-1.08**	**-0.54**	**-0.15**	**-3.46**	**0.46**	**-0.06**
	(0.46)*	(0.46)**	(0.31)*	(0.22)	(2.23)	(0.96)	(0.12)
Log N (negative)*female borrower	**-0.34**	**-0.45**	**-0.65**	**-0.09**	**-3.97**	**-0.58**	**-0.30**
	(0.16)**	(0.21)**	(0.67)	(0.25)	(2.40)*	(1.03)	(1.29)
Log Household income	**0.54**	**0.24**	**0.43**	**0.39**	**0.22**	**0.514**	**-0.18**
	(0.12)***	(0.11)**	(0.19)**	(0.11)***	(0.07)***	(0.24)**	(0.08)**
Ratio female to male education	**0.15**	**-0.02**	**-0.08**	**0.09**	**0.27**	**0.06**	**0.05**
	(0.14)	(0.28)	(0.03)***	(0.04)*	(0.06)***	(0.02)***	(0.01)***
Over-Id test (Chi-sq p-value)	0.539	0.675	0.493	0.416	0.408	0.454	0.747

Table 3.6: Marginal effects of returns to borrowing on log expenditure (continued)

Variables	*Recreation*	*HH repair*	*Personal*	*Soap*	*Men's clothing*	*woman's clothing*	*Women's /men's clothing*
Log N (positive)	**0.11**	**0.16**	**1.17**	**-0.52**	**0.29**	**-0.53**	**-0.28**
	(0.04)**	(0.36)	(0.27)***	(0.20)**	(0.13)**	(0.17)***	(0.13)**
Log N (positive)*female borrower	**-0.21**	**-0.11**	**-1.25**	**0.46**	**-0.23**	**0.86**	**0.12**
	(0.10)*	(0.30)	(0.25)***	(0.17)***	(0.10)**	(0.15)***	(0.10)
Log N (negative)	**0.46**	**0.72**	**1.17**	**-0.97**	**-0.72**	**-0.49**	**-0.09**
	(0.19)**	(0.56)	(0.57)**	(0.54)*	(0.57)	(0.28)*	(0.31)
Log N (negative)*female borrower	**-0.37**	**-0.64**	**-0.98**	**-0.74**	**0.93**	**-0.67**	**0.25**
	(0.21)*	(0.59)	(0.70)	(0.58)	(0.64)	(0.29)**	(0.36)
Log Household income	**0.20**	**0.06**	**0.35**	**-0.23**	**0.19**	**-0.18**	**-0.20**
	(0.09)**	(0.03)*	(0.15)**	(0.11)**	(0.17)	(0.12)	(0.17)
Ratio female to male education	**-0.07**	**-0.04**	**0.02**	**0.02**	**-0.05**	**-0.04**	**-0.005**
	(0.03)**	(0.03)	(0.03)	(0.01)	(0.01)***	(0.01)***	(0.01)
Over-Id test (Chi-sq p-value)	0.371	0.214	0.588	0.298	0.770	0.431	0.382

Standard errors are in parentheses. They are bootstrapped with 100 replications. Given that the expenditure uses prediction from the selection equations, bootstrapping is used to guarantee better properties than the use of the conventional variance-covariance matrix. They are also clustered by households.
* Statistically significant at P < .10 ** Statistically significant at P < .05 *** Statistically significant at P < .01
(a)- variables treated as endogenous, estimates from Instrumental Variable estimation.
Coefficients for N and household income are in terms increase in TK1000

Table 3.7: Marginal effects of returns to borrowing on log expenditure: by the loan sources

Variables	*Total expenditure*	*Adult clothing*	*Child clothing*	*Food*	*Education*	*Medicine*	*Kitchen*
Log N (positive)	**0.66**	**0.58**	**0.72**	**0.59**	**1.06**	**1.35**	**0.45**
	(0.32)**	(0.31)*	(0.37)*	(0.27)**	(0.44)**	(0.60)**	(0.35)
Log N (positive)* Micro-credit	**0.08**	**0.18**	**0.37**	**0.28**	**1.85**	**0.56**	**-0.11**
	(0.03)**	(0.27)	(0.69)	(0.31)	(0.73)**	(0.31)*	(0.29)
Log N (positive)*female borrower	**-0.41**	**-1.22**	**1.02**	**1.14**	**0.30**	**2.36**	**-0.48**
	(0.12)***	(0.56)**	(0.50)**	(0.45)**	(0.16)*	(1.28)*	(0.34)
Log N (positive)* Micro-credit * female borrower	**0.49**	**0.59**	**0.48**	**0.25**	**1.18**	**0.22**	**0.33**
	(0.21)**	(0.25)**	(0.21)**	(0.12)**	(0.50)**	(0.07)***	(0.28)
Log Household Income	**0.30**	**0.64**	**0.33**	**0.44**	**0.29**	**0.71**	**0.34**
	(0.07)***	(0.30)**	(0.09)***	(0.19)**	(0.13)**	(0.22)***	(1.91)
Over-Id test (Chi-sq p-value)	0.730	0.930	0.828	0.787	0.892	0.714	0.531

Table 3.7: Marginal effects of returns to borrowing on log expenditure: by the loan sources (continued)

Variables	*Recreation*	*HH repair*	*Personal*	*Soap*	*Men's clothing*	*Woman's clothing*	*Women's/ men's clothing*
Log N (positive)	**0.54**	**-1.00**	**1.83**	**0.82**	**0.35**	**-0.21**	**-0.14**
	(0.29)*	(0.77)	(0.91)**	(0.32)	(0.16)**	(0.11)*	(0.08)*
Log N (positive)* Micro-credit	**-0.69**	**1.65**	**-0.73**	**-1.05**	**-0.24**	**0.17**	**0.15**
	(0.32)**	(0.48)	(0.55)	(0.85)	(0.10)**	(0.07)**	(0.09)*
Log N (positive)*female borrower	**-0.16**	**0.17**	**-2.31**	**-0.79**	**-0.17**	**0.60**	**0.13**
	(0.09)*	(0.61)	(1.02)**	(0.35)**	(0.07)**	(0.31)*	(0.13)
Log N (positive)* Micro-credit * female borrower	**-0.18**	**-0.68**	**-1.33**	**1.37**	**0.10**	**0.05**	**0.05**
	(0.08)**	(0.45)	(0.59)**	(1.47)	(0.05)*	(0.02)**	(0.08)
Log Household Income	**0.60**	**0.67**	**0.31**	**0.22**	**0.28**	**0.08**	**0.12**
	(0.21)***	(0.57)	(0.65)	(0.22)	(0.15)*	(0.10)	(0.13)
Over-Id test (Chi-sq p-value)	0.887	0.940	0.520	0.817	0.941	0.790	0.603

Standard errors are in parentheses. They are bootstrapped with 100 replications
* Statistically significant at P < .10 ** Statistically significant at P < .05 *** Statistically significant at P < .01
Coefficients for N and Household income are in terms increase in TK1000

Table 3.8: Marginal effects of returns to borrowing on empowerment variables

Variable	*Major economic decision*	*Non-economic decision*	*Mobility*	*Political awareness*	*Legal awareness*
Log N (positive)	**6.54**	**-6.17**	**1.24**	**-5.52**	**1.75**
	(3.35)*	(5.38)	(1.29)	(5.33)	(2.85)
Log N (positive)* Micro-credit	**-10.47**	**4.37**	**-1.19**	**3.32**	**1.86**
	(4.45)**	(2.02)**	(1.37)	(3.53)	(2.30)
Log N (positive)*female borrower	**5.19**	**8.63**	**1.12**	**5.81**	**-2.29**
	(2.44)**	(4.93)*	(0.65)*	(5.53)	(3.24)
Log N (positive)* Micro-credit * female borrower	**7.56**	**2.12**	**2.23**	**-4.51**	**1.10**
	(3.81)**	(1.07)**	(1.08)**	(4.34)	(2.26)
Log Household income	**7.92**	**4.18**	**-1.69**	**-3.80**	**4.20**
	(3.84)**	(4.25)	(0.78)**	(1.11)	(4.00)
Ratio female to male education	**0.12**	**0.45**	**0.048**	**0.12**	**0.29**
	(0.37)	(0.14)***	(0.05)	(0.12)	(0.26)
Over-Id test (Chi-sq p-value)	0.580	0.789	0.602	0.187	0.211

* Statistically significant at P < .10
** Statistically significant at P < .05
*** Statistically significant at P < .01
Standard errors are bootstrapped with 100 replications
Coefficients for N and household income are in terms of increase in Taka 1,000

Appendix A

A1. Variable Description

The main dependent variable is self-employment profit. This is calculated as total revenue from the business plus the value of consumption from production less the operating cost and opportunity cost of time. The operating expense is how much they incurred in production, raw material, and labor excluding their own. The opportunity cost of time is the product of the time investment and market wage. They were asked who invests time in the business and how much time they invest. The total time investment was derived from this. Land is defined as the amount of cultivable land the household owns in decimals. Education ratio is the education of the female spouse of the male head of the household divided by the education of the male head of the household. The bank loan dummy is defined as 1 if the households borrowed from formal commercial banks or informal markets, 0 otherwise.

The total sample size is 4,421 combining both 1992 and 1999 survey. However, 1999 survey added households from new villages but lacked village level information about these villages. Therefore, these households were dropped. In addition, households owning more than 5 acres of land were dropped as well to maintain comparability. Thus, the sample size reduced to 4,027. After the self-employment profit was calculated, there were several households with very high positive and very low positive. Therefore, to retain comparability, I excluded the outliers. Namely, I excluded any households with profit greater than 100,000 Taka and less then -100,000 Taka. These amounted to 115 households. After dropping these and dropping the households that were ineligible to participate in the credit programs because of land ownership of greater than half acre (1039 households), the final sample size reduced to 2,873, with 1,263 households participating in the micro-credit programs and 598 households borrowing from non-micro sources.

Appendix B

B1. Variable Description

The mobility variable measures a woman's freedom of movement within and outside the village. The survey asked how she goes to banks, markets, health centers, or places outside the village excluding her parents' place. If she goes alone, I rank this the highest value. If she goes with other women, other people, her husband, or does not go at all, I rank accordingly, with not going as the lowest value. Thus, it ranges from 0 to 4, with mobility score of 0 if she does not go and a score of 4 if she goes alone.

The Major economic decision making ability concerns four issues and who decides and implements these issues. The issues are housing repair, sale and purchase of livestock, borrowing money, and sale and purchase of land or equipment. I give all these issues equal weight. Her responses ranged from deciding and implementing herself, decide herself but implement jointly with husband, to less control, last one being husband decides and implements himself. There were five possible combinations of these responses. Each issue is given a value of 1. Thus, if her response was deciding and implementing herself for all four issues, this amounted to the highest index of 20.

Major non-economic decision making ability asked who initiates the discussion on the following issues: number of children, when to have children, their education, their marriage, birth control decisions, and methods. I rank the answers in the following way, starting from the lowest: neither the wife nor her husband initiates, husband initiates, wife initiates, both initiates, corresponding to 0, 1, 2, 3, respectively. Thus, imposing equal weight on the 6 issues, the highest is 18 reflecting her ability to initiate these discussions. Note that I give more put to joint initiation for these issues, which may reflect the husband's willingness to listen to his wife and may adopt her ideas.

Legal awareness variable was determined by how much knowledge the woman has in terms of settlements in case of divorce, claim of property in case of her husband's death, and means to stop husband from remarrying when they are still married. In Muslim marriages, there is a amount specified prior to marriage that the husband must pay to the wife in case of a divorce. Highest value was given to the right answer. In terms of claim, presenting document of inheritance (marriage certificate is the best answer). Other answers, starting with second highest ranking is presenting a will, by other means, and cannot claim. For remarriage, she can press charges in the local administration. This was given the highest value. In decreasing order, other answers include not giving permission, charges to community, pressure by relatives, threat of divorce, and other ways. The ranks for these three variables were then summed to get the index for legal awareness. Lastly, the political awareness variable was derived for questions such as if she voted in last election, knows the member of the parliament in her area, ever protested against abuse, whether dowry is good, ever protested against a chairman. Then the dichotomous answers were summed to obtain the index for political awareness.

B2: OLS, Dependent Variable is log Total Expenditure

Variables	Estimate	Std Error
Log N (positive)	0.050	(0.011)***
Log N (positive) * female borrower	-0.072	(0.034)
Log N (negative)	0.059	(0.021)***
Log N (negative) * female borrower	-0.031	(0.255)
Female borrower	0.019	(0.027)
Log Household Income	0.057	(0.011)***
Household Characteristics		
Education ratio (female/male)	-0.026	(0.008)***
Highest grade completed by female spouse	0.042	(0.005)***
Age of household (HH) head	-0.004	(0.001)***
Household land (in decimal)	0.034	(0.001)***
Number of people in HH	0.076	(0.011)***
Religion (1 if Muslim)	0.052	(0.038)
Duration of the self-employment	0.004	(0.001)***
Residence in a micro-credit village	0.230	(0.571)
# of female age 10-20	0.069	(0.017)***
# of female age 20-30	0.076	(0.026)***
# of female age 30-40	0.068	(0.031)***
# of female age 40-50	0.051	(0.033)**
# of female age 50-60	0.004	(0.032)
# of female over 60	0.010	(0.029)
# of male age 10-20	0.078	(0.016)***
# of male age 20-30	0.113	(0.019)***
# of male age 30-40	0.196	(0.028)***
# of male age 40-50	0.180	(0.033)***
# of male age 50-60	0.169	(0.039)***
# of male over 60	0.213	(0.039)***
# of girls under 10	-0.023	(0.014)*
Profit Status (1=positive profit)	0.313	(0.147)**
Village level variables		
Price of rice	0.042	(0.010)***
Price of mustard oil	-0.002	(0.002)
Price of egg	0.034	(0.016)**
Price of milk	0.004	(0.003)
Price of potato	0.006	(0.007)
Price of flour	0.010	(0.010)
Price of Sugar	-0.005	(0.004)
Price of onion	0.005	(0.003)**
Price of garlic	0.000	(0.001)
Price of turmeric	0.004	(0.001)***
Price of salt	0.009	(0.005)**
Price of beef	0.005	(0.001)***
Price of chicken	0.003	(0.001)***
Price of soap (per bar)	-0.011	(0.004)***
Price of tobacco	0.125	(0.030)***
Nearest distance to the market (km)	-0.004	(0.001)***
Nearest distance to the shop (km)	0.007	(0.001)***
Nearest distance to the weekly market (km)	0.002	(0.002)
Constant	7.154	(0.171)***

Notes: Standard errors are clustered by household. All monetary values are measured in units of 1,000 in 1999 Taka. * indicates significance at 10% (** at 5%, *** at 1%). R-Square is 60.05

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